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Dr. GEORGE KURIYAN, B.A., B.Sc., Ph.D., (Lond.)



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By

Dr. GEORGE KURIYAN.

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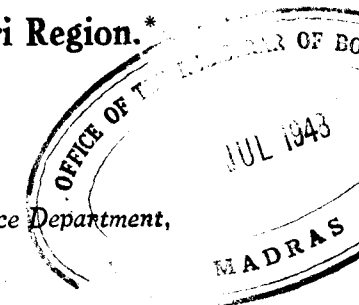
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Industrial problems, Development and Planning with regard to the Lower Godavari Region.*

BY

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Location and Extent :

The Lower Godavari region is situated in the middle of the East Coast of India. The region extends between 16° -20' N and 17° -50' N parallels of latitude and 81° -30' E and 82° -30' E meridians of longitude. The total area of the region is 3987 square miles. (Delta 624 sq. miles; adjoining tracts 3363 sq. miles). The Godavari region is limited on the west by the river Godavari, on the north and north east by the eastern ghat crest line, on the east by the water-shed between the Eleru and other minor streams and the Tandava river system and, on the south, by the Bay of Bengal.

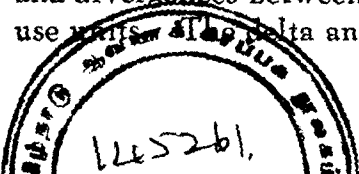
* Paper read at the Geology and Geography section of the Indian Science Congress held at Patna in Jan. 1948. This paper is adapted from the author's doctoral dissertation (chapter on Industries & Minerals) completed under the guidance of Dr. S. P. Chatterjee, Head of the Dept., of Geography, Calcutta University

Regional Units :

Agency, uplands and delta are the three basic regional units recognised by the Government for the purposes of economic development of the region. This three-fold classification serves little either to the land-use researcher or the industrial or regional planner. For purposes of industrial planning and industrial dispersal, the following eight chief regional units are being suggested by the author :

1. The Dissected Papikonda Gneissic Zone.
2. The Marine denuded plain.
3. The riverine and the flood plains.
4. The Sand-stone Zone.
5. The North-east coastal plain.
6. The paddy, paddy-sugarcane and the coconut zone of the delta and the Godavari plain-etc.
7. The Mangrove zone.
8. The Urban zone and the Road-Rail-Canal zone.

From coast to inland, physiography has profound influence on the economic expression of the region, while along the coast, from west to east, the influence of hydrography becomes more significant. The canal irrigation of the Godavari plain and the delta and the channel irrigation of the Eleru plain have induced the cultivators to utilise their lands chiefly to paddy, sugarcane and plantains. The dissected gneissic zone is rich in forest resources, e.g., timber, bamboo and forest products like myrabolams, turmeric, tamarind, nux vomica etc. The north-east coastal plain consists of land-use zones like the cotton-chillies zone, cotton, paddy etc. and, the riverine plain consists of tobacco-chillies zone. The sandstone zone in general, is characterised by garden culture. Both direct (physiography, climate, soil, economic factors etc.) and indirect factors (social, traditional etc.) are responsible for the similarities and divergences between the different land types and the land-use units. The delta and the Godavari plain are intersected by



roads, canals and channels; the coastal plain, the marine denuded plain and the Rampa zone are criss-crossed with roads, and the northern gneissic zone is served with only bridle paths.

Industrial Position And Problems.

Out of the total population of 1,880,000 the number of operatives employed in the factories is nearly 7200 i. e., 0.39 percent of the total population. This is just below the average for the whole of the Madras Presidency, which is 0.42 percent.

The following table shows the number and nature of the chief factories and number of labourers employed :

No. of factories	Nature	No. of employees
77	Rice mills.	1811
1	Tobacco factory.	1390
1	Paper mill.	701
2	Sugar mills.	808
5	Cotton Spinning, Weaving and Ginning mills.	905
1	Fruit canning & Packing.	101
14	Engineering & Railway workshops and Iron foundries.	735
3	Silk factories.	122
7	Printing & binding.	128
1	Tannery.	26
2	Tile factories	104
15	Rice & Flour and oil mills.	367
1	Leather factory	nearly 100

The chief industries of the region can be classified as under :—

Agricultural Industries.	Food Crop industries e. g., Rice Milling Fruit canning
	Cash crop industries 1. Sugar industry 2. Tobacco industry (curing & re-drying)

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Leather & Silk industries.

Cottage industries.

The chief industries are :

- (1) Handloom weaving industry
- (2) Boat building industry
- (3) Cashewnut industry

Large-scale and mineral industries

- (1) Paper industry.
- (2) Ceramic industries.
 - (a) Tile factories.
 - (b) Crucible industry.
- (3) Salt industry -

Out of the 7200 factory workers, 4477 are engaged in agricultural industries. (These workers are in the grip of capitalists.) High concentration of paddy in the Godavari delta offered a good fillip to the capitalists of the region to start a number of rice mills, which are located mostly along the canals and urban and trade centres. There are 77 mills employing more than 1800 workers. Of these there are a few parboiled rice mills* ; four of them are located at Coconada the chief port and major trade centre of the region.

The rice trade in the region has developed to such a large extent that there is no scope for further expansion, as a result of which, certain amount of capital is diverted to other avenues.

The following table reveals the growth of the rice milling industry :

Year.	Number of Mills.
1929	57
1932	45
1935	40

* In the case of parboiled rice, before milling, the grain is boiled first and then dried, whereas in the case of raw rice the grain in the husk (paddy) is taken straight to the huller. Rice is coloured during the process of polishing. There is no local demand for parboiled rice ; it is exported chiefly to Ceylon and the West Coast.

Year.	Number of Mills.
1938	34
1941	38
1944	77

The economic depression and low price of paddy between the years 1932 and 1938 were responsible for the decrease in the number of mills. During the decade ending 1944, the mills competed with one another. The increase in the number of rice mills is a blow to the hand-pound rice industry, which is a typical cottage industry providing off-season work to the cultivators' families. (The sources of power to these mills are either oil engines or steam boilers. Husk serves as fuel especially to parboiled rice mills.) Some of the mills are carrying on double function by taking up to flour and oil milling. Single function mills can take up to subsidiary industries like (1) the manufacture of fish meal, the chief fodder for animals and poultry and (2) the manufacture of vermicelli (samia) which is largely imported from Madras and southern districts. The rice mills in the region should not take up to the manufacture of bricks and tiles or bone manure, as they compete with the existing full time factories. The rice mills, instead of competing with one another in the local market should attempt to compete with Burma and Tanjore rice in Ceylon, if possible.

Next to rice mills, the tobacco re-drying factory employs the maximum number of workers. The factory is located at Anaparthi ; function is to re-dry virginia tobacco. The following are the results of the efforts of the Company (I. L. T. D.Co.) in the Madras Presidency as a whole within a period of 15 years ending 1941 :-

- (1) 300 percent increase in the land values.
- (2) 168 " " in wages of the labourers
- (3) Increase in the acreage under flue cured tobacco from 80 acres in 1928 to 126,000 acres in 1941

- (4) Increase in the quantity of leaf from 4200 lbs., in 1928 to 55, 100,000 lbs in 1941.

The organisers of the Grow-More-Food Campaign protested against the increase under the acreage under flue cured tobacco because the increase chiefly took place at the expense of food crops. (Dry paddy and red gram in the Godavari region.) In the Godavari region, the acreage under Virginia tobacco increased from 200 in the year 1939 to 5260 in 1943 and, that under paddy decreased from 51,958 to 33,018. (in the same period.) Considering the geoeconomic aspect of crop culture in the Godavari region and the economic problems of crop cultivators, there can be no justification for checking the development of Virginia tobacco crop culture.

There are two sugar mills in the region, one at Samalkot and the other at Kirlampudi, 10 miles from Samalkot. The Kirlampudi factory is situated in the heart of the cane growing area (Eleru plain), and the Samalkot factory is located at the north-east corner of the deltaic sugarcane zone. Samalkot is connected by road, rail and canal; Kirlampudi is served only by roads connecting the canals and the railway centres. The crushing capacity of the Kirlampudi factory is 150 tons per day, it can be increased to 250 tons. It has been suggested that a 400 ton factory is the economic minimum for South India. Thus the factory falls short of this minimum. With its present capacity, the factory requires only 24,000 tons of sugarcane annually, whereas the annual production of the area is estimated to be over a lakh of tons. The average sucrose content of cane (Co.419) grown in the Godavari region is 13.5 percent. The average sucrose content of the Indian sugars is 11.5 percent to 12.5 percent. The commercial recovery of Godavari sugar has been estimated by experts at 9 percent. It is really a significant fact to note that the acreage under sugarcane is not much influenced by the factories. In Gannavaram Taluk of Kistna District, the extent of sugarcane has increased at a very rapid rate after the starting of the factory. This is revealed by the following table :—

	Peddapur Taluk (Godavari Dist) acreage	Gannavaram Taluk (Kistna District) acreage.
1930	1623	30
1936	3895	1661
1937	4211	1124
1938	3325	1634
1939	2881	1760
1940	4021	3447
1941	5553	3563

The sugarcane cultivators of the Eleru plain should form themselves into a Co-operative society as in the case of Gannavaram factory and purchase the Kirlampudi factory. Government or some Industrial bank should advance a loan, repayable in instalments. Middleman's profits and uneconomic land holdings are limiting intensive methods of cultivation. With intensive cultivation, considerable areas now under sugarcane can be released for rice, fruits, vegetables etc.

There are four silk factories at Peddapur. The presence of skilled weaving labour in the town and adjoining villages favoured the starting of these factories. Raw silk is imported from Bombay, Kashmir, China and Japan. The skilled weaving labour is being actually exploited by the capitalists. Of the cottage industries, the handloom weaving requires special mention. Both in importance and magnitude, the industry ranks next to agriculture. The handlooms of the Godavari region provide direct employment to nearly 50,000 weavers.* The number of looms increased by more than four times during the 43 years ending 1944. (1901-3709 looms, 1944-55,129 looms). The lace embroidery and fine textured cloth of Uppada, the bed sheets of Nagulapalli and Ramanakkapeta and the fine, yet most durable cloth of Mori have extensive markets; and have retained their well-earned reputation. To the cultivators, the industry is a subsidiary occupation; to some of the communities like

* In India, nearly 10 million people are supported by the handloom industry, either directly or indirectly, whereas the textile industry employs only 4 lakhs and maintains about one million people.

Devangees and Padmasalaees, it is a full time occupation. The conditions of marketing, the nature of supply of the requisite materials, and the havoc of the middlemen have forced the weavers to the verge of starvation. There should be a drastic change in the above conditions. The available material should be distributed with due reference to the capacity of looms, inherent skill of the weavers and the nature of the finished product.

The paper industry is located at Rajahmundry, one of the major commercial foci of the Godavari region. The Rajahmundry paper industry is a befitting example of a case where, the life of an industry can be marred by personal factors, narrow outlook of the organisers and defective development techniques, in spite of the industry enjoying natural advantages. But for the absence of power, the industry is ideally located. The completion of the Ramapadasagara project should solve the problem once for all, which means, the paper industry can be considered as one of the optimum located industries. If worked to full capacity, the industry can produce 10 tons of paper per day or about 3000 tons per annum; it also manufactures 10 tons of bamboo pulp per day.

The Godavari river, supplies soft and fresh water and the region is rich in primary raw materials like bamboo and paddy straw. The Government expert after fully investigating into the bamboo potentialities of the Godavari forests stated that the upper Godavari alone can supply 15,000 tons of bamboo a year: more than double the normal requirements of the industry. The minimum distance of the bamboo zone from the factory is 20 miles and the maximum is 100 miles. The Upper Godavari forests are connected by the Godavari river while the Rampa and the Polavaram zones are connected by road. The cost of land carriage, it seems is becoming uneconomical. The average rate per ton, that is being paid by the mill is Rs. 27/-. It is estimated that Rs. 17/- is a very economical figure. The authorities say that the bamboo is not the type they exactly require. They also feel that the Upper Godavari forest alone will not be able to supply what all they need.

What is slightly lost in the quality of certain materials, should be made up through their technical skill. Their old policy of waiting till the 'apprentice fitter cooli becomes a technical expert' should be abandoned once and for all. The problem of the Rajahmundry paper industry should be considered as one of the chief regional problems of the whole of the Northern Circars. The Chemistry department of the Rajahmundry College, the technical branch of the mill, the technological department of the Andhra University and the Dehra-Dun institute should make a co-operative effort in solving the technical problems of the mill. The paddy straw requirement of the mill is estimated to be two tons for one ton of pulp. The required quantity can be easily obtained within a radius of 50 miles, and can be purchased from the cultivators and carted to the mill, or to the nearest canal. Caustic soda and dyes are imported from abroad. If high class paper is manufactured, china-clay has also to be imported as the quality of the local material is considered to be below the required standard. The following are the yearly requirements of the industry:

For bamboo pulp	For the straw paper.
7000 tons of bamboo	3000 tons of straw.
360 tons of soda ash	450 tons of lime.
1000 tons of lime	370 tons of bleaching powder
480 tons of bleaching powder	4500 tons of coal or
6000 tons of coal or	11250 tons of wood fuel
1500 tons of wood fuel.	

Both steam and electric power are at present utilised by the mill. The electric power is obtained from generators driven partly by steam engines and partly by turbines. Coal and wood fuel are also utilised. The Godavari forests supply the required wood fuel. If a saw mill is started in the region, its wood waste would form the cheapest and the best fuel. Coal consumption of the paper mill is as under:

6 tons of coal per ton of paper, when the pulp and the paper mill are in full working condition

4 tons of coal per ton of paper, when only the paper mill is working

2 to 4 tons of coal* per ton of pulp, when only the pulp mill is working.

The Mill provides direct employment to 700 labourers out of which nearly 90 are female workers. About 900 coolies are employed in the extraction of bamboo from the Rekapalli forests.

The investigated Godavari region can boast of no mineral strength. Workable quantities of Kaolin and graphite occur in the region. In the Khondalite hills near Seethapalli and Velagapalli, graphite occurs as small flakes oriented parallel to the foliation planes of the rock. The mineral also occurs as pockets and veins in the Khondalites. Surface veins are also common. (E. g., Vootla at a depth varying from 30 to 50 feet) Valuable beds of China clay occur in the villages of Bhupalapatnam, Bommuru and Peddapur. At Bhupalapatnam, the depth at which the clay occurs varies between 5 and 30 feet. In the sand-stone cuesta near Bommur, the mineral appears more like a residual or sedimentary Kaolin than the product of weathered felspar. In the marine denuded plain, it is the product of decomposition of felspars in the Khondalites. A Government expert's opinion is: the Kaolin beds appear to consist of a very good variety of pipe clay. The limited mineral resources (graphite and kaolin) of the region are consumed chiefly by the crucible manufacturing companies. Rajahmundry is the seat of the crucible manufacturing industry where, about 600 families with about 150 skilled workers are engaged. The tendency of every potter at Rajahmundry to become a crucible manufacturer should be sternly discountenanced. Methods of mining and grading graphite and kaolin are crude, and require improvement. The contractor system of mineral extraction should be prohibited. The manufacturing company can itself undertake to extract the minerals. The

* The cost of delivery of the Jharia and the Raniganj coal at the mill comes to Rs. 16/- per ton which, as the mill authorities state is very high. The cost of the inferior Singareni coal is not much less and hence is not preferred.

ceramic company should undertake the manufacture of crucibles. More efficient use of the limited mineral resources of the region can be made and economics in labour costs effected, if the industry is on a large scale status, and if manufacturing and organisation are centralised. Systematic planning of the gneissic zone can solve the labour problem of the mineral industries to a major extent.

Industrial development and revival.

On the basis of the character of the regional resources, and assuming that the power problem is going to be solved either through the supply of hydro-electric power or thermal, because the region cannot rely on coal as a cheap source of power, the author suggests the development of the following industries.

- (a) Alkali industry: Large scale status—salt industry is already established at Cocanada, and this forms the basis of the Alkali industry. The Godavari Alkali industry to be started, should first of all purchase the existing salt industry. The industry should also manufacture Hydrochloric acid and Bleaching powder.
- (b) 'Small dimension' stock industry on cottage basis.
- (c) Saw Mill industry.
- (d) Match industry.
- (e) Plywood industry. The main function of the industry should be chiefly to manufacture boxes, tea-chests, match-boxes, air-dry vegetable fruit baskets etc. The fruit canning industry of the Godavari region should assure and increase the demand for these baskets.
- (f) Pencil factory.
- (g) Fish oil and fish meal industries—These should be started on cottage cum factory basis.

- (h) Dairy industry—Increase in the demand for livestock products through the dairy industry and the development of mixed farming (e. g. in the sand stone region) increase the income of the cultivators when they will be in a position to pay better attention to their animals. If the industry is started on a large scale, its bye products can be best utilised. Casein is the basic material for waterproof glue manufacture, which in its turn can be utilised by the plywood industry that is going to be started.

Attempts should be made to stabilise and revive the ancient reputation of the following industries :

- (a) Handloom weaving and hand-pounding rice industry.
- (b) Lace works—Rajahmundry, Ramachandrapur etc.
- (c) Bangle and lacquer ware industry—Duppalapudi, Draksharam, Rangampeta, Gandepalli etc.
- (d) Silvering of mirrors—Rajahmundry.
- (e) Brass and bell metal industry—Rajahmundry, Pithapur Gandredu, Gollalamamidada, Mandapeta and Peddapur are some of the important centres.
- (f) Dyeing and printing—Nidigatla, Cocanada, Gollapalem etc.

Industrial Planning.

An Industrial Planning Committee should be started (the Godavari Industrial Planning Committee-G. I. P. C.) which should function as a branch of the Regional Planning Committee—G. R. P. C.). The G. I. P. C. should be represented by the leading industrialists of the region, technical experts, Heads of the Education Departments, the Government industrial Officer and other interested persons. The following should be the chief objects of the association.

Objects :—

1. To make an industrial and mineral survey of the region with the help of the Andhra University.

2. To classify the existing industries so as to assist industrial planning schemes on the basis of optimum concept. The industrial planners should aim to balance inter and intra industrial relationships as far as possible. A sort of balanced supplementary relationship can be established between the fruit canning industry, the plywood air-dry basket industry and the large scale dairy industry. One industry (fruit canning industry) assures the demand for the other, while casein a bye-product in dairy industry, forms the basis for waterproof glue manufacture, utilised in the air dry basket industry.

3. To select optimum locations for the new industries to be started, and to sieve out industries for which the optimum conditions do not exist, keeping in view the principles of regional planning. For the purposes of regionalisation on a National basis, the whole of the Northern circars should be considered as one region, in which case, the Guntur region will be better suited for the location of glass industry than the Godavari region, with respect to raw materials.

4. To prevent inefficient methods of organisation and wasteful methods of utilization of industrial and mineral resources.

5. To assist the different industries in tackling their manpower and other economic and technical problems.

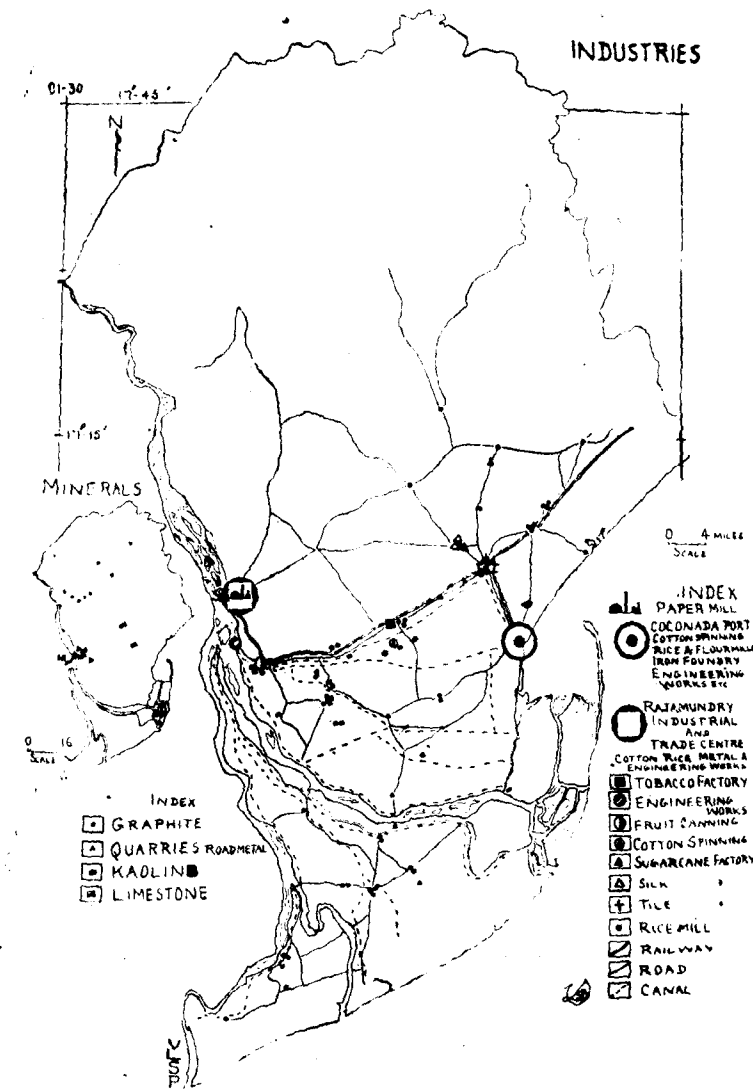
6. The Industrial planners should work in close collaboration with the Transport planner: both should get their schemes approved by the regional planner. The case of Cocanada region deserves special mention. The transport alignment and the industrial development in the urban and the road-rail-canal zone demand the particular attention of the regional planning committee. The planner is concerned with the effects of existing transport alignment on the different

industries and trade of the region and, the question, like what ought to be the pattern of future alignment, and what transport improvements are necessary so as to properly fit in with the proposed industrial and city planning schemes. The landscape character and the geo-economic factors of the Cocanada zone (area within the radius of 8 miles from Cocanada) are favourable for its development into one of the urban-industrial units of the Northern circars region. Of course, the planners should see that localization does not exceed the optimum limit, to be fixed up by a detailed investigation.

Conclusion.

It is doubtful, whether industries could be developed to such an extent as to absorb a vast majority of agricultural population of the region. Agriculture and industry can be integrated; by proper planning one can be balanced with the other. The Godavari region possesses the required capital, adequate labour and abundant resources; all these need better co-ordination. Skilled man power is deficient in the region. Lack of organising ability among the Godavari capitalists is proving a serious handicap. Vested interests, personal prejudices and suspicious outlook are playing havoc. The Government must change its policy. The history of the Rajahmundry paper mill is proof that the Godavari industrialists are toying with industrialisation. To solve the problem of power appears to be easier than to change the narrow outlook of the industrial organisers. Some of these problems can be solved, and better use can be made of the resources by launching syndicates, kartels and co-operative association. The four factors that shape the industrial destiny of the region are: (1) power* either hydro-electricity or thermal (2) capacity to organise and co-ordinate, (3) availability of capital for the right purposes and

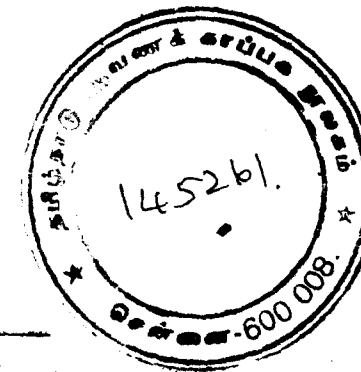
* Ramapadasagara multipurpose project solves the power problem of the region. No coal deposits are reported to occur in the region investigated by the author. Dr. Blandford discovered the occurrence of coal around Lingala (Rec. G. S. I. IV 59-66) Dr. King carried out preliminary investigations in 1875. Tvean showed that the coal of this region is 'excessively poor' and will be 'perfectly worthless as fuel'. The carbon and ash contents according to Tvean are 16.4 and 53.0 percent respectively. At one stage: Dr. King states that none of the coal fields (Polavaram taluk) are worth working; at another stage, he says, a search and a thorough examination are essential. (Rec G. S. I. VII and XV) The Geology Department of the Andhra University is the ideal agency to take up the investigation of this problem in detail.



(4) Government help and supervision. To what extent the second and third factors would influence the industrial development depends on the people of the region. The landscape personality and the geo-economic factors should determine the future character and pattern of industrial development and planning in the Godavari region, which as such, has no personality of its own, and hence, should be considered either as a part of the Northern Circars Region, or a part of the Godavari valley, not only for the purposes of industrial planning but also for regional planning.

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Gosaba - A study in land reclamation in Sunderbans.

BY

UJAGIR SINGH, M. A. (Econ. & Geog.)

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Gosaba State — Only fifty years back covered with dense tidal forests of the Sunderbans, home of wild beasts and animals, devoid of any human occupation, now turned into vast agricultural fields where paddy grows enough to support several thousands of people living in detached villages with their primary schools and cooperative societies — sets an encouraging example of how new lands can be reclaimed and utilised to its full. The state consists of 3 islands in Lot No. 149 separated by river Vidya or Hooghly, Satjel and other Khals. The islands can be reached from Canning Port where motor boat service can be obtained for Gosaba. Our motor—boat would take about 4 hours to reach Gosaba from the Canning port as it would ply about 14 miles over the waters of the Malta, then about 12 miles in the Vidya on whose bank Gosaba village, the centre of the state, stands.

The state owes its existence to one Scotch, Sir Hamelton, a great economist and businessman of Calcutta who took this area from the government on lease and developed it economically, culturally and also socially so as to make it self-sufficient.

Geographically, the area is very interesting. River Vidya, like any other river of the Bengal Delta, is a tidal river and has no steep bank. So during tidal hours water of the river rushes over a large area on both sides of the river and deep silt is deposited near the bank.

To avoid this trouble a bamboo bridge has been constructed by the state from the bank down to the bed of the river. But one could hardly cross the bridge with shoes on, as it is also muddy and wet.

Coming over to the bank, one meets the huge embankments all along the river side, purposely constructed to check the entry of the tidal water into the land. These embankments are the life and blood of the state's people. They give them food, shelter and other comforts. With out them the land would be barren, no human life would be possible. Its importance can be realised better when we go down to trace the history of the development of the state.

As already pointed out the whole area was covered under the deep tidal forest of Sunderbans. First, strong embankments were erected all along the river sides to check the over-flow of saline water of the tidal rivers. Next, the jungles were cleared slowly and slowly and the land was left for several years on nature so as to allow the soil to be leached by monsoon rains and its salinity to be reduced. Generally it took 6 to 7 years for the land to be fit for cultivation when the salinity was leached at least on the top-soil. Thus we see that it is a long and expensive process during which one has to spend a lot and not to gain. Even after it is suitable for cultivation, lot of money has to be spent every year in maintaing the embankments.

Life of the People.

Effects of Geographical environment on human life are, probably, no where as distinct as in Gosaba. Here a tug of war is going on between man and unkind nature. His activities are fully controlled by the environment in which he is forced to live. But thanks to man's ability and his attempt to over-ride nature, he has not only adapted to the environment but has made suitable changes in nature to suit his taste. His housing, method of agriculture, social and economic development are all in relation to his environmental conditions. Let us have a glance over his activities one by one and see how they are related to the environment.

Housing.

It need hardly be said that Gosaba possesses low land areas that are surrounded with a few gates that are controlled by the

state. The result is that in rainy season, the whole state is flooded with rain water and villages, apart from one another, look like islands from a distance. So to avoid the rush of water in the houses in rainy season and from moisture in other seasons, the houses are made on raised mud-platforms, or on wood piles. Houses on piles are smaller in comparison to the mud houses. The houses are mostly bungalow-type and generally have no court-yard. The building materials are naturally mud, wood and paddy straws. The roofs of the houses are steep so as to provide better run-off to the rain water. They are generally made of paddy straws but tin roofs were also to be found in some houses.

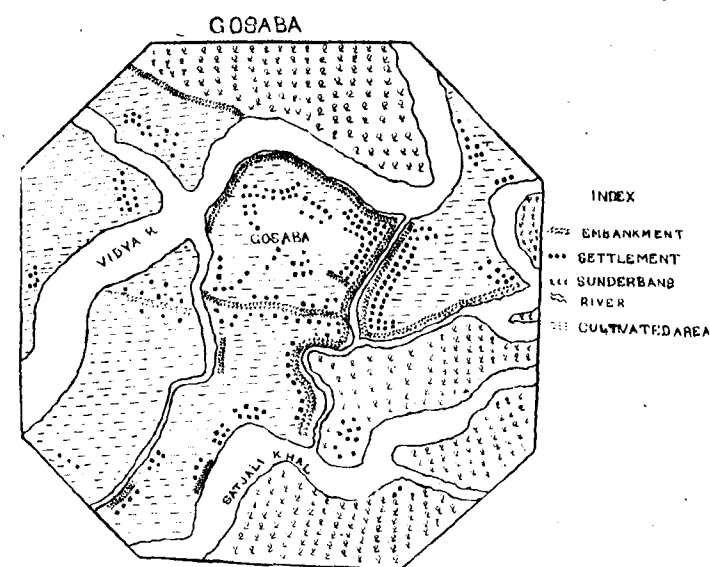
Problem of drinking water.

The most striking features near the houses and especially tin roofed houses, were the iron tanks kept under the outer roof of the houses. On enquiry it was found that they were meant for storing rain water that may serve as drinking water which is a problem in the state. Tanks are the only other source of drinking water. They are not dug deep, as water becomes saline at greater depth. Generally they are only 7 or 8 feet deep. Water of the tank is also not hygienic and it is consumed only after purification by alum. It has been experienced, that a glass of water taken from the tank when allowed to rest for sometime, leaves a thick deposit of sediment at the bottom of the glass.

The state has also tried in vain to solve its problem of drinking water by the help of tube-wells as less saline water could be had several hundred feet down, but they are very expensive to dig.

Agriculture.

Like many other regions of the Bengal delta, rice is the main crop of Gosaba. Just after the rains, ploughing starts and paddy is sown broadcast. Only few varieties of paddy are transplanted. So in Gosaba, only a coarse variety of rice is produced and the yield is also not high. The state maintains



its own Agricultural department under an agricultural officer who conducts researches on the state-model farm. Several improved varieties of rice have been found to be successful by crossing the local paddies with the Assam paddies. This department is also trying to find one salt resisting variety. Thus the department of agriculture is doing a great service to the state's people. From its model farms one can have some idea of what kind of trees and plants might thrive well in this newly reclaimed region. As has already been pointed out, soil, 7 or 8 feet below the surface is too saline and if roots of the trees reach this horizon they are liable to be killed. Therefore, deep rooted plants can not grow. Mango trees are seen on the farm but it is reported that they do not live long and usually die out after 2 or 3 fruitings. Coconut trees common in Bengal, are not to be seen here. Sugar-cane grown in the model farm was also saline in taste. Smaller plants like banana, safeda thrive well in the state. Vegetables like potatoes, tomatoes, brinjals, cauli-flower, sugar-beet, grow all over the state in winter and every family in the state has a small plot of land adjacent to its house for growing vegetables. The plots are fenced by wood and bamboo to protect them from the domestic animals like bullocks, cows and goats. Ducks are usually seen swimming in the tanks and are mainly kept for eggs.

Fishing.

The state has also paid attention to the second most important item of food in Bengal, the fish. The state is maintaining its own fishery department that has adapted an interesting method of catching fish. In the monsoon season when rice fields are flooded with water small fishes are left on the fields where they are allowed to grow till the water is taken off from the fields. The water is made to pass through channels joining the fishing tanks where fishes gather in large number from fields where they had been left to grow. After seven or eight months these fishes are big enough for table-purposes.

In fishing tanks, arrangements are made to provide the fishes with nourishment through the feeding-baskets containing cow-dung mixed with powdered grains.

General conditions of the state.

The state consists of about 40 small villages separated by vast paddy fields. A village site is chosen on the higher ground. Means of communication between the villages are lacking and in the rainy season it becomes very difficult, if not impossible, to go from one village to another through the barren fields. Two most important institutions of the village—the primary school and the cooperative society have gone a long way in improving the social and economic conditions of the villages. In the last Great famine of Bengal (1943) when several lakhs of people died without food in Bengal, not a single death of this kind was recorded in the state. Since the very beginning, the state has made primary education compulsory and as a consequence at present it is hard to find an illiterate person in the village. Any one who has attained majority is a member of the village cooperative society affiliated to the central co-operative society of Gosaba. The Gosaba institute of Rural Reconstruction founded by Lady Hamelton in the year 1933 with the object of turning out students who may stand on their own legs when they enter life, is an ideal institution rarely found in any other part of the country. The Institute is not in favour of imparting higher education to the children. Agriculture, spinning and weaving, fruit preservation and manual training have been made optional subjects, out of which one is to be offered after the middle school course. All these institutions together with the sympathetic attitude of the state have made the life of several thousands of people in this unwanted land, even more comfortable than that of other parts of the country, geographically better situated.

Conclusion.

Thus we see how Gosaba, formerly a part of the Sunderbans has been reclaimed and developed so as to match any geographically favoured part of India. This justifies the statement that man can adapt himself to any circumstance to live in. It is generally accepted that delta region, and especially the Sunderbans is unsuitable for human habitation;

people hesitate even in going to the clear patches of the Sunderbans. But here is an example how a part of Sunderbans itself can be turned into agricultural fields. So at present when the province of Bengal is over populated and facing an acute shortage of food, the government should come forward with its reclamation schemes in the Sunderbans area on the lines of Gosaba. It can be remarked here that reclamation work in this region is very expensive and a large amount of money is to be spent on embankments and in clearing the forests, and without the help of government no scheme will succeed. At the same time only the interior part of the Sunderbans might be reserved but outer portions should be given free or on nominal charges to the public for reclamation purposes.

The Problem of Refugees

BY

K. N. SRIVASTAVA, M.A., B.T.,

(Lecturer, Teachers Training College, Vidya Bhawan, Udaipur.)

The grinding wheels of time are said to move very fast. But in the case of India they have been moving still faster since the country achieved independence. The division of the sub-continent into the Dominions of India and Pakistan has resulted to the greatest exodus of humanity from one country to another the world has ever witnessed. In the past all great mass movements from North-West India have been of invaders from the Central Asian Highlands. We are now facing a very different type of 'invasion' and while offering hospitality India has always accorded to those in need, we should take full advantage of their skill to put new life into our country.

It is regrettable that a stage has been reached when to the ordinary city dweller in India the refugees look like becoming a nuisance as they compete with local folk for accommodation, food and employment. The refugees themselves have realised such a state of affairs in many parts of the country and have lodged complaints to this effect, time and after, to the governments and the national leaders. They may not be misunderstood to mean that the country is not doing anything towards the rehabilitation and resettlement of refugees. But one finds a great truth in their complaint in the sense that the country has failed, to an appreciable degree, to ameliorate the sufferings of millions of refugees who are not having a fixed home and are being denied of even the barest needs of livelihood. The refugees argue that they were not consulted on the question of partition. They are the people coming into India from Pakistan whom the prepartition Government urged to stay on in their homes even after it became known that the country would be partitioned. The Indian leaders when they

took power on the 15th August last advised non-muslims in Pakistan not to leave their homes. When the Government which took over their destinies did not do its duty, they began pouring into India. The colossal destruction of life and property in Pakistan and the mass movements of humanity to India are partly attributed to our own mistakes. Similarly feelings of discontentment were expressed in the Dominion Parliament on Friday the 12th March 1948. Pandit Thakur Dass Bhargava while moving a cut to discuss the permanent rehabilitation of refugees said, "The Government of India had done admirable work in evacuating feeding and clothing the non-Muslims from Pakistan but it had failed to take any positive steps to resettle them on a permanent basis. The Development Board set up by the Government had drawn up good schemes but nothing had been done to give them practical effect—In spite of great sympathy from the authorities nothing concrete had been accomplished for the benefit of the refugees." This opinion truly represents the feelings of everyone in the country. The presence of mere sympathy, however, is little comfort to those who with their children and few belongings are compelled to leave their hearths and homes and their source of livelihood to search for shelter, and new lands where they may again begin their struggle for existence. They require genuine aid at every step which may help them to endure hardships, maintain their stamina and enable them to adopt and adjust themselves to new conditions and ways of living.

Before the refugee problem is discussed in detail it is worthwhile to analyse facts and classify refugees into different types with a view to understand the nature of the problem and the difficulties inherent therein. The problem and treatment of refugees coming from distant countries will be naturally somewhat different from the treatment of Home refugees. Foreign refugees always live in the hope of returning to their original theatre of livelihood and therefore would like to make only temporary adjustments, but care should be taken that undue optimism may not lead to a failure of speedy adjustment to new circumstances.

Refugees or Sufferers? A few months back a controversy was raised as to whether people coming from Pakistan should be called refugees or sufferers. In his post-prayers speech on the 11th November 1947 Gandhiji said that some refugees had objected to being called refugees. They said that the whole of India according to his own showing was equally the home of every Indian. They had suffered heavily in Pakistan and had come to the Union and therefore be called sufferers. The question thus raised was a very interesting one. To me every refugee from Pakistan is not a sufferer. People from the West Punjab are real sufferers who have lost every thing, their homes, their property their means of livelihood and in a majority of cases men, women and children. People from Sind and Baluchistan are not usually sufferers but refugees who have migrated to India to take refuge among men of their own religion. Persons belonging to North West Frontier Province may be classified into both the categories, while those from East Bengal who have recently started exodus are mostly refugees. This classification is an attempt to demonstrate the magnitude of the loss of life and property in their respective provinces they belonged to. As a matter of fact no water-tight compartments can be made in such a classification because one may find both the types in the same group of refugees hailing from the same district of a province.

Refugees' past occupations:—Many of the refugees from the West Punjab are peasants. The country from which they come owes its prosperity mainly to great irrigation and hydro-electric projects. They also include Sikh taxi-drivers, Sikh electricians, Sikh mechanics and Sikh carpenters. Sindhis are a cosmopolitan lot and the Sindwerki merchants have no inhibition about going anywhere to trade with their cargoes of carpets, curios and silks. Refugees from Baluchistan are as a rule traders in fruits, carpets and cloth. Unlike refugees from West Punjab, the people from the North West Frontier Province, Sind and Baluchistan comprised mainly urban population. A majority of refugees from East Bengal are agriculturists. Refugees from every part of Pakistan also include doctors, lawyers, Engineers, clerks, teachers, professors, etc.

Distribution of Refugees:—Many of the refugees from West Punjab have settled in East Punjab, Delhi and the United Provinces. Concentration of refugees in these parts becomes less and less as one goes to the East, the minimum influx being in Bihar. Refugees from Sind and Baluchistan have migrated in most cases to the adjoining parts of the country i.e. in Rajputana, Central India, Kathiawar, Bombay and Central Provinces, the latter having accommodated nearly 30,000 men women and children. This small number is nothing in comparison to mass exodus of refugees to the States of Rajputana. Mewar, one of the four premier States of Rajputana has alone accommodated about 25,000 refugees and 15,000 are yet to arrive. Evacuation from Sind had been and is still arranged by sea and land. Ships have been put on the Karachi-Bombay run many times a week and also between Karachi and Kathiawar ports. The Director General of Evacuation, Government of India has arranged for the running of special trains from Hyderabad or Mirpur to Pali and Marwar Junction where transit camps have been set up for reception.

Refugees yet to Arrive:—Today India, a land of 300 million people, has thrown open her doors to a further four million men, women and children who do not desire to live in Pakistan. But thousands are still awaiting facilities for evacuation. It is estimated that there are about 7 lakhs of non-muslims still in Sind including about 12,000 Sikhs who are stranded in various pockets of the province. They will require at least seven months more if the present speed of evacuation is maintained. There are a number of non-Muslims scattered in Baluchistan. Their evacuation had to be suspended during winter months due to snowfall. Air evacuation from Quetta, it is said, will be resumed as soon as weather permits. It is understood that evacuation to India of nearly 27,000 non-Muslims still left in various parts of the North West Frontier Province will be completed in the next few months. The Military Evacuation Organisation (India) is at present operating in 12 out of the 17 districts of West Punjab. About 70,000 refugees are awaiting evacuation in Bahawalpur. It is expected that the

evacuation of all these people will be completed within the period of the next few months.

Bengal's Peculiar Position :—The two Bengals have remained comparatively peaceful and mass movements of refugees remained checked. But the deteriorating conditions in East Bengal have resulted in the influx of refugees from there into West Bengal. Over 2,000,000 have already arrived. If the exodus continued even the Government of India might not be able to control the resultant situation. Either this exodus should be stopped or circumstances might arise to displace persons now living in West Bengal who ought to be in Pakistan. If no one could foresee the happenings in the Punjab, it is possible now in the case of Bengal. We have experience behind. Proper steps must be taken by all to stop this exodus. If it is not considered feasible, arrangements should be made for a peaceful exchange of population between the two provinces.

The Way Out :—Our aim should be to organise relief and systematic aid to refugees in terms of housing aid, provision of maintenance and wherewithals of existence, employment, care of health, education of children, and such other aid as may become necessary. No doubt, temporary facilities have been provided in every possible way. But more permanent arrangements are needed which can be made by commandeering all available housing space, and if necessary billeting families upon the local population, on a voluntary or paid basis. It is not difficult when the ratio of refugees and the established families in India is 1 refugee to 2 families comprising of 8 members. Colonisation schemes should be planned immediately and the working population be settled at top-speed on non-cultivable lands. There are still vast areas left unproductive. Before any definite plan is executed data should be obtained regarding their housing habits, needs, standard of life, possibility of payment of rent, and the period for which assistance is required.

The unemployed have remained the least attended. In spite of the repeated appeals made by the Government in this connection nothing substantial has been achieved so far. This poor success may be chiefly attributed to misplanning, lack of cooperation and government initiative. The unemployment problem should necessarily be dealt with first. Employment Bureaus though established, have not carried out a detailed survey of the unemployed and no canvassing to take positive steps for finding jobs. We find hundreds of educated men and women hunting for jobs without any fruitful results. The Employment Bureaus after having carried out a survey of the refugees should have classified them under three main headings of skilled and unskilled labour and professional workers. They should have undertaken scientific measures for canvassing jobs and exploring avenues of work. This involves a study of demand for workers and classification of advertisement and direct and personal approach to employees. The condition of the unemployed in Rajaputana about which I have a fair knowledge is deplorable. If positive steps are not undertaken by the State Government the plight of the refugees is to get worse every day. I have heard refugees saying that such a state of affairs is intolerable and therefore they would prefer to die in Pakistan than to face these immeasurable difficulties of unemployment and starvation.

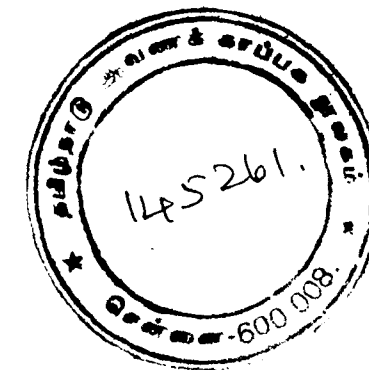
Next comes the question of those who were doing lucrative business in Pakistan before the division of the country. The position of these businessmen is not so critical as that of those who were living from hand to mouth. Although they have lost their business and much of their property yet they can live without much financial help from outside, at least for a certain limited time, may it be a few months or years. The lower strata of businessmen therefore need greater help and encouragement. Most of them have turned to street hawking to earn a bare livelihood and some of them have not even this meagre means to take care of themselves. Such refugees as a class were greatly pained to hear that the Dominion Parliament had passed the Rehabilitation Finance Bill, making the maximum

limit of loans in the case of individuals to Rs. 50,000 and in the case of Joint Stock Companies to Rs. 100,000/-. They were particularly distressed to learn that the Government was intending to offer loans in terms of tens of thousands to the top-ranking people of their class when thousands of refugees were in need of small sums amounting to Rs. 50/- or 100/- or 1,000/- to start their life anew. The Central Government should therefore do its utmost to distribute the sum of Rs. 10 Crores to thousands of poor refugees needing immediate help, than to allow it to pass to a few hundred capitalists. If the money goes otherwise the fate of the poorer refugees will be doomed. *

Are the Refugees an asset? :—The Rehabilitation and resettlement of refugees in India are going to involve an outlay of 22 Crores of rupees or more in the current financial year. But will it after all, prove a loss to the country? Nay! the influx of refugees into India, may be an asset to the advancement of the country. For history is full of examples of countries reaping huge rewards for the hospitality they had extended to refugees. Parsis who came from Persia provide the best example in India. Who can deny that they have amply repaid this country by the part they have played in her trade and industrial development? The capture of Constantinople by the Turks and the resultant migration of the people to the West started a rebirth of learning in Europe. The Flemish weavers were driven to cross over England who made the country the world's greatest textile producer. England in turn persecuted certain sects who migrated to the Eastern parts of America which today is the home of one of the countries most distinctive cultures. The Jews provide excellent example in our own times who served the countries that had sheltered them.

A little thought will show that these millions of refugees can be an asset to the advancement of the country. The progressive farmers from the Punjab who actually developed the canal colonies in the country know the advantages of good roads, decent houses, and improved methods of agriculture.

Why not we use these people to give Indian agriculture a badly needed infusion of new life? We should welcome the idea of settling these refugees in colonies in all parts of the country, instead of looking upon them as a nuisance, where there is now land waiting to be developed as a result of new irrigation schemes. Such settlements could be object lessons to the more conservative folk in the established villages. They could then learn a thing or two about sanitation, a healthier diet, mixed farming, crop rotation, improved housing and village lay-out.



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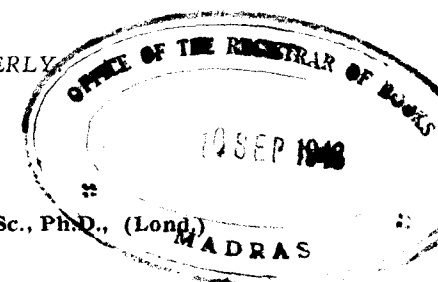
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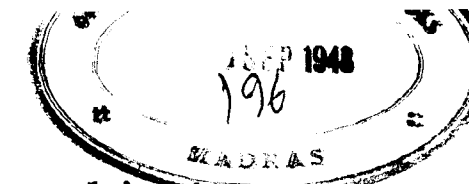
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On the Regional Division of the Indian Sub-Continent An Introductory Essay *

BY

Capt. O. H. K. SPATE, M.A., Ph. D.,

Department of Geography, London School of Economics, London.

The independent pioneer work of Baker and Stamp resulted in a remarkably close agreement on a working regional division of India. Agreement on the main lines is not perhaps surprising, the broad fundamental outlines are clear enough but in detail the problem is by no means simple, especially if strict delimitation based on one master-principle is attempted. Indeed it is very doubtful if this ideal can be attained. Physiography is the most obvious guide, but it is clear that in an area like the Indo-Gangetic plains it is of little help, since it is hardly too

*This essay forms part of a general work on Indian geography now in preparation. As the method is avowedly empirical, the actual regional division advances *pari passu* with the regional description. It may well be urged that the following pages constitute a destructive criticism and that it is only fair to submit my own proposals for counter-criticism. When the complete scheme is worked out which will not be for some months-I propose, with the permission of the Editor, to publish it in the INDIAN GEOGRAPHICAL JOURNAL for the comments of geographers in India and Pakistan. Meanwhile the discussion of principles is presented in the hope that it may stimulate further consideration of the whole question. I would be glad to receive reasoned criticism, either direct, or in the pages of the INDIAN GEOGRAPHICAL JOURNAL.

"India" is used throughout as a geographical expression and no prejudice is intended to Pakistan.

• 1. J. N. L. Baker, *Geography* XIV (1928), pp. 447-455; L. D. Stamp, *ibid.* pp. 502-506.

much to say that there is no physiographic boundary in them from end to end, except local ones between *bet* and *doab*, *khadar* and *bhangar*, which are obviously useless as a basis for regional description on the sub-continental scale. Yet some boundary must be drawn to get manageable units, and the landscape and life of Bengal are obviously enormously different from those of Sind, imperceptible as may be the gradations between these extremes. Here, then, climate is generally accepted as a guide, though obviously in an open plain climatic transitions also are inevitably gradual.

There are also some difficult areas with locally strongly differentiated topography but with affinities far from clear, e.g., the whole great triangle between the Aravallis, the Vindhya-Kaimur scarp, and the Ganges alluvium. A mechanical but none the less real difficulty lies in the fact that some indisputable regions, such as the Vindhya-Bhanrer-Kaimur Hills, or the Siwaliks and other sub-Himalayan zones, are ribbons hundreds of miles long and only a few miles wide. Some sort of more or less arbitrary splitting-up is in practice essential here, to avoid pedantic absurdities such as divorcing by many pages, the treatment of Dehra Dun from its neighbour Hardwar. The two can only be understood in association, and yet they are separated by one of the absolutely primary divisions, that exist between the Extra-Peninsular Mountains and the Indo-Gangetic Plains.

The rather empirical divisions of Baker and Stamp were criticised by Pithawalla of Karachi², who attempted to secure uniformity by a somewhat too rigid system of physiographic regions. His accompanying map, however, was not always consistent with his text, and there were some anomalies, such as the treatment of the entire Irrawaddy basin as a single unit of the Extra-Peninsular Mountains, while nearer home his boundaries in the plains between Indus and Ganges seem very confused. Pithawalla in turn was strongly criticised by Kazi S. Ahmad of Lahore and others.³ Ahmad's own proposals

² *Journal of the Madras Geographical Association* XIV (1939), pp. 213-228.
³ *Indian Geographical Journal* XVI (1941), pp. 257-267; *ibid.* XVII (1942) pp. 67-74.

seem on the whole quite sound, though Pithawalla rightly queries the complete lack of any hierarchical order, which results in the great undifferentiated mass of the Himalayas and the small sub-montane *chos* area in the Punjab ranking equally as regions: this seems to be an example of local knowledge getting out of hand.

Pithawalla himself later submitted a revised scheme meeting some of his critics' objections.⁴

Typical of the rather verbalistic approach to the problem is the disagreement between Pithawalla and Ahmad on the peninsular littorals. Ahmad objects to the standard three-fold division of India. He claims that this division "may be geologically correct but is not desirable from the physiographic point of view as the peninsular area includes two quite different regions, Coastal lowlands and Deccan plateau." Ahmad states that "according to relief" there are four, not three, divisions, the coastal lowlands forming a division of the same value as the other three; but it is not really open to him to base this new division on relief alone since (apart from the fact that physiography and relief are not quite the same thing) he criticises Pithawalla from a structural point of view. Moreover if his argument be admitted there are not three or four grand divisions but five, since the eastern and the western littorals are very different in almost every aspect—relief and structure included. There is obviously no end to this sort of thing: Ahmad's view (as his omission of hierarchy suggests) appears not to consider sufficiently that the heavens themselves, and surely the earth as well, observe degree, priority, and place. But it is perhaps less unrealistic than Pithawalla's description of the coastal lowlands as "shore-facies" of his Deccan Trap and Southern Plateau provinces—a distinct retrogression from his earlier views.

Physiography is doubtless the first factor to be consulted, but it is highly premature, to say the least, to claim as Pithawalla does that "Unscientific notions about the so-called

⁴ *Science and Culture* VII No. 11 (May 1942).

'natural' divisions of India have been discarded, and the idea of limiting the geographer, in a precise and specific manner, to geomorphological considerations in the first place, while producing the chief divisions, has found favour. Over such scientific and logical divisions of the country, all matters relating to climate, natural vegetation, and even human settlement must drape themselves completely and to the satisfaction of all other advocates of allied sciences." It is a sufficient answer to this dogmatism to assert roundly that any *a priori* scheme (which is what the insistence on one-criterion precision amounts to) is not likely to be logical and scientific and that climate, natural vegetation, and human settlements are not always so obliging as to drape themselves in accordance with our preconceived desires; nor can the practising regional geographer undertake to be bound in advance by so rigid a statute of limitations. The subject-matter of our study is far too rich, too varied, and too subtle to be tied down easily by rule and line.

The physical basis is of the very first importance, and I repeat that physiography is the first factor to be consulted, but climatic and positional factors can never be ignored as is evident, for example, in a recent paper which, avowedly dealing with the delimitation of geomorphological regions, nevertheless finds it necessary to take into account oceanic position.⁵ We may discount the metaphysical dubiety which surrounds the concept of the region; for practical purposes regions exist, and if they did not they would have to be invented. But rigidity of definition can probably never be attained, and even a modest precision will take years of detailed study.

Above all, it must ever be remembered that "In a large country like India, it would perhaps be impossible to choose factors which have a universal application, but understanding is more important than classification."⁶ It is of course true that to describe so vast an area, some sort of preliminary regional division is necessary before even a start can be made

5. Dr L. Linton, "The Delimitation of Geomorphological Regions", paper read to the Institute of British Geographers, January 1948 (not yet published).

6. G. Kuriyan, *Indian Geographical Journal* XVII (1942), p. 71.

but in this first instance it can only be empirical, a first approximation to facilitate the local spadework without which no real precision can be gained. This is what has hitherto been lacking in Indian geography; although the broader outlines are clear enough, much more work in the shape of local regional studies, and also studies of wider distributions of specific phenomena, will be needed before that division which satisfies the greatest number of criteria, and does least violence to any one of the fundamentals, can be drawn. We must delimit our regions before we study them, certainly; but after they have been studied in real detail it will be strange indeed if we do not find them with quite different limits from those with which we began. I should be suspicious of my own work if I found that it fitted with such mechanical convenience into a preconceived scheme. Nor, considering the immense totality of phenomena, distributed perhaps with correlation but very rarely with coincidence, in any given area, are we ever likely to be free from doubtful attribution and overlaps. After all even in political geography the concept of the frontier zone is as significant as that of the boundary line, and there are such things as condominiums and buffer states; and yet in this sphere the most conscious efforts at precise definition are made. Nature will make no such concessions for us.

Any serious division adopted at this stage, therefore, cannot claim to be more than reconnaissance, a first working approximation, and this avowed empiricism may well shock purists. Although the most constantly recurring factor will be physiography, the division cannot be exclusively based on any one touchstone—"understanding is more important than classification." Moreover, while theoretically the three-fold division is paramount, as a matter of working convenience certain "Regional Groupings"—essentially positional—might be used, and these would bring the treatment of regions belonging to two or even three of the primary divisions into juxtaposition. After all, regions *are* so juxtaposed in nature, on the map, and in human activity.

Some Aspects of the Regional Geography of Tamilnad

BY

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(Thesis submitted for the Degree of Master of Letters in the University of Madras, January 1945, being the result of study and investigation pursued as a research student in the Department of Geography of the University of Madras, from September 1941 to April 1944, under the guidance and supervision of Dr. George Kuriyan, the Head of the Department of Geography).

INTRODUCTORY.

The importance of regional study for the promotion of geographical knowledge in India has been stressed by eminent geographers. Prof. Ogilvie of the University of Edinburgh deplores the lack of detailed monographs on the various sub-regions of the vast sub-continent of India.¹ Arthur Geddes also complains that in South India, though there has been much talk of linguistic provinces, there has been no conscientious use of geographical method for discussing possible economic provinces, on the basis of regional study.²

As observed by Geddes, the need for regional study is specially acute in South India on account of the agitation for

1. *The Technique of Regional Geography with special reference to India*, The Journal of the Madras Geographical Association, Vol. XIII, p.110.
There have been, however, several detailed monographs in recent years, viz.,
 - i. S. P. Chatterjee, *Le Plateau de Meghalaya (Garo-Khasi-Jaintia): Etude géographique d'une de l'Inde*; Paris, 1936.
 - ii. M. B. Pithawala, *A Geographical Analysis of the Lower Indus Basin*; Karachi, 1936.
 - iii. S. D. Pant, *The Social Economy of the Himalayans, based on a survey of the Kumaon Himalayas*; London, 1938.
 - iv. Radhakamal Mukerjee, *The Changing Face of Bengal*; University of Calcutta, 1938.
 - v. B. S. Sehagiri, *The Bombay Karnataka, A Geographical Survey*; Belgaum, 1941.
 - vi. George Kuriyan, *Studies in Kerala*, The Journal of the Madras Geographical Association, 1937, 1938; The Indian Geographical Journal, 1942.
 - vii. Kananāpal Bāgchi, *The Ganāges Delta*; University of Calcutta, 1944.
2. *Dynamic Problems of Geographical Reconnaissance in India*, J.M.G.A., XIII p. 57.

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the linguistic provinces. This is the justification for choosing a linguistic unit as a geographical region of study. Kazi Saiduddin Ahmad has divided India into several politico-geographic regions and Tamilnad forms one of his regions.³

The choice of a linguistic unit for a regional study can also be justified by the close connection that exists between language and environment. While on the one hand language has had its influence on the cultural and economic development of the peoples of the various regions, the spread of language is also influenced by the topographical features of the country. In his preface to *The Frontiers of Language and Nationality in Europe*, published in 1917 just on the eve of the armistice, Mr. Leon Dominion says, "The Language exerts a strong formative influence on nationality because words express thoughts and ideals. But underlying the currents of national feeling or of speech, is found the persistent action of land or geography, which like the recurrent motif of an operatic composition prevails from beginning to end of the orchestration and endows unity of theme. Upon these foundations, linguistic frontiers deserve recognition as the symbol of the divide between distinct sets of economic and social conditions".

However the region of Tamil Nadu (the country of the Tamils) though by nomenclature a linguistic region, has certain definite physical and climatic characteristics so that it may be described as a natural geographic region. It has a rhomboidal shape bordered by the ramparts of the Ghats, the Eastern and the Western on the north-western and the western sides and the Bay of Bengal on the eastern and the Palk Strait and the Gulf of Mannar on the southeastern sides.

DELIMITATION OF BOUNDARIES

Traditional Limits

In Tamil literature, Tamilnad is said to have extended from Cape Comorin in the south to the Tirupati hills in the

³ *Politico-Regional Division of India*, I.G.J., XIX, p. 97.

north (Kumari Vengadam).^{4 a-d.} The place-name Nellore of Tamil origin⁵ (Paddy village) indicates that the Tamil Region in the past might have extended even north of the Pulicat Lake. As regards the western limit, the ancient work *Silappadhikaram* takes it to the Arabian Sea.⁶ But *Nannool* composed in the 12th century A.D. defines it as extending up to Kudagam (Coorg).⁷ The Malayalam language must have gained separate individuality by then to distinguish Kerala, where it now prevails, as a separate linguistic area.⁸

The Method Used

There have been some movements of peoples in historic times as also political incursions on the part of potentates ruling different linguistic regions of those days. Tradition should not be the criterion in determining the exact limits of the Tamil Region of the present day. The present distribution of the Tamil language should be the main criterion for determining the limits. Accordingly, the limits of Tamilnad have been

4. (a) வடவேங்கடம் தென் குமரியாயிடைத் தமிழ்கூறு நல்லுலகம் (Tolkappiyam)
The Tamil language is spoken in the area, lying between the northern Vengadam and the southern Kumari
- (b) வேங்கடம் குமரி இம்புனற் பெளவமென் நிக்கான் கெல்லை தமிழ்து வழக்கே (Sikandiyar)
The Tamil language is in vogue in the area having as its four limits, Vengadam, Kumari and the two seas
- (c) கெடியோன் குன்றமும் தொடியோன் பெளவமும் தமிழ்வரம் பறுத்த தன் புனல் நாடு (Silappadhikaram)
The Hill of Tiruvikrama and the sea of the goddess Kumari are the two boundaries of the well watered Tamilnad
- (d) நீலத் திரைக் கடலோரத்திலே—நின்று நித்தம் தவஞ்செய் குமரி யெங்கு—வட மாவலன் குன்றம் இவற்றிடையே புகழ் மண்டிக் கிடக்கும் தமிழ்நாடு
The Tamilnad of great renown lies between the shore of the blue sea where the goddess Kumari ever performs penance and the northern hill of the god Vishnu (Bharatiyar)
5. The name Nellore is exclusively Tamil. The Telugu equivalent for it namely *Vadluru*, and the Sanskrit equivalent *Vrihivuram* are unknown.
6. குமரி வேங்கடம் குண குட கடலா மண்டினி மருங்கிற் றண்டமிழ் வரைப்பில் (Silappadhikaram)
The Tamil land is bounded by Kumari, Vengadam, the Eastern and the Western seas.
7. குண கடல் குமரி குடகம் வேங்கடம் என நான் கெல்லியினிருத்த தமிழ்க்கடல் (Nannool-Sirappayiram)
The extensive area of Tamilnad is bounded by the eastern sea, Kumari, Kudagam and Vengadam.
8. B. M. Thirunaranan, Traditional limits and Sub-divisions of the Tamil Region, K. V. Rangaswamy Ayyangar Commemoration Volume, page 162.

based upon the *Village Statistics* of the census of 1931.⁹ These statistics contain information regarding the linguistic distribution of population only for those villages in which more than 10% of the population speak a language other than the main mother tongue spoken in the taluk as a whole. Villages in the border land (as found in the Survey of India one-inch sheets) were first plotted on a map ($\frac{1}{4}$ " scale) and then the percentage of the Tamil speaking population was noted against each village. The 50% line was interpolated amongst these, the villages containing more than 50% Tamils being within this line and those containing less than 50% Tamils without.

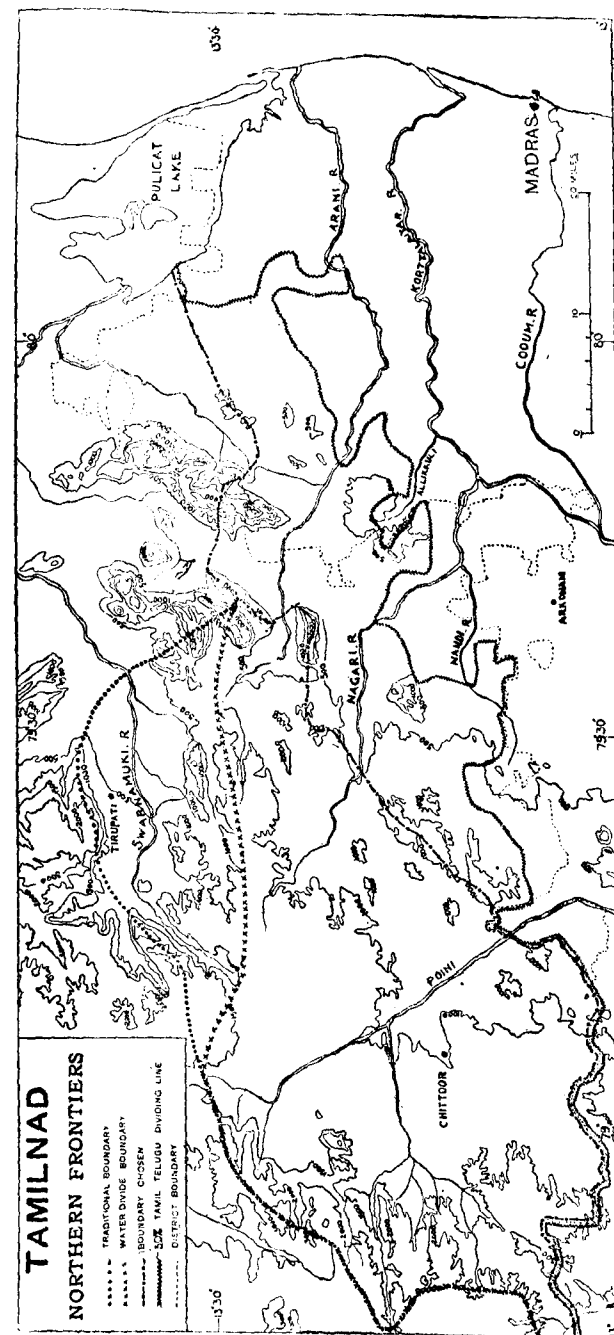
It was found that except in the northern border and in a few parts of the western border, the transition from Tamils to non-Tamils is abrupt across the 50% linguistic line, which more or less corresponds to the escarpment of the Mysore Plateau or the crest of the Southern Ghats. In the north the transition from Tamil to Telugu is gradual, the villages there containing a mixed population. It has therefore been necessary to reproduce only this part of the map so that the various alternative boundaries may be discussed in detail. (Map 1.)

The 50% line here is an arbitrary mathematical line following a zigzag path with the higher elevations on the Telugu side. This line behaves like a contour re-entrant going up along the valleys of the rivers it crosses, viz., Arani, Alikuli channel, Nagari, Nandiyar and Poini rivers. Along the valleys Arani, Nagari and Poini, there are a few preponderantly isolated Tamil villages even beyond the above dividing line.

Tamil-Telugu dividing line

From the above account, it is evident that the Tamil villages cluster along river valleys and the more favoured areas and avoid all higher slopes. It is probable that the stronger Tamil element has been able to displace the Telugu element in the better favoured river valleys and low ground.

9. Unfortunately the *Village Statistics* of the Census of 1941 do not give any detail about the linguistic distribution of the population.



As already indicated this 50% linguistic line is purely mathematical and cannot be entirely depended upon as a criterion for determining the limits of Tamilnad. The limits have therefore to be fixed by a line as close to the above purely linguistic line as possible and at the same time conforming to some definite physical boundaries. It is seen that such a line commences on the Pulicat lake, just north of Arambakkam village of the Ponneri Taluk, and runs westwards to join the Satyavedu ridge. From the Satyavedu ridge it runs to the Nagalapuram hills across the longitudinal valley between them following the water divide in the middle of the depression. From there it goes along the most southeasterly ridge of the Nagari group of hills and then along the Nagari Nose Mountains. Then it runs southwestwards along the crests of the line of foot-hills until it joins the Chittoor-North Arcot district boundary very near the crossing of that boundary by the Katpadi-Chittoor railway line. From there it runs westwards along the crests of the line of foot-hills and then in the forested escarpment of the Eastern Ghats which serves as the zone of separation between the Mysore Plateau and the Tamilnad plains.

Alternatives

It may be contended that the Tamil region should extend further north up to the Tirupati hills in conformity with the traditional limits extending from Kumari in the south to Vengadam in the north. This has got some definite advantages from the physical point of view as it follows the escarpments of Tirupati and the Eastern Ghats. But south of the Tirupati escarpment is the important valley of Swarnamuki, which is preponderantly Telugu and is aspected more to the Telugu country than to the Tamil area further south. Further, the traditional boundary cutting across this valley from the Tirupati escarpment on the north to the Nagari hills in the south must be more or less arbitrary. Another boundary may also be thought of. This would be the water divide running east to west on the southern side of the Swarnamuki valley. This

southern edge of the plateau up to Ramarkandi Malai. Crossing the Moyyar valley it follows the Nilgiris escarpment, which is the boundary between the Nilgiri and Coimbatore Districts. But the 50% linguistic line is pushed towards the plains as the Kanarese and Telugus have spread along the upper reaches of the Moyyar and Bhavani valleys from the plateau.

The Nilgiris is the most polyglot area in the Presidency. Not only do the Badagas, Todas, Kotas and Kurumbas each speak a tongue, which has been classified as a separate language or dialect but the plateau stands where three languages meet, the Tamil of Coimbatore, the Malayalam of Malabar and the Kanarese of Mysore.¹¹ The Tamils predominate only in the settlements of Coonoor, Wellington, Ketti and Ootacamund along the railway line and the plantation centres of Sholur, Hulikal and Melur. Elsewhere the population is non-Tamil. Hence the whole of Nilgiri plateau is left out.

From here onwards the eastern boundaries of Palghat, Cochin and Travancore represent the linguistic boundary but for two exceptions. Near the Shencottah gap, the ghats offer a better frontier than the political one both from the linguistic and physical points of view. Thus the habitable portions of Shencottah taluk of Travancore fall within the Tamil limits. In the extreme south of the Travancore State, the four taluks of Vilavancode, Kalkulam, Tovala and Agastiswaram belong to the Tamil Region as the majority in them speak Tamil as their mother tongue. (See Table below).

Taluk.	Percentage of Population with Tamil as Mother tongue	
	1931	1941
Tovala	99%	98%
Agastiswaram	90%	97%
Kalkulam	85%	85%
Vilavancode	75%	78%
Shencottah	95%	95%
Devikulam	87%	83%
Pirmede	54%	49%

11. Nilgiris District Gazetteer, Vol. 1, p. 124.

From the above table it would appear that there are two more taluks, Devikulam and Pirmede, the population of which is mainly Tamil speaking. But this represents only the migratory labourers on the plantations, who have their permanent homes in Tamilnad east of the Ghats and in south Travancore.

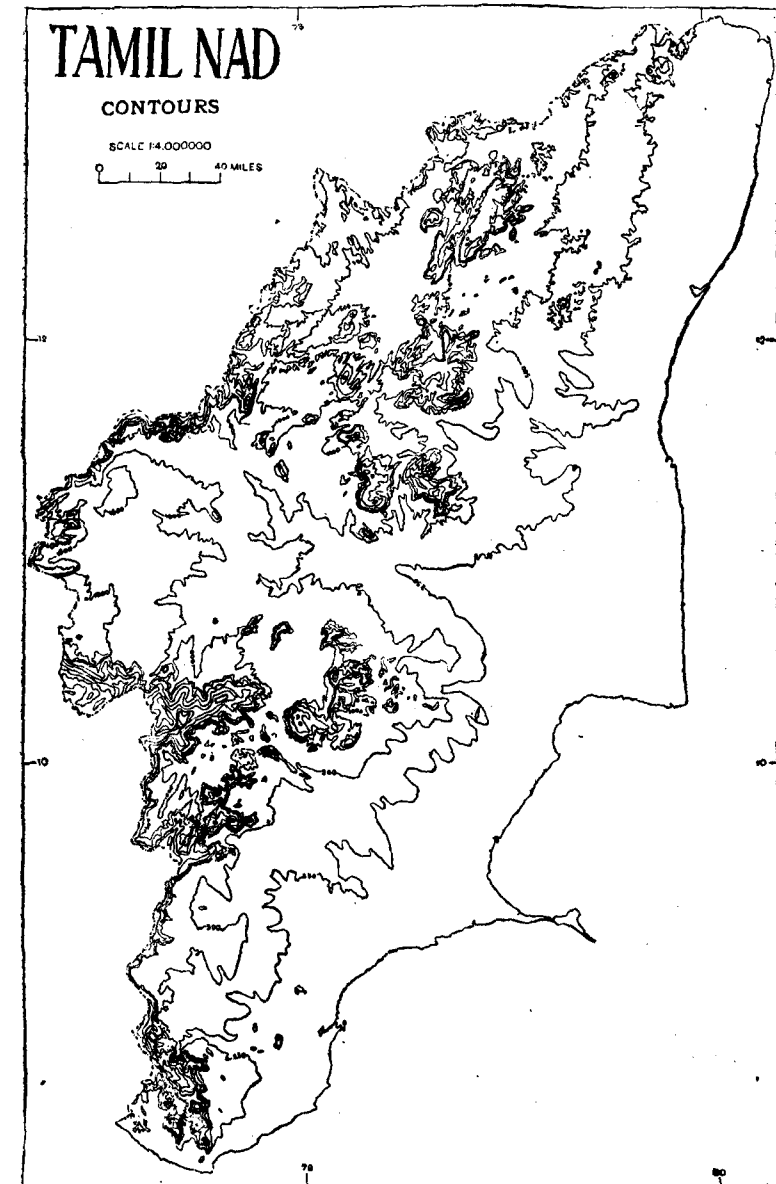
PHYSICAL GEOGRAPHY AND GEOLOGY OF TAMILNAD.

Relief.

As already seen this region is in the form of a rhombus bordered by the hills of the Eastern Ghats and the western Ghats on the northwestern and western sides and by the Bay of Bengal on the eastern and the Palk Strait and the Gulf of Mannar on the southeastern sides. The longer diagonal of this rhombus stretches from the Pulicat Lake in the north to Cape Comorin in the south and the shorter diagonal from the Palghat Gap in the west to Pt. Calimere in the east. The Palghat Gap, on an average 15 miles wide, is the only marked break in the great mountain wall on the west. The ghats on either side of this gap attain their maximum height in the hill groups of the Nilgris and the Anamalais, the lofty Palnis being an off-shoot of the latter. There is another and less important off-shoot of the ghats in the Varushanad and Andipatti ranges in the south.

The major hill groups lying within the region comprise the Javadis, Shevaroyas, Kalroyans and Pachchamalais north of the Cauvery, and the Madura hill group south of the same river. The hill groups north of the river, having the same trend as the ghats forming the northeastern boundary, appear to be one continuous block which has been separated into three main groups by the rivers Pennaiyar and Vellar. The Madura hill groups appear to be a continuation of the Varushanad and Andipatti ranges from which they are separated by the Vaigai valley.

The Cauvery valley constitutes a narrow strip of low country stretching across the region separating the hill groups



MAP 3.

north and south of it. The low country proper roughly below the 500 ft. contour, lying east of these hills, varies from 50 to 80 miles in width. South of the latitude of Madura this plain extends almost up to the foot of the ghats and there are only minor elevations here and there as in the Valanad hills.

The coastline, which forms the boundary on the east is generally emergent in character with a straight and unindented trend. Locally there have been positive or negative changes leading to accretion of land as near the mouth of the river Tambaraparni or erosion at Tarangampadi or Mahabalipuram.¹²

Rivers

The rivers of the region are all of great antiquity and owing to the denudation of the ages, they have almost base-levelled the land. The valleys are broad and shallow, and their curve of erosion is more or less regular except those caused by the falls at the fault scarp.¹³

The principal rivers of the region are the Palar, the Pennaiyar, the Cauvery, the Vaigai and the Tambaraparni. Of these, the Cauvery, is by far the most important. Rising in the Western Ghats almost within sight of the Arabian sea, it travels nearly the entire breadth of the Peninsula and forms a large delta at its mouth.

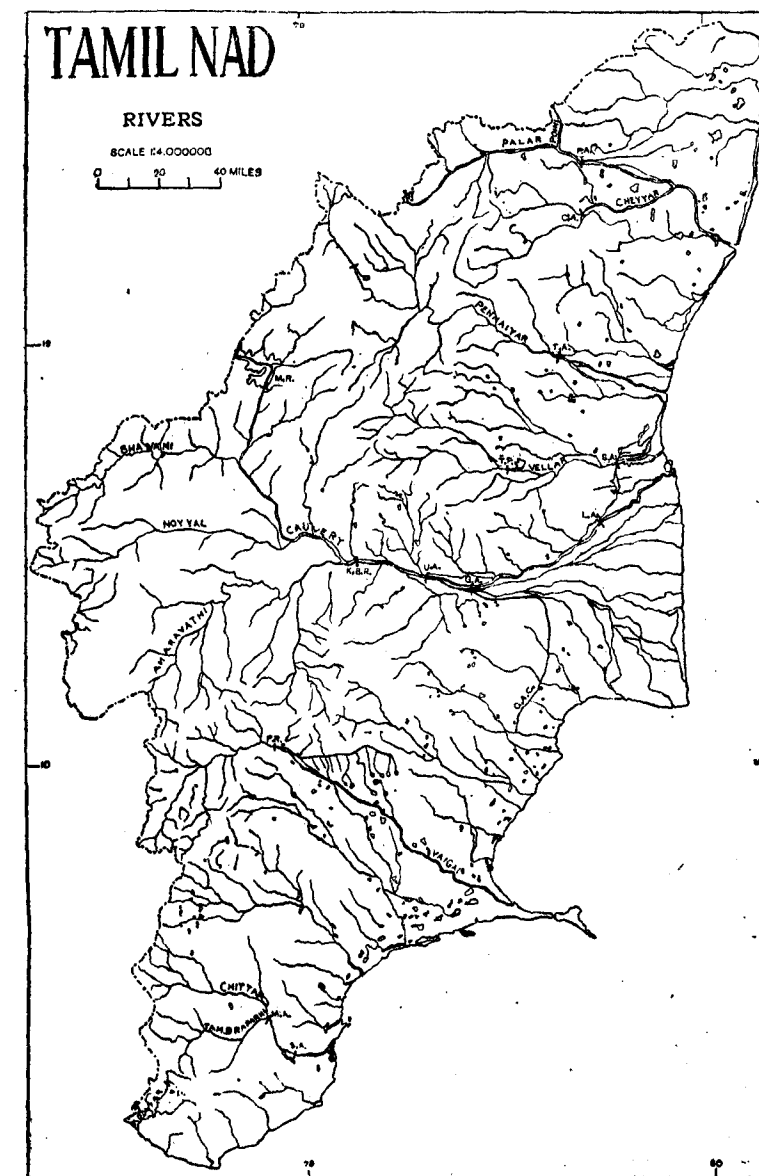
The rivers Palar and Pennaiyar have their source very close to each other near Nandidrug on the Mysore Plateau and flow down the escarpment through gorges and do not form deltas at their mouths.

The river Vellar draining the southern slopes of the Shevaroy's and Kalroyans and the northern slopes of the Pachchamalais enters the sea just north of the Cauvery delta.

Of the two southern rivers, the Vaigai and the Tambaraparni rising in the southern ghats, the latter receives directly

12. Kaverippumpattinam, the one time capital and the chief port of the Cholas, is believed to have been submerged below the sea. The tiny village of the same name is too small to have been the flourishing port of the Cholas.

13. D. N. Wadia, *Geology of India*, p. 17.



MAP 4.

P. A. Palar Anicut. C. A. Cheyyar Anicut. T. A. Tirukkoilur Anicut.
 T. P. Tozhudur project. S. A. Shatistope Anicut. M. R. Mettur Reservoir.
 K. B. R. Kattalai Bed Regulator. U. A. Upper Anicut. G. A. Grand Anicut.
 G. A. C. Grand Anicut Canal. L. A. Lower Anicut. P. R. Perandai Regulator.
 M. A. Marudur Anicut. S. A. Srivaikuntam Anicut. P. D. Pechipara Dam.

the benefit of the southwest monsoon showers. As Mr. R. B. Foote says, "Except in the case of the Tambaraparni, the watershed of the Western Ghats is mostly close to or coincident with the top of the eastern scarp, hence nearly the whole of the very heavy rainfall is drained off into the sea or the backwaters of Cochin and Travancore, while on the eastern side of the mountains the rainfall is very scanty and the rivers receive only occasional freshes which cannot be depended upon."¹⁴ This is the reason why the Tambaraparni alone of the southern rivers has a large flow and forms a delta at its south Vaigai, though a much larger river considering the area of drainage, does not form a delta at its mouth, and before the construction of the Periyar project, its basin ensured only one crop per annum, whereas the Tambaraparni has from time immemorial never failed in its water supply and two good crops are raised in its most fertile valley.¹⁵

A glance at the map showing the rivers and streams of the region will reveal a secondary line of flow (S.W.-N.E.) in addition to the main direction of flow from northwest to southeast following the lie of the land in the region north of the Cauvery. The explanations for these are to be sought for in the structure of the region.

The Geological Formations of the Region

The geological formations met with in this region may be arranged in the following order:—

Aeolian Sand dunes and hills		Recent & Sub-recent
Alluvium		Pleistocene and Recent
Laterites		Variable (Pleistocene or Miocene)
Cuddalore Sandstones		Miocene
Marine deposits of Pondicherry, Vriddachalam & Trichinopoly		Upper Cretaceous

14. R. B. Foote, *Mem. G.S.I.*, XX, p. 3-4.

15. *Ibid.*, p. 4.

Upper Gondwana Shales & Sandstones		Jurassic
Cuddapah Quartzites		Precambrian
Charnockites, Dykes & Veins—Intrusives into Gneisses & Schists	}	
Gneisses and Schists		

Archaeans.

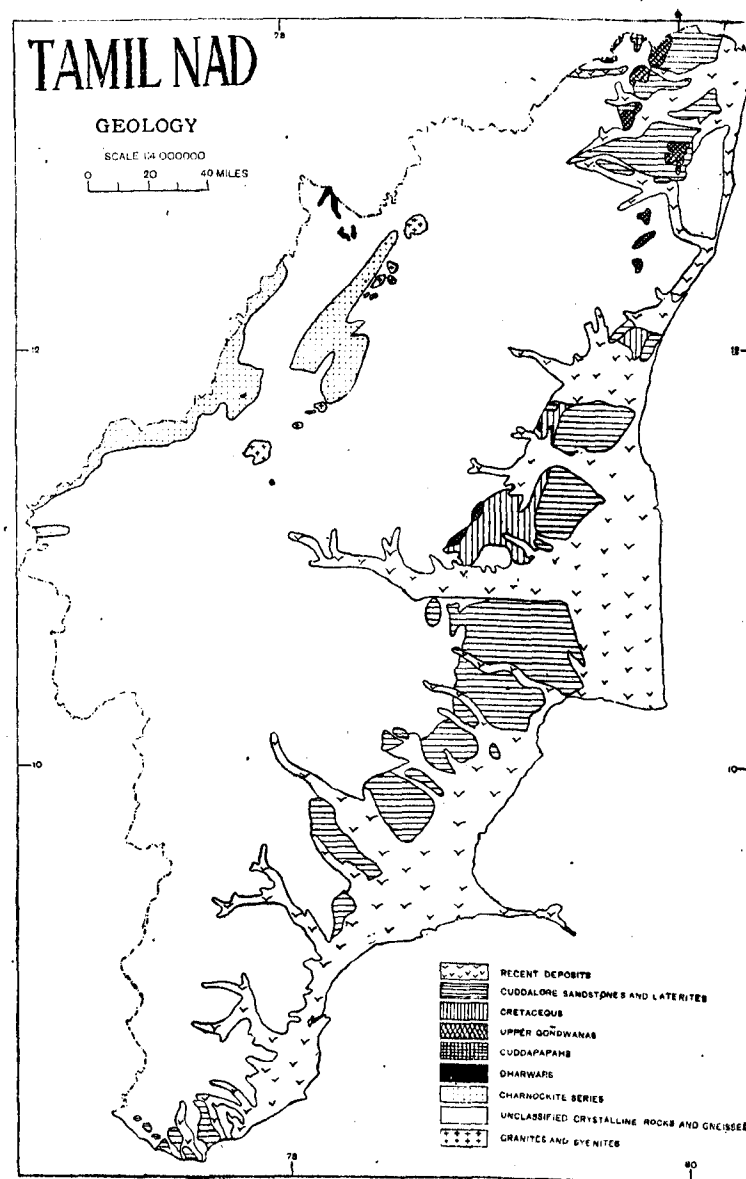
A very large part of the region exposes rocks of the Archaean age and elsewhere, though not visible at the surface, it is quite clear that they form the foundation on which later deposits have been laid down. These fundamental or basement formations may be roughly classified into an older group of gneisses and schists and a younger group of intrusive rocks including the charnockites.

Older Gneisses:—North of the Palar the gneisses are mostly granitoid in character giving rise to rounded hills and characteristic granitic topography—bare masses of rock with tors and here and there precipitous cliffs. They are well seen on the plateau surface and in a few places on the plains to the south of the Palar river. Similar granitoid gneisses are found in parts of South Arcot District, where they present a very unusual appearance when compared to the normal varieties of the gneissic rock in that they appear to be made up of innumerable large rounded blocks, which often stand out as fine tors forming conspicuous objects in the landscape.¹⁶

In contrast to these massive granitoid gneisses of the north, the gneisses in the southern parts of the region are micaceous and possibly hornblendic in character and consequently well foliated, in a roughly N. E. to S. W. direction.

Associated with the gneisses there occurs an extension of the Kolar band of Dharwar Schists across the boundary of the region into Salem District, and on crossing the boundary it splits into two branches—an easterly one about threefourths of a mile broad, which runs as far south as Maharajagadai before

16. R. B. Foote and King, *Mem. G.S.I.*, IV, Pt. 2, p. 77.



MAP 5.

SOME ASPECTS OF REGIONAL GEOGRAPHY OF TAMILNAD 21

thinning out and a westerly one slightly shorter in length extending along the hills on the western side of the Vepanapalle valley. In addition to these main bands there are a number of minor bands east of Krishnagiri. (See Map 5).

There are numerous talcose and chloritic schists in the Salem and North Arcot districts well developed along the north bank of the Pennaiyar river. Associated with these schists in some places are small beds of steatite or potstone, used for making culinary vessels.

Charnockites:¹⁷—Intruded into the older gneisses are outcrops of the members of the charnockite series—acid, intermediate and basic divisions. The leading features of the members of this series are their medium grained texture, bluish grey to dark greenish grey colour (owing to the characteristic blue colour of the quartz and the associated felspar and the presence of a rhombic pyroxene), the subconchoidal fracture and the fresh condition of the rocks. The charnockites are found developed extensively in the region south of the Palar where they form the more important relief features—the Javadi hills, the Shevaroy and the Palnis and also the greater part of the Southern Ghats in the extreme south. They generally form plateau like masses with a gently undulating surface—a feature which is suited for the formation of lakes like those near Kodaikanal, Yercaud etc. The members of this series have a rough foliation in a direction N. N. E. to S. S. W, parallel to the direction of the coastline. The compact masses of charnockite composing the lofty hill groups of the Nilgris, the Palnis and the Shevaroy have been squeezed in while in a molten condition along the foliation planes in the gneisses, this being the direction of least resistance to the invading rock.¹⁸

Associated with charnockites and believed to be their genetic relatives, there are masses of quartz felspar rocks occurring either as veins or dykes or occasionally in large masses, as

17. T. Holland, *Mem. G.S.I.*, XXVIII, p. 124.

18. H. Narayana Rao, *J.M.G.A.*, Vol. I, p. 61.

for example at Mahabalipuram, where a ridge of this type half a mile in length and running parallel to the coast, has been elaborately sculptured for the construction of temples. The rocks that form the Southern Ghats and the Cape Kumari are also largely of this type.

Associated with the gneiss are to be found outcrops of crystalline limestone at several places. In Madura and Tirunelveli (Tinnevely) districts the principal outcrops are at Tirumal, Kokkulam, Pantalakudi and Shenkottai. The Pantalakudi exposure is a large and important one with an average width of 50 yards, and is continued 6 miles to the south in the Shenkottai beds.¹⁹

Crystalline limestone of fine quality is found to the south and to the southeast of Karur. The Madukkarai bed, which crops out on the ridge seven miles southwest of Coimbatore is, according to Foote, of great value and very accessible and would work into various ornamental forms and articles.²⁰ On this is based the cement industry at Madukkarai.

In Tiruchirapalli (Trichinopoly) and Salem districts this rock is found only in the southern parts. It occurs at Naiveli and Mootum on the banks of the Iyar, and near Culpatty and at Shattumbur 7 miles to the southwest of Namakkal.

Although the limestone occurs at the several places above mentioned, it is not much used by the people. They prefer the more stubborn gneiss as a building stone for their temples and the more readily collected little fragments of kankar for making lime. As a material for building, it is lighter than any of the gneissic rocks, and more or less equally durable.²¹

Minor Intrusions:—The archæan gneisses and schists have been intruded into by dykes and sills, the great majority of which are traps. They are referable to two systems, one from north to south and the other east by north to west by south. Their exact age is not known but they may be (in the opinion

19. R. B. Foote, *Mem. G.S.I.* XX, p. 21.

20. *Coimbatore Manual*, Vol. I, p. 22.

21. R. B. Foote & King, *Mem. G.S.I.*, I. IV. Pt. 2, pp. 50-57.

SOME ASPECTS OF REGIONAL GEOGRAPHY OF TAMILNAD 23

of Dr. M. S. Krishnan) of the same age as the traps intrusive into the rocks of the Cuddapah system.

As a rule the dykes weather more slowly than the surrounding gneisses and consequently they form conspicuous wall-like ridges, especially in the northern part of the region. Associated with the basic dykes are dykes of felspathic porphyries, quartz veins, granitic veins²² and pegmatites, some of which seem to be younger in age than the basic dykes. They are mostly developed in the North Arcot district.

The basic dykes are extremely rare in Tirunelveli and South Travancore, very few are seen in Madura, Pudukkottai and South Tiruchirapalli. North of the Cauvery their number increases. They are most numerous in the northern parts of the region and often of great size and length and the network formed by these multitudinous dykes is one of the remarkable displays of trappean injection in any country.²³

The Magnesian Series of Chalk Hills:—The ultra-basic rocks traversed by abundant magnesite veins are found in an area of about 12 square miles to the north and northwest of Salem town. This is a barren hilly tract with a whitish appearance by which it came to be known as 'the Chalk Hills'. The magnesite of the Chalk Hills was formed by the action of carbonic acid on eruptive peridotites.²⁴

Cuddapah Formations.

The next series of rocks in point of age belong to the Cuddapah system. The Nagari Nose mountain, the Kambakkamdrug and the Nagalapuram ranges are composed of the

22. The greatest development of granitic veins occurs north of the river Cauvery in a band stretching from the neighbourhood of Irungānallur about 10 miles north-northeast of Tiruchirapalli to as far as Karur and even beyond. This band is from 4 to 6 miles wide. These veins are intruded between the foliation planes in the gneisses in a northeast by north direction (*Mem. G.S.I.* IV. Pt. 2, p. 114).

23. R. B. Foote, *Rec. G.S.I.* XII, p. 196.

24. The peridotite is an olivine rock (magnesium silicate), which under the action of carbonic acid has produced magnesium carbonate and free silica. The free silica, formed as the end product of alteration of peridotites by carbonic acid, gives rise to masses and veins of pure quartz. The most important of these are the two masses of white quartz known as the White Elephant Rocks found on either side of the Shevaroya. (F. J. Richards, *Salem District Gazetteer*, Vol. I, Pt. 1, p. 29).

quartzites and conglomerates of this period. These rocks are the lowest formations of the Cuddapah system and occur on the northern border of the region and continue further north.

Upper Gondwana Formations

This group of rocks found as small patches eastward of the gneissic rocks are probably the remnants of a once continuous formation, now separated by denudation and overlain by later deposits, chiefly laterites.²⁵

To this system belongs the sandstones, shales and conglomerates composing the shale beds of Sriperumbudur and the Satyavedu and Alikur hills. They are referable to two stages, the lower and the upper. The lower beds form a group known as the Sriperumbudur beds consisting of whitish shales containing fossil plants. The Sriperumbudur beds are overlain by a series of coarse conglomerates interbedded with sandstones and grits which contain few organic remains. This upper division is known as the Satyavedu beds.

Isolated outcrops of the Upper Gondwana formations are met with at a number of places south of Sriperumbudur in the Chingleput and South Arcot districts. The plant beds near Utatur in Perambalur Taluk consist of soft sandy clays and micaceous shales, with sandstones and coarse conglomerates of gneissic boulders and pebbles at the base resting directly on the gneiss. These beds are exposed in five or six narrow patches extending along the western boundary of the Cretaceous area in a N. E. to S. W. direction, parallel to the direction of the strike of the metamorphic rocks.²⁶

Two outcrops of shales closely resembling the shales of Sriperumbudur have been noticed by Foote underlying the lateritic rocks to the northeast of Sivaganga, but unfortunately no fossil evidence was found. He also noticed a few boulder beds to the northeast of Sivaganga formed by marine action resembling similar beds at the base of the upper Gondwana formations.²⁷

25. R. B. Foote, *Rec. G.S.I. XII*, p. 198.

26. *Trichinopoly District Gazetteer*, Vol. I, p. 14.

27. R. B. Foote, *Rec. G.S.I. XII*.

Cretaceous Formations,²⁸

The Cretaceous beds are exposed in three detached areas, separated from each other by the alluvium of the Pennaiyar and the Vellar rivers. They rest to the west on the gneiss or upon the Upper Gondwana beds and are covered on the east by the Cuddalore sandstones. The southern and the largest of these areas, between the Vellar and the Coleroon rivers, is in Trichinopoly district and hence is known as the Tiruchirapalli area. The two smaller ones further north are known as the Vriddachalam and Pondicherry areas after the important towns of those areas. In all these three areas there is a low dip to the east with the lowest beds in the west and the higher ones in the east.

The Cretaceous rocks are divided into three stages in the order of superposition, Ariyalur (uppermost), Tiruchirapalli* and Utatur (lowermost).

Utatur stage:—The Utatur stage is the lowest of the series. It is mostly an argillaceous group of about 1000 ft. in thickness. The base of the group contains large masses of limestones formed as Coral reefs. This is succeeded upwards by fine silts, clays and gritty sandstones.

Tiruchirapalli Stage:—The next upper stage known as the Trichinopoly stage is also of about the same thickness. The rocks are false bedded coarse grits and sands, clays and shelly limestone with shingle and gravel beds. Some of the shell limestones for instance that of Garudamangalam, form a very hard bluish grey rock, which in parts are translucent. This is much prized as an ornamental stone, and used in building work under the name of the Trichinopoly marble.

Ariyalur Stage:—The Ariyalur stage also consists of about 1000 ft. of regularly bedded sands and clays with calcareous and concretionary beds full of fossils towards the top. The Ariyalurs occupy by far the largest part of the Cretaceous area and are richest in fauna. They are more sandy than the two

28. H. F. Blanford, *Mem. G.S.I. IV*, Pt. I.; D. N. Wadia, *Geology of India*, p. 302.

*Tiruchirapally is the modern name for Trichinopoly.

lower groups. The uppermost beds of this stage are sharply marked off from the lower ones and form a distinct sub-division known as the Ninniyur stage though there is no stratigraphical break between them.

Cuddalore Sandstones.²⁹

Out crops of this formation extend in more or less disconnected inliers throughout the whole length of the coast. The beds are soft and loose textured and are generally ill consolidated, being rarely sufficiently compact to be used as a building stone. They consist mainly of grits and sand-stones. They are often ferruginous, argillaceous and gritty and are of all hues of yellow, red, brown and purple. They are overlaid by lateritic conglomerates, gravels and sands and the relations between the two being extremely obscure it is not possible to differentiate them on the map. Owing to the absence of any fossil remains excepting some tree stems found at Tiruvakkarai near Pondicherry, the exact age of this formation is yet undecided.

The outcrops of this formation generally form low plateaus terminating in low but abrupt headlands on their northern and eastern sides.

The flora on this formation is characteristic of dry soil, marked by the absence of trees requiring much moisture such as coconut palm, and bamboos, and the occurrence of extensive jungles of low scrubby, prickly shrubs and palmyras. Where an abundant supply of water can be got, rice cultivation is also carried on, but compared with the alluvium, the whole country has a barren aspect. The surface is level, or only slightly undulating, without any rise worthy of the name of a hill.

Lateritic Formations.³⁰

Laterite is generally formed by the sub-areal alteration of the surface rocks under the alternatively dry and humid (i. e.

29. R. B. Foote and W. King, *Mem. G.S.I. IV*, Pt. 2. p. 34; D. N. Wadia, *Geology of India*, p. 230. p. 37 & p. 234.

30. R. B. Foote and W. King, *Mem. G. S. I. IV*, Pt. 2. p. 45; D. N. Wadia, *Geology of India*, p. 37 and p. 294.

monsoonic) weather of India. It is a kind of vesicular clayey rock composed essentially of a mixture of hydrated oxides of alumina and iron. The iron oxide generally preponderates and gives the rock its prevailing red colour. It has the peculiar property of being soft when newly quarried, but becoming hard and compact on exposure to the air. On account of this property it is usually cut in the form of bricks for building purposes. Also loose fragments and pebbles of the rock tend to recement themselves into solid masses as compact as the original rock. This property makes it a very useful road metal for very light traffic. It is found to occur on all the previous formations, especially over the Cuddalore sandstones.

Alluvial Formations.

Owing to the great extension of wet cultivation carried on along the various rivers and under tanks constructed across their tributaries, the area of alluvium has in the course of many centuries, been largely increased by the formation of artificial alluvial spreads.³¹ There are also variations in the alluvial spreads accompanying the changes in the courses of rivers. It is a well established fact that the river Palar has shifted from its original course marked by the present Kortelliar river to the present position. Hence the present valley of Palar is very disproportionate to the river and equally the alluvium of Kortelliar is greatly disproportionate to its river, which now flows in a deep channel.³² The alluvium generally consists of the reddish loam derived from the red soil of the gneissic tracts. But occasionally it is made up of black loam as in the Virudupatti and Vaipar rivers, being washed up regur.³³

An interesting feature is noticeable in the alluvial spreads of the rivers of the South Arcot district. The alluvial plains are much wider inland than they are at the sea board, the reason being that the rivers which formed them were constricted by

31. R. B. Foote, *Rec. G. S. I.* p. 144

32. R. B. Foote, *North Arcot Manual*, P. 21.

33. R. B. Foote, *Mem. G. S. I. XX*. P. 76.

the plateau of the Cuddalore sandstones which intervenes between them and the sea.³⁴

The rivers of the east coast turn northwards just when they enter the sea. Mr. P. G. Dowie contends that the northward flow of rivers at their mouths on the east coast is due to the activity of the northeast monsoon currents, (described by him as being more active on this coast) which causes greater accumulations to the south of the mouths, the rivers being diverted northwards away from the silted area.³⁵ On the contrary it is the southwest monsoon currents which are more active, and these extend the sand bars northwards thus pushing the rivers to the north.

In the case of the Tambaraparni owing to the accumulating sediments, the delta is advancing into the sea at the rate of 18 ft. per annum.³⁶ One consequence of this is that the old towns which were once important sea ports have now receded into the interior and fallen into decay, while new ones are springing up. (e. g. Korkai & Kayal).

An interesting formation is 'Kankar' in the valleys of the rivers of the region. It is well developed in many places such as in the river valleys of Bhavani and Amaravati near the towns of Bhavani and Karur in the Coimbatore district, and in the southern part of the Tirunelveli District. It is worthy of note that both these parts are among the drier areas of Tamilnad. Hence "there is the possibility of water percolating to some degree in the soil and the sub-stratum only in the valleys of rivers and streams and this percolated water is sucked up by capillary action to the surface and evaporated in the dry season; and the dry southwest monsoon may greatly help in the drying process of the surface layers."³⁷

These calcareous deposits generally consist of nodular and vermicular shapes and in a more agglomerated state (Odeikkal

34. W. Francis, *South Arcot District Gazetteer*, Vol. I, p. 19.

35. P. G. Dowie, *J. M. G. A.*, XV, p. 319.

36. R. B. Foote, *Mem. G.S.I.* XX, p. 81.

37. P. G. Dowie, *J.M.G.A.*, XV, p. 317.

or river-stone) as continuous sheets. Near Tirunelveli this tufaceous conglomerate, forming a low platform in the bed of the river, has served as basements on which small temples have been built.³⁸

There are several clay beds of alluvial origin near the coast full of marine and estuarine shells of the existing species. Their economic importance is due to the fact that the sub-fossil shells are dug out and burnt into chunam.

Aeolian Formations

The Aeolian formations are of two different kinds both in colour and mode of origin—the white sands of the coastal sand dunes, and the red sands of the teris.

The sand dunes found in many parts of the coast owe their origin to the drifting of the sands by the winds. They frequently extend for two or three miles inland from the coast. The drifting of the sands is prevented by planting casuarina.

The red sand deposits or the *teris* are confined to the Tirunelveli and Ramnad coasts only. Dense clouds of sand and dust are blown by the southwest monsoon off the bare red soil plains towards the coast, where this wind meets the sea breeze, and is checked and sand deposited to form the *teris*.³⁹ It appears probable that this accumulation is favoured by the gentle elevation of the marine formations over which these deposits occur.⁴⁰

The continual movement of the *teris* is frequently a serious problem as it buries cultivated fields, gardens and houses, covers up the tanks, alters the drainage system of the region. Several small lakes, which the *teri* deposits themselves have created by damming up of the drainage, have been greatly diminished or completely covered by their subsequent advance.⁴¹

38. R. B. Foote, *Mem. G.S.I.* XX, p. 77.

39. R. D. Oldham, *Manual of Geology of India*, p. 416.

40. P. G. Dowie, *J. M. G. A.* XV, p. 327.

41. *Ibid.* p. 325.

As the population increases, the whole waste will eventually be reclaimed, for the teris are by no means barren sand heaps. There is a high proportion of fine red clay mixed with siliceous grains and hence given sufficient water the teris will be fairly productive.⁴²

As the teri deposits are loose and porous it is only in exceptionally heavy rains that any water flows off the surface of the sands; all other rainfall is absorbed at once and flows around the base quietly and continuously as springs. Advantage is taken of these springs and water from them is conducted by means of channels for irrigating the fields and gardens in the neighbourhood. Besides, the sandy deposits act as sponges in absorbing the little rain the region receives and storing it in the lower layers and this water is tapped by wells in the valley depressions by the people.⁴³

The Structure of the Region

As the gneissic formation covers the major portion of the area the structure of the region is determined by that of the gneisses. These gneisses were formed in very early geological times by forces acting in a S. E.—N. W. direction. Hence the planes of cleavage or foliation planes have developed at right angles to this direction i.e., in S. W. to N. E. direction. It is evident that the axes of folds and hence the strike of the bedding will also be in the same S. W. to N. E. direction perpendicular to the direction of force. In the alternation of outcrops of hard and soft rocks, the latter are more easily denuded to form the river valleys while the former stand out as ridges. Thus the ridges and valleys have developed in a southwest to northeast direction especially in the Salem Arcot area.⁴⁴

It may be noted in this connection that the strike direction in Tirunelveli is N. W.—S. E.

42. R. B. Foote, *Mem. G.S.I.* XX, p. 96

43. *Ibid.*, p. 92; P. G. Dowie, *J. M. G. A.* XV, p. 324.

44. F. J. Richards, *Salem District Gazetteer*, I. Pt. 1, p. 4.

There is some parallelism existing between the direction of strike and the coastline in the north probably because they are the result of the same cause. In North Arcot district, the strike direction which is southwest to northeast in the southern part, changes to southeast to northwest in the north. This change in the direction is a feature common to the whole gneiss area about the latitude of Madras eastward of the Mysore plateau.⁴⁵ Here also it may be noted that the coastline at Madras shows a suggestion of the same change of direction as that of the strike.

The peninsula of which this region forms a part has remained a stable landmass of great rigidity and has been unaffected by any folding movement during later geological periods. The only structural disturbances are of the nature of vertical, downward or upward movements of the nature of faults.⁴⁶

The fact that all the principal elevations such as the Nilgris, the Palnis and the Shevaroyes are plateaus and not ridges have led the earlier geologists to conclude that they are the remnants of a tableland separated from one another by marine denudation. R. D. Oldham in his *Manual of Geology of India* has doubted the correctness of this theory, when he said, "Except in the peculiar form of the hills there is but little in favour of this view, but on the other hand there is nothing to indicate that the hill groups of the Carnatic and Travancore are areas of special elevation".⁴⁷

At about the same time, Sir Thomas Holland, showed that these mountains owe their origin to the fault movements. The major faults which have occurred on the southeast face of the Nilgris, the Shevaroyes and the Palnis running in a N.E. to S.W. direction, have been described by him, as being due to the transverse dislocations formed by unequal compression of the different parts of the same fold.⁴⁸ In such earth movements

45. R. B. Foote, *North Arcot Manual*, I, p. 10.

46. D. N. Wadia, *Geology of India*, p. 13.

47. R. D. Oldham, *Manual of Geology of India*, p. 5.

48. T. Holland, *Mem. G.S.I.* XXX, p. 139.

"it is natural to expect the great solid masses of compact rock, such as the Nilgris to sever connection with the very different material which forms the gneiss and schists of the Coimbatore plains".⁴⁹

Economic Geology

Building Stones:—The gneissic rocks have been used as building stones for the construction of temples, chatrams and other public buildings, where the permanance of the structure is important. In private houses these rocks are not made use of extensively except in the door steps, pillars etc. Certain types of these rocks are excellently suited for fine carvings as is illustrated in the numerous temples scattered all over the country. In certain of them as at Vellore and Srimushnam stone chains have been carved from a single block of stone and each link in them is separate and moveable.

The charnockites extensively quarried at Pallavaram and other places are used as road metal and rail road ballast. The basic varieties are well suited for ornamental stones in buildings, as they take on excellent polish and hence are used as tomb and ornamental stones. Due to the prevailing dark colour of the rock it is not extensively used as a building stone.

Trap rocks are used only as rough stones for tank bunds etc., and very rarely as road metal, for which latter purpose they are better than almost any other class of rocks, especially for military and other roads exposed to heavy traffic. For use as a road metal, the question of how far the increased expense of quarrying and breaking up would be met by its greater durability has to be considered.⁵⁰

Satyavedu sandstone of the Upper Gondwana series is widely excavated near Satyavedu, Nagalapuram, Kanchepuram

49. T. Holland, *Mem. XXVIII*, p. 186.

Fermor in his memoir expresses the same view, "The charnockite region is on the whole more elevated than the non-charnockite region, although composed of rocks that must have been once at greater depths below the surface. This means that there must have been a rise of several thousand feet of rocks of the Charnockite region relative to the non-Charnockite region" (L. L. Fermor, *Mem. G.S.I. LXX*, p. 48).

50. H. F. Blanford, *Mem. IV. Pt. 1*, p. 204.

etc., and used as good building and ornamental stone on account of its easy workability and possessing a pleasing appearance of reddish or yellowish red colour. The Sriperumbudur shale beds of the same age form a very important pure deposit of clay, suitable for the manufacture of good porcelain ware. There is a ceramic factory based on this at Tiruvellore.

A few deposits of crystalline limestones are known to occur in the vicinity of Sankaridrug. In the limestone of Iveli-Annadanappettai area the limestone is exceptionally high grade with magnesia under 1.5% and is therefore suitable for the manufacture of bleaching powder (for anything higher than 1.5% would make the bleaching powder hygroscopic and affect its stability). The area is favourably situated as regards transport, being close to the railway and to an important road. The total quantity which might be expected from Iveli and the area further south is about 100,000 tons within a depth of 10 ft. from the surface. The quantity available is enough for a moderate production for a period of several years. Recent surveys have indicated an extension of the limestone belt further east of this area. Some of these limestones are dolomitic in composition and therefore suitable as basic lining for the steel furnaces.⁵¹

Crystalline limestone is found in Tazhaiuthu ridge near Tirunelveli town. Portions of this are of very high grade and have therefore been reserved for chemical purposes. The India cement works proposes to start a cement industry based upon this as well as from Coral steel limestone from the coast.

The limestones of the cretaceous rocks are used for the construction of small pagodas and chatrams. In Pondicherry they are used in the door steps of the houses and the curbstones of the pavements of the streets. They are not well fitted for exposed exteriors where they yield to the heavy tropical rains.⁵² These stones being soft and easily worked are used to a considerable extent for rice mortar and water troughs.

51. M. S. Krishnan, *Rec. LXXVII*, Professional Papers, No. 7.

N. K. N. Aiyangar, Note on some crystalline limestone deposits in the Salem district, G. O. No. 817, Development, dated 28th Feb. 1945

52. H. F. Blanford *Mem. G. S. I. Vol. IV. Pt. 1*, p. 205-206.

At the base of the Utatur Cretaceous beds there is a dark grey somewhat arenaceous limestone. It is locally used as a building stone and within the last five years, for the manufacture of portland cement at Kallakudi (Dalmiapuram) near Pullambadi.⁵³

Laterites are used as building stones, rivetting tank bunds and for road metalling. For the last purpose its property of binding closely, renders it particularly suitable and counterbalances the disadvantage that it wears away quickly. It is particularly used as a cheap building stone because of the ease of quarrying and because of its peculiar property in being soft on quarrying but hardening on exposure.

Neither the crystalline limestone of the gneissic rocks, nor those of the cretaceous are employed for making lime. The people prefer to burn kankar or the shells deposited in backwaters, or the sub-fossil shells dug out from the alluvial beds.

Alluvium is used in many places for the manufacture of bricks. Near Panruti, on the south bank of the Gadilam, is found a fine plastic clay, which is soft and extremely tenaceous. This as well as the Tertiary clay are used for the manufacture of the famous Panruti toys.

Iron Ores:—Iron ores in the form of magnetite quartzites occur in several parts of Salem, Tiruchirapalli and South Arcot districts. Though not rich in their natural condition, the iron content varying from 35 to 40%, they can be concentrated electromagnetically. The reserves are fairly large in size, more than 300 million tons in the Salem district. There is little or no sulphur and the phosphorus is variable and in some cases high. "There is some indication that the phosphorus content can be decreased during concentration, but more work will have to be done on large samples in order to settle this point as it is one of importance."⁵⁴ The chief drawback of this area is the fuel problem. The question of freight would kill any attempt at their utilization with the help of the Bengal coal.

53. M. S. Krishnan, *Geology of India*, p. 379.

54. M. S. Krishnan and N. K. N. Iyengar, *The Iron ore deposits of parts of Salem and Trichinopoly districts*, G. O. No. 4832, Development dated 11-11-1944, p. 10.

Alternative methods of smelting the ores by which the dependance on coal can be cut down to a minimum, have therefore to be examined. They are:

(i) using charcoal instead of coal

(ii) smelting in an electric furnace using a small quantity of coal or charcoal for reduction only and not for the generation of heat.

The latter method appears to be promising but the whole question will have to be looked into in some detail by proper technical men. Any way the attempts at utilizing the ores can be successful only if they are converted into finished or semi-finished steel or special steel goods in one straight process.

The Salem area in addition to possessing in readily accessible locations large reserves of iron ore that can easily be concentrated has easy accessibility to cheap power, water, and a number of contributory materials, like magnesite, chromite, quartz, bauxite, limestone and dolomite.⁵⁵

Magnesite ⁵⁶:—Reserves are practically unlimited. The crude material of very high purity (over 95% of the carbonate) is quarried and then conveyed to kilns, where it is calcined to the magnesium oxide. The lightly calcined magnesia is used in making cements of a very high order, in the manufacture of paper pulp from wood, of colourless and scientific glassware and of rubber. Magnesium alloys in preference to aluminium alloys for lightness and strength are increasingly used in the manufacture of aeroplane parts. Magnesia is also used as inner lining in various metallurgical furnaces on account of its refractoriness.

The annual production of magnesite about 20,000 tons and is almost wholly exported to the United Kingdom and the United States, the value of the exports being about Rs. 4 lakhs.

55. V. Kalyanasundaram, *The Future of Salem Iron Ores*, Journal of the Madras University, XVII, No. 1.

56. H. R. Robinson, J. M. G. A. XI, pp. 119-122.

Bauxite:—Bauxite has recently been discovered occurring as cappings 30 to 40 feet thick on some of the highest peaks in the Shevaroy Hills. The average material would contain roughly 45% to 50% alumina, about 20% ferric oxide, 5% to 6% silica and 25% water. It should be possible in actual working to eliminate the more ferruginous portions and ship a grade containing over 55% alumina, less than 7% ferric oxide and 5% silica. The reserves are estimated at about 6 or 7 million tons of which one-third will be of marketable grade.⁵⁷ Bauxite is the ore for the metal aluminium, but is more extensively used in India for the manufacture of refractories. At present, Yercaud bauxite is being utilized for the latter purpose.

Beryl⁵⁸:—Beryl or Aquamarine is obtained from Pattalai in Dharapuram taluk of Coimbatore district. This mine is said to have supplied aquamarine for some centuries. It is of a peculiar translucent sea-green colour.

Corundum:—Corundum is mined at Karutapalayam and Gobichettipalayam in Coimbatore district, and at Palakod in Salem district. Ranking in hardness next to diamond, it is in great demand as an abrading agent in metal work and stone cutting.

Phosphatic Nodules:—The Utatur Cretaceous rocks of Trichinopoly contains an area of about 11 to 12 sq. miles to the southeast and northeast of Utatur in which phosphatic nodules (useful in the manufacture of fertilizers) are found to occur. The estimated reserves are 8 million tons, but it is however doubtful if more than a fourth of the total reserves can be recovered economically. In the Pondicherry Cretaceous, the phosphatic nodules occur in the upper part of the Ariyalur stage on a ridge which runs along a line from the village of Tutipattu to Akasampattu. The phosphatic nodules of Trichinopoly have been collected from the surface in a small way from about the beginning of this century. Two or three

57. N. L. Sharma, *Bauxite in India*, Journal of Industrial and Scientific Research, I, No. 31.

58. F. Nicholson, *Coimbatore Manual*, Vol. I. p. 23.

thousand tons can still be gathered from the surface before any quarrying becomes necessary.⁵⁹

Strontium:—Deposits of celestite of some importance occur in the Utatur stage of the Cretaceous rocks of the Trichinopoly district, traversing the Utatur clays as veins.

Celestite is also found filling the cracks and spaces within the phosphatic and ferruginous nodules and some unidentifiable reptilian bones were also found replaced by it. The celestites are particularly abundant east of Utatur and between Karai and Kulkalnattam. Celestites are used in the manufacture of strontium salts for the beet sugar industry and pyrotechnics.⁶⁰

Gypsum:—The deposits of gypsum in Trichinopoly sedimentary rocks are being utilized in the cement industry. These deposits are also of considerable potential importance as they can be used for the manufacture of sulphuric acid or directly for the conversion of ammonia into ammonium phosphate to be used as fertilizers,⁶¹ and for the manufacture of common chalks.

Small deposits of gypsum and sulphur are being formed at the present day in certain lowlying areas along the coast, which are liable to seasonal flooding. Intensive study of the local conditions and the processes of formation will show how far it is possible to augment supplies of these materials under controlled conditions in other places.⁶²

Garnets:—Red garnets are found in the crystalline metamorphic rocks in Salem district near Sankaridrug, brownish pink to deep red garnets are found near Mel Amatur in Tirunelveli district. Garnets in the form of powder is a valuable grinding agent for precious stones and is used in making 'emery paper'.⁶³

59. M. S. Krishnan, *Rec. G.S.I. LXXVI, Bull. on Economic Minerals*, No. 4.

60. M. S. Krishnan, *Rec. G. S. I., Bull. on Econ. Minerals*, No. 3. p. 9.

61. L. B. Green, *Mad. Dept. of Industries and Commerce Bull.* No. 44. p. 15.

62. M. S. Krishnan, *I. G. J., XIX*, p. 65.

63. L. A. N. Iyer, *Bull. on Economic Minerals*, No. 6, p. 33.

Graphite:—Graphite of good quality is found in Singampatti hills; it also occurs in lumps of the size of small eggs in kankar deposits of Tirunelveli. Minute quantities of the mineral also occur at Rapanasam and Vikramasingapuram in crystalline limestone and gneiss. But it has not apparently been possible to work it profitably.⁶⁴

Lignite:—Seams of lignite occur associated with Tertiary rocks near Pondicherry and Vriddachalam. The quality seems to be fairly good but the extent of the resources and its workability have to be investigated.

Recent investigations point to the existence of several million tons of lignite in this area. Proper exploitation of these resources will greatly benefit South India and more particularly the Tamil region, which is devoid of any reserves of this 'mother of industries'. Though no detailed reports are so far available it should be possible to utilize it in locomotive boiler, with or without preliminary treatment like briquetting and also for the production locally of thermal electricity, which will share the load on the existing hydroelectric generators at Pykara and Mettur and serve as a standby in times of poor monsoon.

Monazite, Ilmenite and Zircon:—Monazite which constitutes the raw material for the preparation of thorium nitrate, used in the manufacture of gas mantles, occurs in the older dunes, in the dry beds of streams draining eastwards from the hills and in the beach sands, in Tirunelveli where they have undergone a slight concentration.⁶⁵ Monazite contains phosphorus also and can therefore be used as a source of fertilizers. The deposits are not comparable in size to those of Travancore.

It is associated with ilmenite from which titanium dioxide used as paint material is prepared. Zircon also occurs with these; this mineral yields zirconium oxide which is a super-refractory used for special purposes.

64. *Tinnevely district Gazetteer*, II, p. 150.

65. *Ibid.*

The sea beaches contain deposits of ordinary sand used generally only for building purposes. Sand from Ennore (just north of Madras) has been used in glass making for some years.

Conclusion:—With the spread of the work of the Geological Survey of India in recent years, much light has been thrown on the mineral wealth of India. Mineral distribution in India is localized and so far as Tamilnad is concerned we find that there is not only a fair distribution of a number of minerals but they also occur in workable quantities. Yet there is not much in the way of mineral industries and this region is very backward in the development of mineral industries in comparison with the known resources.

—(To be Continued)

Arab Geography in the ninth and tenth centuries A. D.

Agricultural and Economic. *

BY

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The series of geographical treatises compiled during the period under review are well known to the students of Arab geography. They have largely been used and widely quoted and form what is perhaps the earliest regional geography of the Islamic countries. The material supplied by these sources is not, of course, only topographical description as there in is to be found, but also, a vivid picture of the agricultural products, mineral resources, manufacturing industries and trade of each country. It is with this aspect that we are pre-occupied here. In the following pages it is proposed to select a few countries and to give extracts to indicate how far these books afford material to the student of economic geography.

Agriculture.

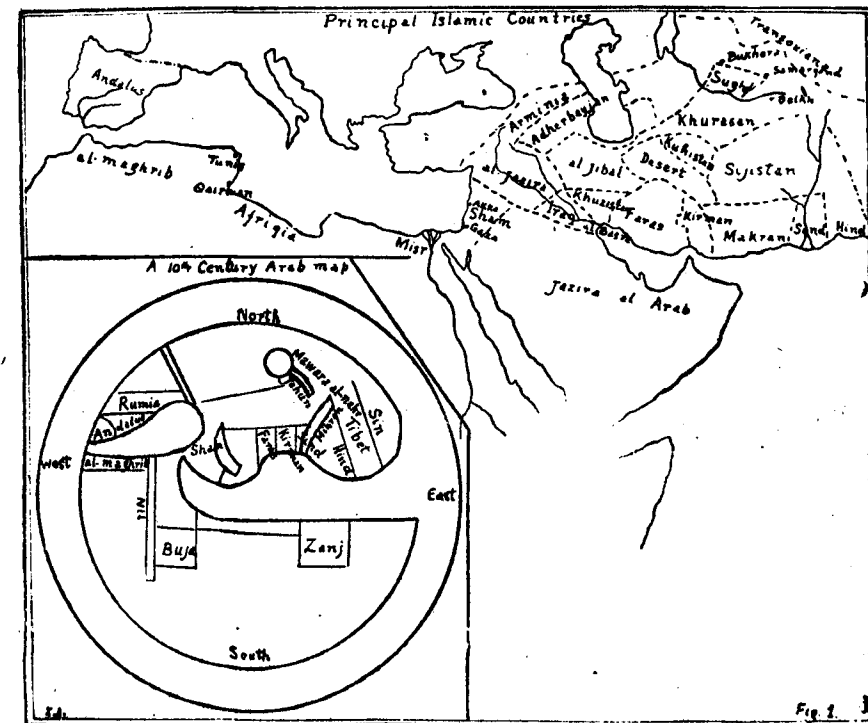
A glimpse of the agricultural conditions of the Islamic countries as obtained from the writings of Arab geographers may be considered under two heads : irrigation and agricultural products.

Irrigation :—As irrigation plays an important role in the agricultural economy of any country, and more so of the Islamic countries which being situated in the regions of uncertain and deficient rainfall were characteristically dry, we begin by a study of the information given by Arab geographers.

To begin with, the Tigris Euphrates valley. The Arabs had inherited from the Persians the system of canalisation

* The paper is a portion of the research work done in the Aligarh Muslim University under the direction of Dr. S. Muzaaffar Ali, Reader, Department of Geography. The author owes a debt of gratitude to the learned professor for supplying valuable material which he obtained from European libraries and also for going through the pages and enriching them with his suggestions.

which made the lower courses of the Euphrates and Tigris i. e. the Sawad, or the alluvial plain to the south of Takrit and al-ambar—one of the richest lands of the east. Their canal system on the one hand, was so designed as to carry off the surplus waters of the Euphrates into Tigris for the purpose of irrigating the lands between the two rivers, and on the other hand the water of Tigris was for the most part tapped by canals on its eastern bank, in order to irrigate the lands which lay on the Persian border of the stream. The five great irrigation canals of the Euphrates were Nahr Isa, Nahr Sarsar, Nahr Malik, Nahr Kutha and Nahr Sura.¹ These canals irrigated the district of Firoz Sabur, Baduriya, Sawad and Kutha. (Fig 1.)

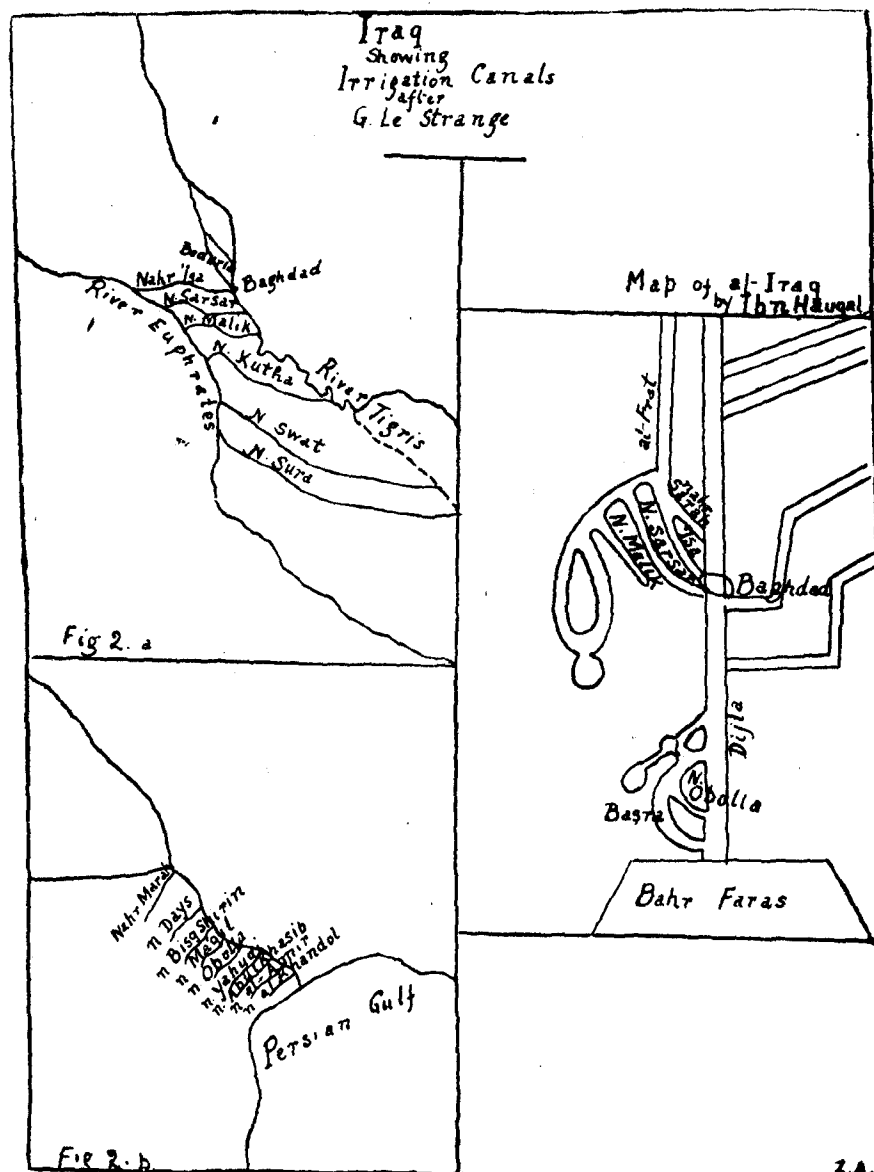


The important irrigation canals² of the lower Tigris valley as enumerated by Ibn Serapion³ are Nahr Marah, Nahr Days,

1. Le Strange. Description of Mesopotamia and Baghdad by Ibn Serpion. article in Journal Royal Asiatic Society. 1895, (London.)
2. Ibid.
3. According to modern researches the geographical account referred to above is attributed to Sohrab vide Journal Royal Asiatic Society, (London) 1932.

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45261

Nahr Bisq Shirin, Nahr Ma'qil, Nahr Ubullah, Nahr Yahudi, Nahr Abul Khasib, Nahr al Amir and Nahr al Khandol. From all these canals there branched smaller canals which watered adjoining domains. All these canals flowed into the Fayd of al-Basara. The abundance of canals in the lower Tigris valley may be judged from the following words of Ibni Hauqal. (Fig 2.)



"Some chronicles say that the canals increased in the days of Bilal bin Abi Bardan to over one hundred and twenty thousand in which boats could move. I doubted this at first but later when I myself visited most of these places, I found that within the compass of an arrowshot there were many canals and in all of these boats plied".⁴

In Faras irrigation offered grave problems for solution Al-Maqdisi says that the region of eastern Faras which lay at a distance from the main rivers was cared for by ingenious systems of irrigation. Here, where there were only insignificant rivers or brooks, it was necessary to collect rain water as well as ground water to the last drop. Long tunnels with easy gradients which even now reach as far as 50 Kilometers were drawn through the ground; at definite intervals airshafts lead to the surface. There were famous works of the sort at Qumm and Nisabur.⁵ Thus it may be said that the system of irrigation was the same to which we now give the name of Karez which is generally employed in the hilly regions of modern Iran and Afghanistan. Al-Maqdisi also mentions an irrigation work organised by Adad al Daula on the river Kur where a mighty wall was built and the water was raised into a tank from which about 300 villages were irrigated.⁶

Al Hamdani supplies us information concerning the methods of irrigation in south Arabia where they collected running water for use, they had small pools (Masani) bordered with pebbles; but further up the mountains as in San'a they had dams (Sadd) with openings below, from where water was distributed by means of canals.⁷

The canal system of Samarqand is vividly described by al-Istakhri in these words: "From these rivers flow a large number of canals which supply water to the villages and fields. The number of canals increases in the suburbs of

4. Ibni Hauqal: Kitab al masalik wal mamalik. p. 158.

5. al Maqdisi: Ahsan al Taqasim p. 329. Vide Mez: Dic Renaissance des Islam translation by Khuda Bux. p. 450.

6. Ibid; p. 444.

7. al Hamdani: Sifat Jazira al, Arab p. 138, 112.

Samarqand, on account of the increase in the number of villages, so that for each village there are two canals. In the city itself there are innumerable smaller canals according to the number of plots and gardens". "As regards the prosperity, he says, "From an elevated place in the Sughd valley nothing is seen but verdure, which is interrupted only by castles⁸". As a matter of fact the land round Bokhara especially under the Samanids in the ninth century, A. D. was a veritable garden "one of our earthly paradises,"⁹ as it was styled by Ibn Hauqal (the other three being Ghuta of Damascus, Obola and Sha'b Bawwan). In these gardens there flourished several varieties of fruits and vegetables, such as dates, apples, apricots, peaches, oranges, figs, grapes, olives, cucumber etc. This sounds surprising in the light of the present day dull and grey scenery of Samarqand having no match with the picture presented by the Arabs. The cause of this decay in agricultural prosperity and neglected state of irrigation system is not far to seek. The political upheavals witnessed by the country after the tenth century as well as the gradual desiccation are mainly responsible. Under the present soviet regions, due to the prospects of dry farming, interest in central Asian lands is again reviving and it is to be seen whether the prosperity of the bygone days can be achieved once again.

Distribution of agricultural products:—Arab geographers supply us information concerning the distribution of agricultural products as they found in their own time, and as such, this information is of great importance to the student of historical geography.

Wheat:—Although wheat occupies an important position in the economy of Islamic countries of today, it is not mentioned by the Arab geographers as the staple product of any country except Khuzistan.¹

8. al Istakhri: *Kitab masalik mamalik*.

9. Ibn Hauqal: *Kitab al masalik wal mamalik*, p. 345.

10. Ibn Hauqal: *Kitab al masalik wal mamalik*, P. 173.

Millets¹¹:—Ibni Hauqal says that millets occupy the chief place in Arabia, Nabia and Kirman.

Rice¹²:—Ibni Hauqal mentions rice in Mesopotamia and Mazenderan Tabaristan.

Grapes¹³:—Grapes are mentioned by all the Arab geographers, as the most cultivated of the fruits, the chief centres being Khuzistan, Khorasan and Ferghana. The thriving state of viticulture may be judged from the following words of Ibn Faqih. "Even if we were to set out from early youth to old age, travelling through the countries, valley by valley, and town by town, going from vineyard to vineyard, to learn their varieties and to master their peculiarities, one would not be able to do so in a single climate or a single region¹⁴".

Orange:—A graphic account of the history of orange cultivation is given by al-Masudi in these words: "The orange or the citron trees were imported from India after 300 A. H. (912 A. D.) and planted in Yemen. They were then taken to Basra, Mesopotamia and Syria and became plentiful in the houses of Taurus, Antioch, the Syrian coast of Palestine and Egypt, where they were unknown before. But the fine fragrance and beautiful colour which they had in India passed away from them.¹⁵

Water-melon:—al Istakhri says that water melons of north Persia were very famous. They were brought to Mesopotamia from Merv.¹⁶

Dates:—All the Arab geographers agree in saying that dates are the chief products of Mesopotamia, Kirman, North-Africa and Arabia. In Mesopotamia dates of several varieties

11. Ibid. p. 272.

12. Ibid. 272.

13. Maqdisi: *Ahsanal-taqasim* p. 341-42. Istakhri: *Kitab masalik al mamalik* p. 266.

14. Ibn Faqih *Kitab al Buldan* edited by de Goeje. p. 125.

15. Al-Masudi; *Muriyal-dhahab* Vol. II, p. 438f.

16. Al-Istakehri: *Kitab masalik al mamalik* p. 262.

were found.¹⁷ In the date producing districts of North Africa one could buy, in good years, a camel load for two dirhams. In Kirman the price of 100 mann seer of dates sometimes fell to one dirham.

Olive¹⁸:—According to al Maqdisi the best Olive came from Syria and Nablus and according to Ibni Hauqal one could get 90 to 70 Qafiz (3 bushels) for a dinar.

Sugarcane:—al-Maqdisi says that the centre of sugar-production was Khuzistan but it also came from the district of Jundisabur and in Mesopotamia the neighbourhood of Basra was the most famous centre of sugar industry.¹⁹ al Hamadani says that Yemen produced sugar which was exported to Mecca and Mesopotamia.²⁰

Cotton:—Although cotton had long been cultivated in Upper Egypt it is surprising that it is not mentioned by Arab geographers as an Egyptian product. It appears to have played no part in the land which now produces the best cotton. On the other hand Arab geographers mention Persia and al-Maghrib as producing cotton.²¹

Flax²² is mentioned in Persia and Egypt.

Timber for ship building came from Upper Egypt. According to al-Istakhri Fort Tinat near Alexandretta was the centre of trade for Syrian pine-wood whence it was exported to all parts of Syria and the forest of Mazenderan produced hardwood which was used in furniture making and wood carving.²³

17. Ibni Hauqal: Kitab Masalik wal mamalik, p. 143, 159, 223, 65, 105; al Maqdisi Ahsan-al-Ta'asim, p. 142.

18. al Maqdisi; Ahsan al Taqasim page 174; Ibni Hauqal: p. 47.

19. Ibid. p. 162, 180, 408.

20. Al Hamdani: Sifat Jazira al-Arab, p. 198.

21. Ibni Hauqal: Kitab al masalik wal mamalik, p. 185, 214, 55.

22. Ibid. p. 102, 89.

23. Al-Istakhri; Kitab masalik al mamalik, p. 312, 63, 212.

Indigo²⁴:—al-Maqdisi says that Indigo is produced in Palestine and Kirman.

Saffron²⁵:—al-Istakhri says that Saffron is produced in Persia, Transoxiana and Arabia and al-Hamdani includes it among the products of Arabia.

Mineral Wealth.

Distribution of Minerals:—Arab geographers supply much valuable information concerning the mineral wealth of the Islamic countries.

Gold:—Goldmines are mentioned by Ibni Hauqal in Ulaqi, fifteen days journey from Assuan.²⁶ The author of Hudud al 'Alam locates gold mines in the mountains of Afghanistan.²⁷

Silver:—al-Istakhri speaks of silver mines in Arabia and Transoxiana²⁸; the author of Hudud al-'Alam speaks of silver mines in Hindukush-the five hills of Benjahr.²⁹ According to Ibni Rusta the silver mines at Badhagis (Afghanistan) had to be given up because of fuel shortage.³⁰

Copper:—al-Ibni Rusta says that Copper was exclusively mined near Ispahan where the mines paid a tax of 10,000 dirham.³¹ It came from Bokhara adds al-Magdisi.³²

Iron:—Ibni Hauqal says that iron was produced and wrought in Faras and Kabul³³ but according to al-Maqdisi,³⁴ Beirut and Kirman also had iron mines. He also speaks of its export from India and Africa.

24. Maqdisi: Ahsan al Taqasim, p. 186, 175, 181.

25. al Istakhri: Kitab masalik al mamalik, p. 190; al-Hamdani: Sifat Jazina al Arab, p. 100.

26. Ibni Hauqal: Kitab al masalik wal mamalik p. 307.

27. Hudud al Alam, p. 64, 68.

28. Ibni Hauqal: Kitab al masalik wal mamalik, p. 307.

29. Hudud al Alam, p. 64.

30. Ibni Rusta: I'laq al Nafisa, p. 156.

31. Ibni Rusta: Ilaq al Nafisa Ed de Goeje p. 156.

32. al Maqdist: Ahsan al Taqasim td. de Goeje p. 324.

33. Ibni Hauqal: Kitab al masalik wal mamalik, p. 214.

34. al-Maqdisi: Ahsan al Taqasim, p. 184, 470; Ibni Hauqal: Kitab al masalik, p. 328.

Sal-ammoniac:—Istakhri and Ibni Hauqal mention Transoxiana as the producer of sal ammoniac. "In the Buttam mountains" says Ibni Hauqal, "there is a cave over which a house with closed doors and windows has been built, out of this cave rises a vapour, like smoke at day and like fire at night: when the vapour is precipitated, sal ammoniac is obtained out of it. The people entering the house, must cover themselves in wet felt or without it they may be hurt"³⁵. al-Mas'udi gives us a remarkable account of the sal ammoniac valley. "In China, at the source of the great rivers, is the mountain which yields sal ammoniac. Here in summer, fires can be seen at night at a distance of 100 farsang; at day time owing to the greater power of sunlight it appears as vapour. The sal ammoniac is obtained thence. Travellers in summer take their road from Khorasan to China by this mountain; for there is a valley through it, which is 40 to 50 miles long. At the entrance of the valley wait some men who offer themselves to carry the baggage, if they are well paid. They use sticks to drive the passengers on their journey; for any stoppage or rest would be fatal to the traveller, in consequence of the irritation which sal-ammoniac vapours of this valley produce on the brains, and on account of heat. At the end of the valley are marshes and water, into which they throw themselves to obtain relief from the depressing influence of the vapours of sal-ammoniac, and of the heat of air. No animal can pass through the valley. In summer the sal-ammoniac throws out flames, and in that season no one can venture into this valley. In winter much rain and snow fall which extinguish the heat and flames: at that time men can enter it, but not animals on account of the heat. Those coming from China are as hard hit as those who are making their way thither"³⁶.

Other minerals include quicksilver³⁷ from Transoxiana, antimony³⁸ from Ispahan, kaolin³⁹ and marble from Tabrez,

35. Ibni Hauqal: Kitab al Masalik wal mamalik. p. 363.

36. al-Masudi: Muruj al-dhahab ed. C. Barbier de Maynard. vol. I, p. 347-348.

37. al-Istakhri a Kitab al masalik al mamalik, p. 320; Ibni Hauqal. P. 337.

38. Ibid. p. 203.

39. Ibid. p. 203.

borax⁴⁰ from lake Armia, sulphur⁴¹ from Syria and Palestine, and asbestos⁴² from Transoxiana.

As for precious stones—garnet crysolite, ruby and emerald⁴³ are attributed to eastern Egypt and South Arabia. Al-maqdisi says, "In South Arabia near Sana people get a piece of emerald as big as a rock and at times nothing at all"⁴⁴. According to Ibni Hauqal the mountains of Afghanistan furnished valuable rubies⁴⁵.

Coral:—al-Mas'udi mentions precious coral⁴⁶ in N. W. Africa (Marsa al Khozar) where it is still found (e.g. Ceuta).

Industry And Trade.

Manufacturing industries:—Arab geographers portray a vivid picture of the industrial position of the Islamic countries. Their account give us the impression of a manufacturing people specialising in linen, cotton and silken goods, manufacture of carpet was widespread and constituted the most important industry, paper was manufactured, silkworm reared, porcelain, earthenware, iron, steel and leather goods were made and exported to distant countries.

Linen Industry:—Egypt's speciality in textiles was linen. The chief centres according to al-Maqdisi were Taha, Fayyum, and Lake Tinnis.⁴⁷ Ibni Hauqal says that the price of one piece of linen was 100 dinars and sometimes gold thread was interwoven and the cost was doubled.⁴⁸ The east had its seat of linen industry in Persia with centre at Khazrun⁴⁹ called the Damietta of Persia. al-Maqdisi says that in earlier days flax was

40. Ibni Hauqal: Kitab al masalik wal mamalik, P. 248.

41. al-Maqdisi-Ahsan al Taqasim. p. 184.

42. Ibid., p. 203.

43. Ibni Hauqal: Kitab al-masalik wal mamalik, p. 99; Hadud al 'Alam p. 68.

44. al Maqdisi; Ahsan al Taqasim. p. 101.

45. Ibni Hauqal: Kitab al masalik wal mamalik. (near Badakhshan).

46. al-masudi: muruj al-dhahab vol. IV, p. 97.

47. al Maqdisi-Ahsan al Taqasim p. 20, 433, 435.

48. Ibni Hauqal: Kitab al Masalik wal mamalik p. 101.

49. al Maqdisi: Ahsan al Taqasim p. 433.

imported from Egypt to the Persian maritime town of Siniz which was celebrated for its linen qasab, whereas in his own time the local product was chiefly employed for this manufacture.⁵⁰ This shows that the linen industry had been transplanted there from Egypt. It seems that at first the industry was localised in the coastal towns of Siniz, Janaba and Tawwaj, but afterwards when it became independent of the Egyptian material it penetrated into the interior e. g. Khazrun.

Cotton Industry:—The chief centres of cotton industry were situated in Persia,⁵¹ Merv, Nishapur, Bemm (Eastern Kirman) the speciality of the last according to Ibni Hauqal consisted in veils interwoven with wreaths which were exported as far as Egypt, costing about 30 dinars a piece.⁵² The product of Merv according to al-Maqdisi was soft flannel.⁵³

Silk Industry:—As for silk industry, Ibni Hauqal says that the province of Khuzistan, where the Sasanids had transplanted the art from Byzantine empire, was famous for silk looms,⁵⁴ and silk throwing was localised in the north where abresham was produced which was exported everywhere.⁵⁵ al-Istakhri on the other hand adds to the list damask, satin, and floss silk as products of Khuzistan.⁵⁶

Woollen Industry:—The countries which distinguished in the woollen industry were Armenia, Persia and Bokhara. According to al-Mas'udi the floor and the walls of the palace of the Omayyad Caliph waliph II, were covered by Armenian carpets.⁵⁷ al-Istakhri says that the highest value was set on Persian carpets which most nearly resembled Armenian workmanship.⁵⁸ In praise of the persian carpets, Ibni Rusta

50. Ibid. p. 442.

51. Ibni Hauqal : Kitab al masalik wal mamalik, p. 223, 362, 316.

52. Ibid. p. 223.

53. al Maqdisi : Ahsan al Taqasim p. 324; Ibni Hauqal Kitab al masalik al mamalik p. 316.

54. Ibni Hauqal : Kitab al masalik wal mamalik. p. 272, 247, 316.

55. Ibid p. 272.

56. al Istakhri : Kitab al Masalik al mamalik p. 212.

57. al-Musudi : Muruj al dhahab vol. VI. p. 334.

58. al-Istakhri : Kitab al Masalik al mamalik. p. 153.

says that they matched particularly well with the Armenian carpets but looked sufficiently well by themselves.⁵⁹

Aromatics:—al-Maqdisia speaks of special branch of industry which flourished in Persian province of Sabur—"The preparation of perfumes from violet, lotus, narcissus, fragrant screwpine lilies, white Jasmine, myrtle, marjoram and orange peel."⁶⁰ al-Istakhri speaks of a similar industry in al-Iraq also where "fragrant waters were made from rose, palm-flower, southern wood, safflower, and willow. Thence rose water was exported to the whole world, Maghrib, Spain, Yemen, India and China."⁶¹ This important industry of which the ancients say nothing must have risen in the Islamic world.

Paper industry:—In the manufacture of paper the period witnessed great improvements. Yaqubi, towards the close of the 9th century speaks of a small town in lower Egypt in which paper was made.⁶² In the 10th century Ibni Hauqal says that paper was manufactured in Transoxiana, the like of which was not to be found elsewhere.⁶³ al-Maqdisi says that paper was made in Damascus and Palestine.⁶⁴

Flour industry:—Evidence is found in Arab geographical literature that running water was extensively used for the driving of mills. Ibni Hauqal says that the river Jiruft in Kirman drove 50 mills.⁶⁵ Al-Maqdisi recounts factories at al-Basra erected at the mouth of canals which were fed by tide and moved by the force of falling water.⁶⁶

Trade and Commerce

Foreign Trade:—Muslim commerce in the tenth century was a proud spectacle. The tapestries of Damascus the woollen

59. Ibni Rusta : I'laq al-Nafisa. p. 153.

60. al-Maqdisi : Ahsan al-Taqa'im.....p. 443.

61. al-Istakhri : Kitab al Masalik.....p. 153.

62. Yaqubi : Kitab al-Buldan. p. 338.

63. Ibni Hauqal ; Kitab al Masalik.....p. 337.

64. al-Maqdisi : Ahsan al Taqasim.....p. 180.

65. Ibni Hauqal : Kitab al Masalik.....p. 442.

66. al-Maqdisi : Ahsan al Taqasim.....p. 222.

textiles of Armenia, carpets of Persia, silk from Khuzistan, paper of Transoxiana, dates of Basra and grapes of Yemen were noted throughout the world.

Exports:—The export trade of the Islamic countries was mainly with China, India and Africa. There was also a brisk inter-provincial trade. The trade comprised in the first place what the Mohammadan countries themselves yielded of natural and industrial products such as textiles, carpets, leather goods, paper, lapis lazuli, and other precious stones, etc.

Imports:—Baghdad, the centre of the Islamic Empire was the emporium of the world. The merchants of Baghdad obtained silk from China, the spices, aromatics, different kinds of woods and coconut from India; ivory, gold and timber from Africa. All these wares from Baghdad found their way to different parts of the empire. A part of this merchandise of course came to the Red sea ports of Jadda and Qulzum from where the occidental part of the Islamic countries were supplied.

Communication.

Caravan trade-routes:—In those days caravan traffic was the most common means of travelling and trading between the different Islamic countries. Arab geographers give us a detailed account of such roads their distances. At the same time there were important overland routes that led to India, China and Africa which on account of their importance deserve special notice,

Some of the important trade routes of the empire are:⁶⁷

(1) Up the Tigris from Baghdad to al Musal, then through al-Jazra (Mesopotamia) passing Sinjar Nishibis, Ramla, Gifar, Cairo, Alexandria and then to Grenaca.⁶⁸

(2) From Baghdad to Syria via al-Ambar, at Hit crossed to the western bank of Euphrates.

67. Mez: Die Renaissance des Islams. Translation Khuda buz. p. 497.

68. Qudama: Kitab al Kheeraj. p. 227. foll.

(3) the chief road to east went below Baghdad crossing the Nahrawan bridge to reach Hamdan. Thence the road proceeded to Ray, Nishapur, Merv, Bokhara and Samarqand.⁶⁹

In Merv the road branched off through central Khurasan. It did not go directly to Balkh but made the tremendous circuit of 300 kilometers along the Merv river to Merv er Rud. A farsang further, on account of the mountain range, the road made use of a ravine as far as Talaqan. Beyond Balkh it crossed the Oxus near Tirmid and entered Ferghana at Rasht.⁷⁰

(4) The road which crossed Iran diagonally from Shiraz through Yezd is noticed by Ibni Khurdadbeh⁷¹ but it is not found in Ibni Rusteh or Qudamah.

(5) The pilgrim road from Baghdad crossed the Euphrates at al-Kufa and entered the desert at Udaib.⁷² (Fig. 4.)

(6) In North Africa most of the roads led in the direction of Qairwan and from Qairwan to Sus al-Adna on the Atlantic Ocean. Two great roads left lower Egypt for the west, one along the sea coast and the other further to the south.⁷³ This was the great highroad communicating between Spain and the East.

(7) An important feature of the period was the opening of the Russian North. Ibni Khurdadbeh gives us a description of the route followed by the Russians. "They are a slav race and bring beaver skins and hides of black foxes from the most remote regions of the slavs to the Greek Sea, where the ruler of the Greeks takes from them his tithe. They frequently sail down the Don, which is the river of the slavs and proceed through Khamlij, the metropolis of the Khazars, (whose ruler takes his title from them), to the Caspian Sea, where they disembark at any point they chose. They frequently bring their goods on camel-back from Jurjan to Baghdad".⁷⁴ The mission

69. Ibni Rusta; I'laq Nafisa. p. 167.

70. Ya'qubi: Kitab al Buldan p. 287.

71. Ibni Khurdadbeh: Kitab al Masalik wal mamalik., p. 50.

72. Qudama: Kitab al Kharaj. p. 186.

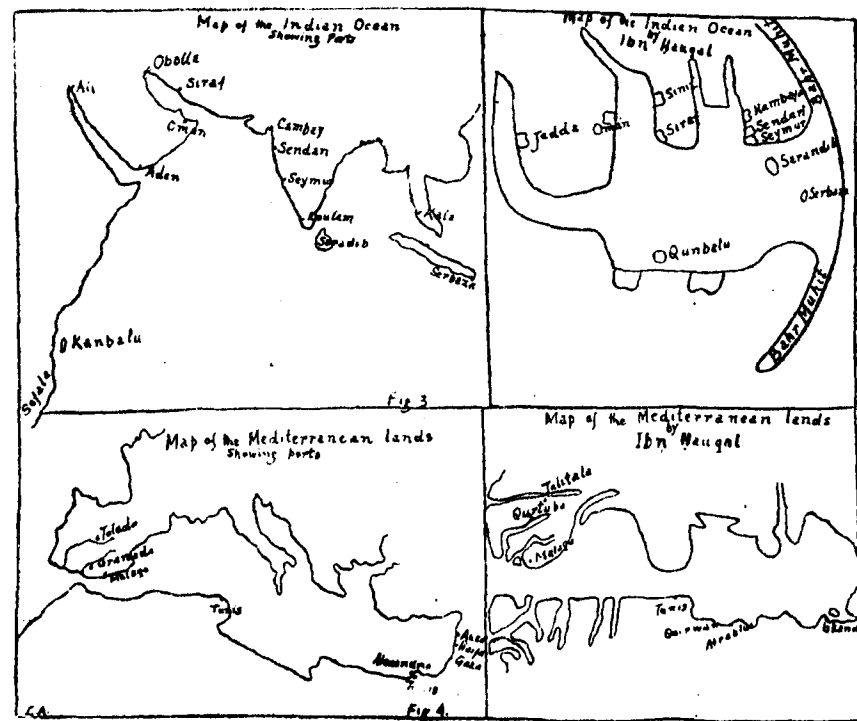
73. Ibni Khurdadbeh: Kitab al masalik al mamalik, p. 89.

74. Ibid p. 154.

of Ibn Fozlan to the Volga region, further opened this area to commerce. The evidence of a prospering intercourse is further obtained by the Arabic coins found in Northern Europe belonging to the tenth century A. D., more than two third of these being Samanid.⁷⁵

(8) As in the north west, so too in the North east, Arab geographers mention a new route. According to Abu Dulaf in the year 943 A. D. the king of the Ugurs in Kan-Chan entered into friendly relations with Samanids in Bukhara and this secured the land route to China for the Mohammedan trader.

Important inland commercial centres:—A discussion of the over land trade routes of the Empire give us an occasion to say something about the chief centres of trade which were situated along the great highways. The object of the study is to emphasise the fact that the prosperity was the direct out come of their nodality and pointed at the thriving state of commerce. (Fig. 4.)



75. Mez: Die Renaissance des Islams. Translation Khuda Bux, p. 472.

Baghdad:—Baghdad the capital of al-Iraq and the seat of caliphs was a great town. It was one of the most prosperous towns of the world. Situated at the banks of river Tigris it had a prosperous river traffic. Its situation in relation to the different roads was preeminent as all roads converged at this point. Industrially and commercially too its position was envious. Baghdad produced cotton stuffs, silk textiles, crystals turned on a lathe, glazeware, as well as also potions and electuaries which were exported every where.⁷⁶ The city has a very fine climate "says al Maqdisi, and contains in itself everything that is good and beautiful. All men of skill come from thence, every refinement finds haven there; every heart is drawn to it".⁷⁷

The following passage quoted from al Maqdisi throws some light on the selection of the site for the city.

"We judge it advisable for thee to settle in the midst of the four districts, on the east are Buq and Kalwadha and on the west Qutrabul and Baduriya (Fig. 1). In this way thou shalt always be surrounded by palm trees and be near water, so that if one district suffers from drought, or fails to yield its harvest in due time, there will be relief in another; while being in the banks of al-Sarat provisions will reach thee in boats which ply on the Euphrates. The caravans from Egypt and Syria will come by way of desert and all kinds of goods will reach thee from China on the sea and from the country of Greeks and from al-Musal by Tigris. The enemy cannot approach thee except in ship or a bridge by way of Tigris or the Euphrates".⁷⁸

Al-Musal⁷⁹ was the metropolis of the province of Aqur. (Mesopotamia). It was a great city, well built and possessing a pleasant climate and healthy water. It is of great renown in high antiquity with good markets and inns; nor did it ever

76. Hudud al-alam: translated and explained by Minorsky (London), p. 138.

77. al-Maqdisi: Ahsan al Taqasim, p. 119.

78. Ibid. p. 119-20.

79. Al-Maqdisi-Ahsan al Taqasim. p. 138.

lack a high authority in traditions or a noted doctor of law. It supplied Baghdad with its corn and thither also went all the caravans of al-Rehab.

Al-Ambar⁸⁰:—The importance of al-Ambar was chiefly due to the fact that the first large navigable canal of Aqur i. e. Nahr 'Isa connected it with Tigris.

Hit⁸¹:—Hit was a town of considerable commercial and industrial importance. The caravans trading between al-Iraq and Syria particularly between Baghdad and Halb crossed Euphrates here. This circumstance gave rise to flourishing transport and a busy trade.

Al-Ramla⁸²:—The capital of the province of Tabaryya. It was a fine city and wellbuilt, its water was good and plentiful and fruits abundant. It combined several advantages. Commerce here was prosperous and markets excellent.

Damascus⁸³: was a prosperous and flourishing town, possessing fields and running water and roads. It produced olive oil, cloth, brocade, brass vessels, paper, nuts, dried figs, and raisins and had a thriving trade.

Hamdan⁸⁴: was the ancient Ecbatana, the capital of the province of Media. Ibn Hauqal describes it as a large fine city. There was much merchandise in its markets and the surrounding district was fertile.

Shiraz⁸⁵:—The capital of Faras was founded by the Arabs in the days of Caliph 'Omar'. Al-Maqdisi points out that Shiraz owes its preeminence as a town to its central position lying 80 leagues from each of the four corners of the province.

80. Encyclopedia of Islam. Vol. I, p. 348.

81. Ibid. Vol. II, p. 322.

82. Al Maqdisi: Ahsan al Taqasim. p. 164.

83. Ibid. p. 156-7.

84. Abulfeda: Taqurim al Buldan Ed. Reinaud. Vol. III, p. 417.

85. Al-Maqdisi-Ahsan al Taqasim. p. 429.

Herat⁸⁶:—Heart was described by Ibn Hauqal and al-Maqdisi as a great city having running waters. In the North lay mountains, two leagues distant from the city, which produced millstone and paving stones. The city produced cotton stuffs and grape syrup.

Nisabur⁸⁷:—Nisabur (Nishapur) was the most important of the four great cities of Khorasan. Arab geographers describe Nisabur as a thickly populated town divided into 42 wards. There were public markets the best known being Murabba' al Kabira and Murabba' al Saghira. The most important business streets were 50 in number, all kinds of ware were on sale in them. No town in all Khorasan says Ibn Hauqal was healthier or more populous than Nisabur, which was famous for its rich merchants and store of merchandise coming daily from Caravans. Cotton and raw silk were the chief exports and all kinds of goods were manufactured here.

Merv⁸⁸:—It was a pleasant and flourishing place. Its market was good. Merv produced, roots of asafoetida, condiments, textiles of raw silk and mulakhas silk.

Balkh⁸⁹:—Ya'qubi speaks of Balkh as the greatest city of Khorasan. All around Balkh lay gardens providing oranges, lily and sugarcane. Its grapes were exported in quantity and its markets were frequented by merchants. The author of Hudud al-'Alam says that Balkh is the emporium of Hindustan.

Bokhara⁹⁰:—A large and prosperous town in Transoxiana. It produced plenty of fruits and had running water. It produced good woollen carpets as well as saltpetre which was exported to different places.

Samarqand⁹¹:—Samarqand was upstream and about 150 miles upstream due east of Bokhara situated at a short distance

86. Encyclopedia of Islam: Ibn Hauqal: Kitab al masalik wal mamalik, p. 316-17.

87. Ibid. Vol. III, p. 928.

88. Hudud al Alam. ed. Minorsky. p. 105.

89. Ibid Vol. I, p. 622; Hudud al Alam. p. 108.

90. Encyclopedia of Islam. Vol. I, p. 776-81.

91. Ibid. Vol. IV, p. 129.

from the southern bank of Sughd river. All round Samarqand were orchards and palaces and irrigation canals. The suburbs of Samarqand lay along the river bank on the lower level. The market of the suburb was the centre of trade being full of merchants and merchandise from all parts of the city. The city was the emporium of Transoxiana. Among other things the paper of Samarqand was exported throughout the world.

Ferghana⁹²:—Situated on the banks of Saihun (Jaxartes) it was described by the Arab geographers as the focus of industrial and commercial life of the country. The mountains of Ferghana yielded gold, silver, mercury, petroleum, turquoise, iron, copper, lead, sal ammoniac. Ibn Hauqal mentions tarragon as a special feature of Ferghana, the seed of which was exported to all the countries. al-Istakhri mentions deposits of coal, at Isfara the price of coal being 1 dirham for 3 ass loads. According to al-Maqdisi, turkish slaves, white cloth stuff, cuirasses and swords, copper and iron were exported from Ferghana to Isfidjah.

Rivers as Means of Communication.

al-Maqdisi mentions twelve navigable rivers in the whole of the Empire⁹³ by which, of course, he means some of the bigger rivers such as the Euphrates, Tigris, Nile, Oxus and Indus, etc. Arab geographers emphasise the exceptionally favourable conditions for inland navigation as far as Musal. It was through the river Tigris that Armenian goods came to Baghdad; besides, al-Musal supplied Baghdad with vegetables and fruits of its mild climate.⁹⁴ According to al-Maqdisi two-third of the prosperity of Baghdad lay in its rivers.⁹⁵ Canal traffic flourished most luxuriantly in the neighbourhood of al-Basra where old chronicles talk of 120,000 navigable brook where-in vessels could sail.⁹⁶

92. Ibid.

93. Al-Maqdisi; Ahsan al Taqasim. p. 19.

94. Ibid. p. 138.

95. Ibid. p. 124.

96. Ibn Hauqal: Kitab al Masalik wal mamalik. p. 158.

Navigation in the Nile was in such a volume in the tenth century that al-Maqdisi was astounded by the number of vessels which lay at anchor or sail at the wharf of old Cairo. An Egyptian asked me," says Al-Maqdisi, "Whence art thou?" "From Bait al Maqdisi," I replied. "A great city," he said, "but my friend may God prosper you! If all the vessels which sail hence to distant countries and to the Egyptian villages were to go to Bait al-Maqdis, they could receive its inhabitants, with their goods, chattels and the stone and timber of houses so that people would say once there was a city here." The above mentioned passage points out in an interesting way the greatness of the merchant navy of Egypt.

Seas as Means of Communication.

Muslim traders, who as already seen distinguished themselves on land also won laurels on the sea. Arab geographers emphasise the fact that their country i.e. Arabia was naturally destined to play a leading role in world trade because it was surrounded by seas on three sides which formed as the connecting link between Arabia and other important countries of the world such as India, China and Africa. We may consider Arab maritime activity under two heads: navigation in (i) the Indian and the Pacific Oceans and (ii) the Mediterranean sea.

Navigation in the Indian and Pacific Oceans:—As already mentioned Baghdad the centre of the Islamic Empire was linked with Indian Ocean by the great water ways of al-Iraq and the Persian gulf. By this means the navigation of the Indian Ocean became the instrument of world trade. Thus the merchants of Baghdad obtained silk from China, the spices and aromatics from India and different kinds of woods, spices and coconuts from the innumerable islands which were situated in the sea. The Indian Ocean was thus a great field of enterprise. Its base was the Persian gulf where ports like al-Basra, Siraf and Obola had been even in pre-Islamic times very important centres of trade and navigation. The coming of Islam, and especially the establishment of a political centre in al-Iraq encouraged the enterprise.

Trade relation with India:—A study of Arab geographical literature gives us the impression that the Arabs had trade relations with India from very ancient times. As for the trade during the period under review Ibnī Khurdadbeh supplies valuable information. "The products which the Arab merchants bought from the Indian market are: perfumes, woods, sandal wood, camphor, spices, cubeb, coconut, linen textiles, ivory, corundum, pearls, marble, lead, dyes, bamboo and cane⁹⁷". On the other hand the things which Arab merchants sold there included, liquor, silk stuffs, fur, skins, swords, water of roses, iron, marjoram and precious stones.⁹⁸

Trade relations with China:—The history of muslim trade with China is somewhat troubled. As early as the eighth century A. D. it is recorded that foreign captains (Arabs and Persians) had their names registered at the Bureau of marine commerce in Canton (khanfu) and all sorts of restrictions were put on foreign goods. The Muslim colony in Canton was already so populous that "in the year 758 A. D. it could plunder the city, burn the ware-houses and make off with the spoil."⁹⁹ The early commercial enterprise in Canton which had become an emporium of trade with China, was brought to an end in 878 A. D. by certain disturbances in which the port of Kanfu was destroyed.¹⁰⁰ From that time the scene of marine commerce shifted from that country and did not extend further than the town which the Arab authors called Kala, the position of which must be sought on the western coast of Malacca. Abu Dulaf bears testimony to this state of affairs by saying that Kala is the commencement of India and the limit of navigation: the ships can go no further, else they come to grief.¹⁰¹

97. Ibnī Khurdadbeh: *Kitab al Masalik wal mamalik*, p. 71. For further details see also al Masudi: *Muruj al-dhahab* Vol. I, Chap. VI; Ibnī Faqih: *Kitab al Buldan*, p. 251; Abu zaid: *Ancient account of India and China*, part II, p. 131; Ibnī Hauqal: *Kitab al masalik wal mamalik* p. 228.

98. Ibnī Khurdadbeh: *Kitab al masalik wal mamalik* p. 153. Ibnī Hauqal: *Kitab al masalik wal mamalik* p. 213; Abu Zaid and Suleman: *Ancient accounts of India and China*, p. 9, 145.

99. Reinsud: *Relation des Voyages*, p. 14.

100. Ibid.

101. Yakut: *Mo'jam al-Buldan* III, 453.

Navigation in the Mediterranean Sea:—Now turning to the west we find that the muslims were the masters of the Mediterranean Sea; it was an Arabian lake. In the 10th century Europeans had no power over it. In the year 939 A. D. the ships of Fatimid could raid and plunder southern France and Genoa.

Arab traders carried on business with all the coastal towns and the islands, the chief of the islands being Jabali Tariq, (Gibraltar) Qabras (Cyprus) Saqliya (Sicily) Sardanias (Sardinia) Iqritus (Crete). The Arabs counted 36 days journey for the Mediterranean from the Atlantic Ocean to the port of Antioch.¹⁰² This port of Antioch was Seleucia which in the 9th century A.D. was the most important trading centre of Syria, the Caliph Mo'tasim had it fortified.¹⁰³ We are told by Ya'qubi that the harbour of Syrian Tripoli holds a thousand vessels; military harbour against Byzantine was at that time Tyre, which was protected by massive fortifications.¹⁰⁴ The eastern half of the north African coast was ill suited for navigation. The only port between Alexandria and the gulf of Tunis was that of Tripoli. And this was of sufficient depth even for the shallow draught of the vessels of the time; the inhabitants used their boats free of charge to help strangers in their difficult landing.¹⁰⁵

Important Ports:—The chief ports which commanded the maritime trade of Islamic countries were 'Aden, 'Oman, Suhar, Jedda Siraf and al-Basra.

'Aden:—was the great centre of trade between Africa and Arabia and the *point d'appui* of that between China, India and Egypt. al-Maqdisi calls it the vestibule of China, there the people could hear of a man starting with 1,000 dirhams, and coming back with 1,000 dinars and another starting with 100 and coming home with 5,000, a third starting with incense

102. Edrisi, edited by Dozy p. 214.

103. Ibnī Khurdadbeh: *Kitab masalik al mamalik*, p. 153.

104. Yaqubi: *Geography*, 327.

105. Ibnī Hauqal: *Kitab al Masalik wal mamalik*, p. 46.

and coming back with this same quantity of camphor instead. 'Aden imports ambergeris, all kinds of perfumes, aloes, iron and pepper¹⁰⁶.

'Oman:—A large town on the sea coast, merchants are numerous in it. It is the emporium of the whole world. There is no town in the world where the merchants are wealthier than those found here, and where all the commodities of East, West, South and North are brought and from there carried to different places.¹⁰⁷ According to al Maqdisi the following articles are imported, apothecarie's drugs, all kinds of perfumes, Saffron, boqqam, teak wood, ivory, pearls, brocade, onyx, rubies, ebony, coconuts, sugar, aloes, iron, lead, canes, earthen-wares, sandal-wood, glass, pepper, and other articles.¹⁰⁸

Suhar:—The capital of 'Oman was famous because there was not on sea of China, a more important town than this. It was a city of great wealth and many merchants and a place abounding in fruits and natural resources. It was the gateway to China and the emporium of the East and al 'Iraq.¹⁰⁹

Siraf:—The world port of the Persian gulf through which the imports and exports of Persia passed. It was especially the port for China, even goods from Yemen intended for China were transhipped in Siraf¹¹⁰. The people of Siraf were the wealthiest traders in the Persia, they gave proof of this especially in their tall houses of many stories, built of costly teak. al-Istakhri says that an acquaintance of his spent 30,000 dinars on his house. The merchant princes were however curiously simple in their dress.¹¹¹ Men of Siraf conducted business from al-Basra also. Ibni Hauqal met one of the traders who had property of about a million dinars. Many a man of Siraf he further adds, spent his whole life on the sea. This position of Siraf had its effects. The chief language of the muslim traders

106. Al-Maqdisi: Ahsan al Taqasim-edited by de Goeje (Leyden.) p. 97.

107. Ibni Hauqal: Kitab al Masalik wal mamalik. p. 32.

108. al-Maqdisi: Ahsan al Taqasim. p. 97.

109. Ibid.

110. Istakhri: Kitab al Masalik wal mamalik edited by de Goeje (Leyden.) p. 34.

111. al-Istakhri: Kitab al Masalik wal mamalik. edited by De Goeje (Lyden.) p. 139.

was Persian and the Persian influence was exerted in other aspects also, such as the nautical terms.

Al-Basra:—al-Basra the great commercial port of Baghdad and Jazir-a, lay on the Arabian side of the estuary of al Basra and about 12 miles as the crow flies from its bank (two days journey). Two great canals, Nahr Ma'kil on the North east and Nahr al Ubulla on the south east, brought the ships up from the estuary to the quays of the town which stood at the junction of these two canals.¹¹² The modern town of al-Basra stands on the estuary of shatt al-Arab (Faid of al Basra) and is probably identical in situation with ancient al Ubulla.

In front of the river's mouth there was an island with small, fort 'Abbaden whose inhabitants maintained themselves by manufacturing halfa mat.¹¹³ Six miles further sea ward was a building on piles, stakes driven into the ground and there on stood a light house which was illuminated at night to keep the ships a way from the place.¹¹⁴

Economic policy of the state:—The great strides made by the muslims during the period was mainly due to private initiative; there was no state organisation whatsoever to protect indigenous industries or to run state owned factories. Still there was some sort of help which emanated from state authority which was brought to bear on the agricultural and economic geography, so it is necessary to bring to light what Arab geographers say on this important aspect of our study.

The state action which brought much prosperity to the agricultural conditions of the Empire was the provision of irrigational facilities. "In al-'Iraq" says Qudama bin Ja' far, "that the state has to see for the maintenance of weirs, dams and sluices and for this there were employed a large number of engineers".¹¹⁵ The regulations concerning water in eastern

112. Ibni Hauqal Kitab al masalik wal mamalik p. 206.

113. al-Maqdisi, Ahsan al Taqasim edited by de Goeje (Leyden.) p. 118.

114. Ibid p. 12.

115. Qudama bin Ja'far: Kitab al Kharaj ed. by de Goeje. p. 63. vide Renaissance des Islams p. 149, (translation).

Faras were very elaborate. In Merv there was a water beureau.¹¹⁶ The head of this beureau had a staff of 10,000 men under him. He was a higher official than the chief of police in the region.¹¹⁷

Steps were also taken by the state to ameliorate the conditions of travel. al-Istakhri bears witness to the fact that in eastern Faras, there were tanks of water for every three farsangs on the road through the desert and in Tabaristan there were more than 1,000 hostels where the needy traveller was supplied with nourishment for himself and fodder for the animal.¹¹⁸ Al-Maqdisi says that in Khuzistan buckets of water, which often had to be fetched from a distance were placed along the road at an interval of one farsang.¹¹⁹ Ibn Hauqal adds that in the wild and unsafe region of the west there were foundations providing for lodging and protection.¹²⁰ Bridges were also built on important roads and rivers in al-'Iraq, Ahwaz, Khuzistan and Faras. Ibn Hauqal mentions one on river Tab which formed the boundary between Khuzistan and Faras.¹²¹ He also professes to have seen the remains of a bridge of brick work near Takrit.¹²²

But inspite of all these helpful considerations on the part of the Government, there was the dark side of the picture also. The governments concerned burdened the trader with innumerable taxes. The Arab geographers complain of a multiplicity of taxes which harassed the cultivator and the trader a great deal. These taxes included port duties, inland transit duties, customs duties etc.

In Arabia the tariff varied a great deal. At Jadda, the Government levied half a dinar on every camel load of wheat, on every bale of Egyptian linen 2 or 3 dinars according to quality ; for a camel load of wool, two dinars etc. At Qulzum they

116. al-Khwarizmi: *Mafatih al 'Ulum*, p. 68.

117. Istakhri: *Kitab al Masalik al mamalik*, p. 261, 68.

118. Ibid. p. 290.

119. al-Maqdisi: *Ahsan al Taqasim*, p. 418.

120. Ibn Hauqal *Kitab al Masalik wal mamalik*, p. 49.

121. Iban Hauqal: *Kitab al masalik wal mamalik*, p. 170.

122. Ibid p. 168.

levied on every camel load 1 dirham. Even at other Arabian ports customs duty was levied, but the rate was lower. The ships coming from west to Egypt paid customs at Alexandria ; those from Syria at Farama.¹²³ al-Iraq groaned with sea, river and street tolls. On account of its exacting searches and harassing interference al-Basra bore a bad reputation. In al-Basra there lay the frontier between the territory of the Caliphs and that of Karmatians at the gate of the town were located face to face custom houses of the two powers ; so that on a single sheep as much as four dirhams were levied. The gate, indeed, opened for only one hour a day.¹²⁴

In the province of al-Jibal at Yahudia, the merchant quarter in Ispahan, 30 dirhams were imposed as octroi for every camel load.¹²⁵ In Transoxiana they charged for a passage across the Oxus for every male slave 70 to 100 dirhams, for every turkish slave girl 20 to 30 dirhams, and for a camel 2 dirhams.¹²⁶ For luggage of the passenger 1 dirham was charged.¹²⁷

Faras always was the most difficult to govern, because of its complicated system of taxation.¹²⁷ Persians were so drilled into obedience that they became the most patient of men under injustice.¹²⁸ They were weighted down under the most oppressive taxes and knew not what justice¹²⁹ was. Diversified as the constitution of this mountainous country was, unapproachable rocky castles, forests and landed aristocracy constituted a perfect feudal frame work. Most of the lands were held in fiefs and yet the financial system was so minutely worked out that even the ordinary labourers on the crown land had to pay their taxes in dirhams.¹³⁰ These taxes were assessed on the basis whether the land was irrigated, and if irrigated, with machinery or

123. al-Maqdisi: *Ahsan al Taqasim*, p. 104.

124. *Ibid. p. 133-34.

125. Ibid. p. 400.

126. Ibid. p. 340.

127. Istakhri: *Kitab al masalik al mamalik*, p. 146.

128. al-Maqdisi: *Ahsan al Taqasim*, p. 451.

129. Ibid. p. 448.

130. Ibid. p. 421.

without machinery. In case, if the irrigation was not by machinery they paid a certain sum which was made the standard of assessment. Two thirds of the amount was raised on lands irrigated by machinery and only one half on land which was not irrigated by machinery.¹³¹

In Egypt especially in Tunis and Damietta (on the banks of the Nile) taxes were very heavy. On every bag of oil one dinar was levied at Tunis and heavy were the imports at Fostat. "I was told" says al-Maqdisi that at Tunis the daily customs duty was to the extent of 1,000 dinars. And there were quite a number of such places on the banks of the Nile in Upper Egypt and on the coast near Alexandria".¹³²

In Syria, however, taxes on merchandise were light and continued to be so under the Egyptian Caliphs. Only there existed, particularly in Jerusalem the rule that goods could not be sold save in authorised market places which had to pay a heavy sum to the government. The peculiar feature of this province was the himaya, (licence tax) as for instance the licence for keeping carriages.¹³⁴ The district of Nishibis alone yielded five million dirhams apart from the capitation tax, which brought in 5,000 dinars; wine tax which brought in 5,000 dinars; taxes on domestic animals and vegetables which brought in 5,000 dinars and the taxes for mills, both shops and crown lands which brought in 10,000 dinars.¹³⁵

Conclusion:—By way of conclusion it may be said that a perusal of the Arab geographical literature gives us the impression that the treatment of the subject was most thorough and covered a vast field; but at the same time it must be admitted that it was not so developed as it is today. For instance in dealing with the agricultural conditions of a country Arab geographers seldom pay attention to the relationship

131. al-Istakhri: kitab al mrsalik p. 157

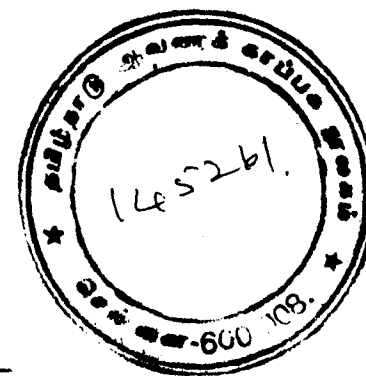
132. al-Maqdisi: Ahsam al Taqasim p. 213.

133. Ibid p. 189.

134. Ibni Hauqual: Kitab al masalik...140 Sqq.

135. Ibid.

which exists between physiography, climate and the growth of plants. They simply deal with the conditions of water supply and point out the agricultural prosperity and enumerate the crops of the region. Similarly in the treatment of other economic aspects they deal with the distribution of raw materials, manufacture and trade in water tight compartments, seldom adopting a geographical procedure in which all these items are inseparably linked together; with all these short-comings, however, we cannot ignore the fact that they give first place to a description of climatic and topographic features of the country under discussion and that they set forth other characteristic things such as plants, animals, minerals, industries, trade etc. This arrangement of descriptive matter clearly shows that according to them an understanding of the physical environment of a country is the pre-requisite for the study of economic phenomena. Besides this, the real value of their contribution lies in their presentation of a true picture of the economic conditions of the times, and hence its value to the student of historical geography is supreme.



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