Vol. XXII April—June, 1947 No. 2

The Indian Geographical Journal

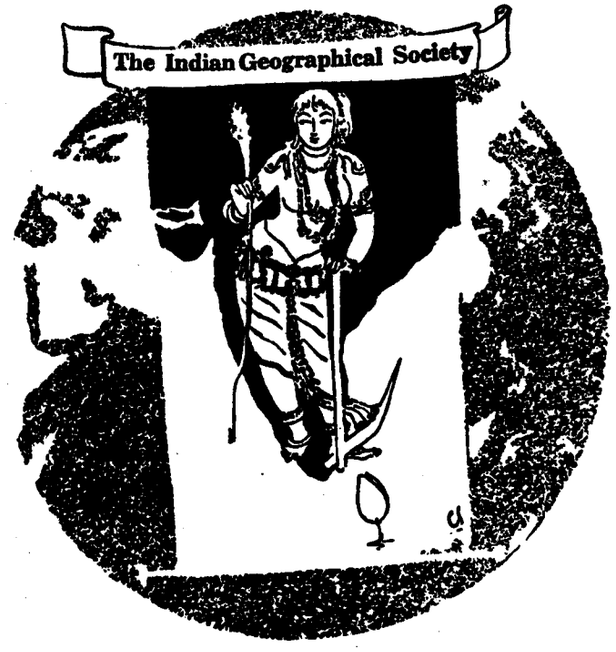
Formerly

THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

PUBLISHED QUARTERLY

Editor

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



THE INDIAN GEOGRAPHICAL SOCIETY,
Wellclose, Cathedral P.O., Madras.

CONTENTS

The Indian Geographical Journal

Formerly
THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION

Vol. XXII APRIL—JUNE, 1947 No. 2

Physical Geography of the Arabs in the Xth Century A.D.

BY

ZIAUDDIN ALAVI, M A., (Alig.)

After a vigorous start in the ninth century the superiority of the Arab culture continued to be felt throughout the tenth century. In fact it it was felt more strongly than ever, not only because the foremost men of science were Muslims, but also because the cultural influences are cumulative. By the middle of the tenth century the excellence of Arab science was already so well established even in the west that each new Arabic work benefitted to some extent by the prestige pertaining to all. One of the characteristic feature of Arab civilization was the importance attached to geographical surveys of various kinds and the richness of its geographical literature. The following pages give a brief outline of only one particular phase of geography *i.e.* Physical geography developed by the Arabs in the tenth century. The ideas are based on Ikhwanus-safa[1], Al-Masudi[2], and Abi-sina[3]. It will be seen that the explanation of the various natural phenomena are rudimentary but show a spirit of research.

A logical division of the subject matter of physical geography falls into three studies—the study of lithosphere, atmosphere and hydrosphere.

1. Tracts of Ikhwanus-safa 975 A. D. Among the known collaborators are Al-Busti, Zindjani, Nahrandjuri, Al-Aufi and Zaid bin Raifa.
2. Murujuz-zahab wama'dan al jawahir.
3. Ash Shifa.

A. Study of Lithosphere.

Arab geologists and geophysicists studied the earth surface as regards its origin. According to them the evolution of landform depended on the agents of erosion, deposition and earth-movement.

Processes of erosion and deposition : Arabs attributed the weathering of mountain ridges to prolonged action of the rays of the sun, moon and stars, and regarded rainwater and streams as agents of erosion and deposition. According to Ikhwanus-safa the mountains on account of the intensity of the brightness of sun, moon and planets absorb the moisture and increase the dryness and consequently break the hard rock into large stones small stones and sand. The rain and streams take these stones and sands towards the valleys and rivers, which carry them toward the seas and lakes. The seas on account of the force of the waves spread them at the bottom, one layer upon another, which, in course of time give rise to lands and mountains[4]. The above statement clearly shows that the Arabs almost anticipated modern concept of the agents of erosion and deposition.

Alternation of the relative position of land and sea:—As regards the alternation of the relative position of land and sea their views may shortly be summed up below: In every nine thousand years the planets move one quarter of the celestial sphere (three zodiacal signs), completing a round of all the twelve zodiacs in thirty six thousand years[5]. This causes a change in the sides of the planets in relation to the rays of the sun. Now as the rays of the sun fall on new lands their destructive and constructive activities also shift. In this way the Arabs accounted for the view that mountains become land and land becomes sea and then land again. It is creditable that the Arab theory of precission of equinoxes is strikingly similar to the modern theory.

Origin of mountains :—The main theory of the Arabs on the origin of mountains was this. Mountains may arise from two causes—either from the uplifting of the ground, (earth—movement) for instance by earthquakes or from effects of running water and wind in hollowing out valleys in soft rocks and leaving the hard rock prominent[6]. This in their opinion was the most effective process in the case of hills or mountains of moderate height.

4. Tracts of Ikhwanus—safa Bombay Edition Vol. 2 page 63.
5. Ibid page 62.
6. Founders of Geology A. Geikie page 47.

Kinds of mountains:—The different kinds of mountains find a place in the Tracts of Ikhwanus-safa but their ideas are rudimentary. It mentions that the mountains are of two kinds: (1) Mountains made of hard stones smooth and bare rock on which nothing grows. (2) Mountains made of soft rock such as clay and sand which are combined in the form of layers. These mountains have many caves, cavities, airs and springs. These mountains bear vegetation[7].

Origin of soil:—The views of the Arabs on the origin of soil[8] are based on the differences of structure in different stratas of the earth. They attributed the formation of soil to the decay of organic remains mingled with earthly material which was originally deposited in the sea, which according to them once overspread all the land. This was based on their observation of the aquatic and other animal remains as well as the structural differences in the upper layer and the lower one.

Origin of earthquakes and volcanoes:—The explanation of the causes of earthquakes and volcanoes were attempted by many Arab writers. They believed in the 'wind theory' of the earthquakes which may be traced as far back as Aristole[9].

The Arab theory may briefly be mentioned as follows: when there is no outlet for the water to come out of the caves and cavities, the internal heat of the earth heats it so that it turns into strong vapour (like wind[10]) and begins to rise and wants more space, so if the earth is weak it gives way and the steams come out. If on the other hand the earth is strong it stops the steam from coming out, so it breaks the earth and gushes out. This is called 'davi' (humming noise). It is often accompanied with earthquakes[11].

As regards the origin of volcanoes the Arabs point out that the interior of the earth is very hot and that sulpheric, naphthic and oily waters are also found there[12]. So they concluded that the winds that force their way downwards are volatilised, and contact with sulphur gives explosive force, smoke and fire[13].

7. Tracts of Ikhwanus—safa Vol. 2. page 65.
8. Founders of Geology A. Geikie page 47.
9. Works of Aristotle Ed. Ross. Vol 3. Meteorologica, page 365. "The earth is essentially dry but rain fills it with moisture, the sun and its own fire warm it and gives rise to a quantity of winds both out-side and inside it, The earthquakes are a necessary consequence of this fact."
10. Ash-shifa Abi-sina MS. No. A. 1413 Asiatic Society Bengal. Page 676.
11. Tracts of Ikhwanus-safa vol. 2. Page 67.
12. Ash-shifa MS. No A. 1413 A.S.B. Page 678.
13. Ibid page 678.

Origin of rivers :—Their views on the origin of rivers were scientific. They attributed it to the melting of snows and internal springs. According to Ikhwanus-safa "The high mountains have another advantage. On their heights are caves where in winter the water is accumlated in the from of snow, and from these it comes out in spring season and gives rise to springs[14].'

According to Al-Masudi it is the law of nature that the surface of water be level but as the earth is in some places high and in others deep, the water goes to the deepest part and when it is enclosed in caverns it has a tendency to form streams which produce a pressure on the earth from beneath, so it gushes out and gives origin to springs and rivers[15].

Causes of floods :—One of the natural phenomena most puzzling to the Arab scholars was the inundation of different rivers particularly river Nile. Their accounts of the causes of floods, in most cases happen to be fairly correct. As regards the cause of flood in most of the rivers which flow from north to south, in spring season, it is said that in this season snow begins to melt on account of the heat of the sun (as the sun is nearer).[16] The cause of flood in Nile is that this river rises in south and flows towards north and its sources lie beyond the equator (when it is winter in the north it is summer in the south and vice versa) where, at this time, it is rainy season.[17]

B. Study of Atmosphere.

The atmosphere was studied by Arabs under two heads (*a*) meteorology (*b*) climatology. The Science of meteorology was devoted to the investigation of individual and local atmospheric phenomena and climatology to the investigation of the geographical distribution of weather conditions throughout the world as observed over long periods. Meteorology and climatology sometimes merge into each other. An understanding of the one is absolutely essential to the understanding of the other, and hence a few meteorological theories of Arabs are first taken into consideration and then a short description of Arab climatology is attempted.

The Arab meteorologists tried to establish that changes of state in the air are influenced by constellations. They supposed that this happens by virtue of the incidence of stellar rays upon the elements.....colour,

14. Tracts of Ikhwanus-safa vol. 2. page 67.
15. Murujuz-zahab chap 9 page 203-204. (Les prairies D'or, vol. I.) Ed. Barbier de Meynard Paris.
16. Tracts of Ikhwanus-safa vol. 2. page 68.
17. Ibid. page 68.

light and darkness, heat and cold, winds, clouds, mists, rains, snow, hail, rainbows, lightning and thunder represent changes in the atmosphere. Strictly speaking their ideas on meteorology though interesting are not scientific but we will consider them because they assist us in understanding the Arab conception of climatic phenomena.

Atmosphere. Stratosphere and Tropopause :—The Arab conception of the Atmosphere was taken from the Greeks who conceived the atmospheric shell as made up of three layers. The layer nearest the earth was supposed to be temperate, the one above it very cold and the third one nearest the moon, very hot. This is in accordance with the modern conception of the division of the atmosphere, according to which after a certain height is reached the temperature increases with the increase of elevation.

According to Ikhwanus-Safa the atmosphere surrounds the earth on all sides. The height of the atmosphere from the face of the earth to its uppermost limit is nearly equal to the diameter of the earth *i.e.*, 2268 farsakh[18] (6806 miles). The Atmosphere is characterised by three distinct belts of air. The first is nearest the moon, the second is nearest the surface of the earth and the third is in between. The air which is nearest the moon is burning hot, the layer which is in the middle is intensely cold and the layer nearest the earth is temperate[19].

Insolation :—

Arabs knew the fact well that on the surface of the land the distribution of insolation depends on the relative position of the sun with reference to the different parts of the earth in different seasons. The greater the angle of incidence of sun's rays the lesser is the amount of heat received by the surface at that place[20].

Convection Currents :—

Arabs were aware of the fact that the surface of the land is heated by the absorbtion of heat from sun, and that the heated air expands and rises. If the heating continues, a convection current is established in the heated area[21]. They also emphasised the importance of convection currents as a factor in the distribution of temperature thereby causing winds and rain etc. Arab Geographers also mention the fact that ascending currents of hot

18. A measure of three miles.
19. Tracts of Ikhwanus-safa page 44 Vol. II.
20. Ibid page 46.
21. Ibid page 48.

air are always prominent in Iraq, while descending currents occur in places where the temperatures are low[22].

Humidity of the Atmosphere :—

Arabs knew well that water evaporates and that when a mass of air is cooled some of its vapour condenses in form of rain and snow, mist and dew. Their explanation of these phenomena is exactly on the lines of modern meteorology.

Rain and Cloud :—According to Arab Geographers rain is caused by the rise of vapours in the air. The upward rise is checked by the cold upper layer, these vapours go on increasing and thickening. These accumulation of vapours lead to the formation of clouds which are dry when hot; and on becoming cold they become heavy, and owing to heaviness so produced they condense in the form of rain.

Mist and Dew :—When the saturated vapours come in contact with cold layers of air at night they are prevented from ascending up and freeze near the surface of the earth forming mist and dew.

Snow :—If the vapours rise in the air to some height the cold effects them, they become liquid cloud and if the cold be intense small drops freeze in the forms of snow[23].

Lightning and Thunder :—

The cause of these phenomena is rather strangely explained by the Arabs, they did not add much to what Aristotle has said in regard to the causes of lightning and thunder. According to Ikhwanus-Safa it was due to the rising vapours which mix up with dry air and come in contact with the cold of 'Zamharir,' the dry air tends to separate itself from vapours, making the vapours split. On account of the heat of the dry air a rumbling noise is produced and this same cause produces lightning.

Rainbows :—

Arabs thought that rainbow occurs in the sphere of Nasim *i.e.* the layer of air nearest the earth. They attributed the formation of rainbow to the refraction of the sun's rays on the particles of vapours in the air and their diffraction towards the sun[24].

22. Ibid page 54.
23. Tracts of Ikhwanus-Safa vol. 2. page 50-51.
24. Ibid page 53.

Winds :—

The explanation of the Arabs for the causes of winds is not very different from the Greek notion[25]. According to the Arabs one of the causes of the movement of the wind is the ascent of dry vapours (which is smoke[26]) and moist vapours from Sea as well as land[27]. These vapours rise on account of heat in the air and begin to fall down when their further progress is obstructed (by coldness). The direction of these retreating vapours is controlled by the ordinary air. Another factor emphasised by the Arabs was the location of mountain ranges which determine the direction of the winds[28].

Some Geographical aspects of the study of atmosphere :—

There are certain distinctly geographical aspects of the study of atmosphere that were attended to by the Arab scholars which deserve our attention.

Arabs conceived of the interaction of the atmosphere and the earth in two ways : effects produced by the land specially mountains upon the atmospheric phenomena and the effects produced by the atmosphere on land.

In connection with the first the Ikhwanus—safa remark thus : " On mountains the angles formed by the suns rays are acute so the sun's heating effect is less, hence coldness prevails here[29] ".

As regards the effects produced by atmosphere on land it may suffice here to quote one instance which emphasises the effects of insolation on the surface of the earth : " The air near the surface is temperate in some places than in others. Had not the rays of the sun, moon and stars fallen on the earth and reflected on the air the surface of the earth would have been intensely cold[30]."

25. Works of Aristotle Ed. Ross, Vol. 3. Meteorological page 369 b " If any of the dry exhalation is caught in the process (*i e.* while escaping to the upper region) as the air cools, it is squeezed out as the clouds contract and collide in its rapid course with the neighbouring clouds, and the sound of the collision is what we call thunder .....It usually happens that the exahalation that is ejected is inflammed and burns with a thin faint fire ; this is what we call lightning. "
26. Ash-shifa Abisina MS. A. S. B. page 705.
27. Tracts of Ikhwanus-safa vol. 2. page 48.
28. Ibid page 49.
29. Tracts of Ikhwanus—safa page 46 Vol. II.
30. Ibid page 46 Vol. II.

Differences of climate :—

Arabs also had some idea of the division of the earth into hot and cold zones. The climatic differences between northerly and southerly latitudes were well understood[31]. These differences were attributed to the apparent movement of the sun. They observed the phenomena that when the sun for six months is in the northern zodiac the atmosphere there is heated intensely, while coldness prevails in the southern zodiac. But when after six months the sun reaches the southern zodiac the order is reversed, and hence it was deduced that when it is winter in the northern hemesphere it is summer in the south and vice versa.

C. Study of hydrosphere :—

Now we must note the features of the sea which interested the Arabs—these were the origin of the sea, salinity and tidal phenomena.

Origin of Oceans and Seas :—

Al-Masudi gives a summary of the ancient and Arabian views on the subject. He says, " Some are of the opinion that the sea is a remnant of the primitive humidity, the greater portion of which has been dried up by fire, and that portion which remained had undergone a change through the process of burning and has become salt. Some consider it as the remainder of the secondary humidity which was left after the earth had extracted the purer part for the production of solid bodies. Some consider it as the sweat of the earth which is caused by the constant revolutions of the sun round our planet."[32]

Salinity :—

Arabs knew well that the salt in the sea is derived in part from rivers, Al-Masudi says, " The water which flows into the sea from high and low grounds of the earth, absorb according to its nature the salt which the earth throws out in the basin[33]

Arabs were also aware of the fact that evaporation of lighter fresh water leaves behind the heavy salt water. The sweet and salt waters are originally mixed, the sun attracted the lighter sweet water (evaporation), leaving the saltish water."[34]

31. Ibid page 129 Vol. I.
32. Murujuzzahab (Les Prairies D'or) Vol. I. Ed. Barbier de Maynard Paris Chapt. XIV pages 277-278.
33. Ibid page 277.
34. Ibid page 277.

Tidal Phenomena. 1. Influence of moon theory :—

From the earliest times it has been known to the mariners that there is some connection between the tides and the moon. But the cause of this connection was not known till the time of Newton. It was with the help of the gravitation theory that we knew the fact that bodies attract each other in proportion to their masses and inversely as the squares of their distances. The moon therefore attracts the part of the earth nearest to it more strongly than the parts which are farther away. These differences of attraction disturb the water of the seas.

Arab ideas, however, were based not on the attractive force of the moon, but on the amount of heat generated by the moon. She being congenial with water, makes it warm, which after being heated becomes lighter and needing more space goes on pushing upwards till it reaches the coast. The full moon communicates a greater amount of heat and hence water increases in volume. This was called by them monthly tide.

2. Course of wind theory :

Another theory by which the Arabs tried to explain the tidal phenomena was based on their observation of the fact that the motions of the sea cohere with the course of the wind, for when the sun is in the northern hemesphere, the air moves to the south, the sea is also higher there. In the same way when the sun is in the northern hemisphere the course of air and with it the current of water is from south to north, and hence there is less water in the south.

We thus see that the Arabs developed the Greek notions on physical geography and added to them some of their own observations contributing a vast and rich literature on the subject. They classified landforms and gave a scientific explanation of their origin. Similarly in other branches of physical geography like climatology and oceanography great advance was made by them. No doubt their ideas are rudimentary yet they show a spirit of research. In their ideas we find a beginning of modern science.

Geography at the Science Congress

BY
NAFIS AHMED, M.A.,
Professor of Geography, Islamia College, Calcutta.

The 34th Session of the Indian Science Congress at Delhi in January 1947 was a great success. It had the largest representative gathering of Indian and Foreign Scientists in recent years. The section of Geology and Geography was particularly well attended. A special colour was lent to the deliberations of the geographers by the presence of Dr. L. D. Stamp, Professor of Geography, London School of Economics and Director of Britain's Rural Land Utilization Survey, who came with the foreign delegation of Scientists.

The Indian Geographers welcomed this opportunity of discussing with Dr. Stamp, problems connected with the application of their science to tasks of national development and scientific planning of the country's resources. One of extreme importance and requiring immediate attention is a Land Utilization Survey—a field in which the services of trained geographers can be utilized in assessing and harnessing the resources of land on a scientific basis.

Dr. Stamp in the course of his observations explained how in Britain the Land Utilization work was shared by the Ministry of Town and Country Planning, and the Boards of Trade and Agriculture. He said that the work was begun before World War II, but the urgent demands of wartime on national resources led to an exclusive reorganization and systematic effort. It was realized, he stressed, that we live in an environment of many facets—a mosaic, the pattern of which is not easily discerned at first glance. Both Britain and India were densely populated countries with no spare land. They have, therefore, to do with what they have, and the continued welfare of this generation, and every succeeding one, depends first upon how wisely we shall use the land that is ours. It must be subjected to a thorough and scientific investigation to find out the present uses in the light of the landscape's history. Then alone answer can be found to many "whys" and methods may be evolved and techinique

1. In writing this note I have taken some help from the notes of this discussion prepared by Mr. Omprakash Bharadwaj of the University of Punjab.

developed for uses in future in order to achieve maximum results for human welfare. He emphasized the importance of careful field work, painstaking collection of data and the preparation of large scale and small scale maps. Dr. Stamp pointed out the enormity of such a task in a huge country like India and was strongly of the opinion that initiative and financial backing must come from the Government. As to the personnel undertaking the work, he referred to the special suitability of trained geographers and mentioned the leading role that they were playing in his Directorate in Britain. Finally, he displayed a set of Land Utilization maps recently prepared under his supervision in England, Scotland and Wales.

Earlier, Dr. K. S. Ahmed (Punjab University) had read a paper on the necessity of a Land Utilization Survey in India. Dr. S. P. Chatterjee (Calcutta) explained some of the work undertaken by him on a small scale in parts of the Howrah district (Bengal). Dr. George Kuriyan mentioned about the work done by the Department of Geography of the University of Madras. Other geographers present expressed their views and offered certain criticisms. Unanimous scepticism was shown with regard to the authenticity and correctness of the Government records and a plea was made for the need of investigators with some kind of training. Some of the special problems connected with the typical aspects of the landscape of widely separated parts of the country were pointed out. For example, in India the non-existence of true "grass-lands", "Woodlands" and Orchards (especially in northern India) was taken into account.

Ultimately, the following provisional classification of the present uses of land was arrived at, and a colour scheme for these subdivisions was also suggested.

Classification

I. Forest and "Woodland" (wherever such conditions are met with.)
   (A) High Forest.
   (B) Small Forest.
   (C) Scrub.

II. Waste Lands.
   (A) Arable.
   (B) Old Fallow.

III. "Grass Lands" or Green Areas.

IV. Gardens.

(A) Orchards

(B) Plantations (including the Mango groves of northern India.)

V. Arable Land (including current fallow.)

(A) Irrigated.

(B) Unirrigated.

[Here in, on the colour scheme may be superimposed alphabets indicating the names of the crops and their number.

VI. Land not available for cultivation.

(A) Communications.

(B) Factories.

(C) Other built-in areas.

Colour Scheme for Above

1. Forests (Green).
2. Grass Areas (Light Green.)
3. Orchards and Gardens, etc., (Purple.)
4. Arable Waste (Yellow with brown lines.)
5. Waste (Brown.)
6. Arable (Yellow.)

Routes and the Transport system of the Great Mughals.

BY

A. H. KADRI,

Department of Geography, Muslim University, Aligarh.

Alama Abul Fazal A in the first in concerning the "House Hold" writes, "Good princes make no difference between great and small matters. They take with the association of God the burden of this world and the responsibility of the world to come on the shoulder of resolution and are yet free and independent, as is the case with the king of our time (viz. Akbar the Great). In his wisdom he makes himself acquainted with the successful working of every department. For every branch he has made proper regulations and he sees in the performance of his duties a means of obtaining God's favour. The success of the vast undertaking depends upon two kings:—Firstly, wisdom and insight to call into existence suitable regulations. Secondly a watchful eye, to see them carried out by men of integrity and diligence."

Indeed it is a fact that the empire that Akbar inherited was a chaos. It had no peace and order. India after Sher Shah was governed by weak rulers who had no time to give any attention to the social and economic development of their kingdom. Sher Shah after conquering the various parts of the old Delhi Empire set himself whole—heartedly to the great task of consolidation. He was wise, alert and firm. He used his personal abilities and his vast resources to the good of his people. Particularly he gave great attention to the sound organization of land Revenue System and the construction of good roads, well protected against thieves and robbers, profusely provided with shady trees, sweet-watered wells and spacious inns (saras) for weary travellers. Sher Shah's empire and administration both, broke down in the days of his careless and weak successors. However we see that the son of his great enemy, not only combined the fallen off parts of his empire but also took up his laws and regulations improved them and applied them to the greatest benefit of the state and the people, with necessary additions and alterations.

Abul Fazal says, "It is only when cared for that the inhabitants of the towns and those of the rural districts are able to satisfy their wants and

enjoy prosperity. His Majesty has taught man something new and practical, and has made an excellent rule, which protects the animals, guards the stores, teaches equity, reveals the excellent, and stimulates the lazy man". The peace and order of a few years and the confidence engendered in the minds of the people by the stability, justice and full return of their labour soon made the empire prosperous and the people happy and economically active. Development of agriculture and industry, prosperity of trade and extension in the boundaries of the empire necessitated the construction of good and numerous roads. It had now become essential that the road and river traffic of the empire must be well organised and should be given in the control of a department run by efficient and experienced officers.

In the zeal of public good and for a great military necessity His Majesty organised the transport department which was given in the charge of Miri—Burro—Bhaz. At first it was made a part of the army ordinance department, and Mohd. Qasim Khan who was the best military engineer was made incharge of this department and was called Mir—Burro Bhar (Head of admirality and the first commisioner of works.)

In 1578 he was made Governor of Agra and later on in 1587 he became the Governor of Kashmir which he conquered and kept in proper subjection and constructed road for military purposes[1].

When His Majesty had more time and leisure to give his thoughts to the economic development of the empire, he reorganised the transport department and split it over into three main sections :—

(1) The Ministry in charge of land route section.

(2) The admirality or ministry in charge of inland river transport, section.

(3) The ministry in charge of Sea-traffic and the development of empire ports.

Roads department was attached to the imperial army as usual and was directly under the supervision of the Emperor. " His Majesty used to take great interest in the project of new roads and was kept informed of all the activities of the road building department. Especial reports were made to the Emperor of all the accidents and breaches of law on the imperial roads. (A.F.Ain) For the care and proper development of the inland river traffic an imperial department of the " admiralty " was later on established. Abul

1. Not on Qasim Khan by J. S. Hoyland's translation of Father Mouserrates's S.T. page 81.

Fazal in the Ain 26 giving the reasons for the justification of the department of the " admiralty ", says " Rules and Regulations were very carefully prepared by His Majesty himself with the idea of promoting the efficiency of the Department as an act of Divine worship with the following four important considerations.

(a) The appointment of a capable, honest man for the post of Mir Bhari.

(b) The appointment of other officers, seamen and sailors.

(c) Collection and remission of the port and ferry dues.

(d) Rules about the construction of ships and boats for the purposes of inland river traffic and sea journey.

3. The ministry in charge of the sea-transport was responsible to the Governors of Ahmadabad and Guar, who administered their duties through Shah-Bandur the officer in charge of a port and the chief custom officers.

Roads and Road scheme of Akbar the Great.

Akbar had several occasions of making long journeys in his early period of reign, either he went on hunting expeditions to the very interior of the empire forests and cultivated villages or now and then pounced upon his enemies like a fearless lion. His march against the king of Gujarat is a record of speed in the 17th century India. These journeys made him understand the necessity of good roads and well protected river traffic, Sher Shah Suri's grand trunk Road and Humayun's road of Delhi, were good specimens before him. Realising the importance and usefulness of a good transport system he courageously and jealously took up the difficult and costly scheme of "Inland Transport".

Akbar's difficulties were of various nature viz. :—1. Natural difficulties; (2) Political hindrances (3) social and religious differences of the people. Here we try to describe briefly the general characteristics of these difficulties. We take up the first category first i.e, the natural difficulties. India is a sub-continent. It has four main topographical divisions. (1) Northern mountain region. (2) The vast central plain of Indo-Gangetic valley and the Rajputana Sandy and hilly tract (3) The raised platform of the Deccan plateau and lastly (4) the coastal strips of the East and West of the peninsula. Akbar's Empire included all these land forms. Besides them the feature of the local topography of districts and their intricacies were greater difficulties to the road Engineers than the general relief of the Empire. For instance the Punjab and

North western frontier territory presented inconceiveable difficulty in the construction of smooth and well levelled roads. (M.C. 81.) Similarly they experienced difficulties on the area from the other side of the Chambal upto the southern limit of the Empire *i.e.* the rough craggy section of the Vindhya Chal range and likewise on the broken edge of the table land. The Gangetic valley with its innumerable rivers impeded the construction of a road at each step. To be brief one should say that the vast plains with continuous or awkwardly scattered tumours of hills and crags together with long barren deserts stretching in, between the ill drained low tracts of flood plains and river strewn areas, not only demanded a great engineering skill for the construction of good roads but increased the cost of construction to a prohibitive limit. Densely wooded areas and big rivers were hard nuts to crack for a road engineer of Akbar the Great. As the construction of a Pukka bridge was not an easy task in those days hence the continuity of a road was much disturbed by such rivers which caused both cost and inconvenience to the travellers and traders. India was given an epithat of ('Jannat Nisha by her musalman inhabitants but unfortunately it could never satisfy the essentialities of this definition. Our country had always been woefully divided into innumerable social, religious and political factions. Her social and religious differences had always been harder than her basalt rocks which could be easily cut or blasted with a small quantity of powder. These differences and the vastness of the area created a wilderness of variety of languages which could never be cleared and a common lingua franca could never be formed. Hence social and economic relations could not be developed among the neighbouring peoples. (See Babar's remarks). Even to this day we are greater strangers among ourselves than the English people are to Russians, or China men. Politically we always tried to become a united nation but never succeeded. It is true that the geographical conditions put great obstacles in our way of nation building with the consequence that our country had always been in the state of war. Our national resources and intellectual powers were always spent in cutting throats of our own country-men or making our brother prisoners, or in subjugating to others will. (Birnier's remarks). This warfare never gave any opportunity to our Rajput, Pathan or even Mughal rulers for establishing peace and order. The life of centuries of warfare had given the people a character which is described by Father Monserrate thus, " The inhabitants of these mountains (the Satpura range) worship ghosts. They are ruled by three kings ..they are constantly at war with the Mongols. When one of their tribes is pacified, and a treaty is made with the Mongols, the other two tribes carry on the wild and

1. Like a paradise.

savage warfare,.....These mountaneers are wild, barbarous and degraded. They are addicted to brigandage, and have no weapons except bows made of bamboo and short arrows with rusty points. Yet they are exceedingly fierce, intractable, greedy of spoil and headstrong. "

Before Akbar the Great, people of India ceased to understand the very meaning of a national state. They had no idea of the responsibilities of a citizen of a civilized state. Their loyalties were attached to their tribal heads or to the feudal Lords. They served the state as mercenary soldiers for pay and rank, or to protect themselves against the high landedness of the court favourites. And sometimes to gain power and authority to coerce others. True loyalty to the state or to the ruling authority was an unknown commodity in this country in those days and to a greater extent it is wanting even in these days of enlightenment and higher education. In short these political, religious and social enmities had always been the great unsurmountable difficulties of a state in carrying out any scheme of national economic development.

Lastly but of no less importance was the problem of finance. Capital in the empire both private and state was limited. Poeple yet preferred to hide their wealth and bury their gold and silver. Money was slow in circulation.

Banking system was defective and at a very primitive stage of its organisation. Public contributions either in the form of donations or loans were unthought of. Therefore the whole cost of carrying out any scheme of public utility had to be borne by the state, which had very limited income and only a few resources; for instance the total income of the Mughal Empire in Akbar's reign was Rs. 17 Karores and in the progressive and peaceful days of Shah Jahan it reached Rs. 22/—Karores which is about the income of a province of British India.

It was therefore very difficult for the state in those days to bear the heavy cost of the construction of roads of the highly advanced type as were being constructed in the European countries of that period. Construction of the bridges across the numerous and large rivers as well as the building of Saraies, ghats (Ford Stations) and the maintenance of roads and their protection, all these were the items which demanded a huge amount of capital to complete the transport scheme of the Empire.

Akbar the Great should be highly praised for his courage, generosity and efforts which he displayed in carrying out his road building scheme to such a great success.

"Agra was the centre of the Imperial Roads which were radiating from Agra like spokes from the hub of a wheel" writes of one of the early English travellers.

Roads :—

From Agra to

1. Delhi—Lahore—Multan and Thatta.
2. Fatehpore (Sikiri) Muthra — Delhi — Sirhind Nagarkot — Kalanaur — Chamba Rohtas — Gagar (in Hazara District) Peshawar—Jalalabad—Khaiber—Landikhana—Kabul.
3. Ajmere—Jelour—Ahmadabad.
4. Dholpore—Gwalior—Burhanpur. Surat.
5. Fatehpoure Sikri — Bayana — Bander Sindri — Ajmere—Merta—Bagra—Roha—Ahmadabad—Baroda—Broach—Surat.
6. Etawah—Allahabad—Benares—Mughal Sarai—Patna—Guar.
7. Kanauj — Lucknow — Ajodya — Fyzabad — Jaunpore—Allahabad.
8. Delhi — Lahore. Shadra — Najanri — Pir Panipat (rout Rajanri) — Laha — Thana — Behramgalla — Pusbiana — Hirapur — Kuser — Khanpure—Srinagar—Kashmir.

Agra was Connected with

(1) Lahore. (2) Allahabad. (3) Ajmere. (4) Ahmadabad and Surat. (5) Burhanpoure. (6) Multan and Thatta. (7) Kashmir. (8) Kabul and Kandahar. (9) Satgain-Dacca-Chittagong. (10) Lucknow or Jaunpur.

Agra was thus connected with the three main forts of the Empire *i.e.* Agra—Lahore, Multan—Thatta, to Lahori Bandar.

2. *via* Ajmere-Ahmadabad-to Surat.

3. *via* Allahabd-Satgoang-to Chittagang.

Looking the list of the various routes connecting Agra with the important forts and provincial towns of the Empire we can safely infer that the scheme was very carefully and diligently prepared and carried through. The main roads radiating from Agra to Bengal or, Peshawar, to Thatta or Surat, to Burhanpore or Lucknow were well connected with the

branches coming from different Forts and towns, with the result that a network of roads was soon spread over the whole empire, as Dr. Pant remarks "so we see that Agra in the days of the Mughals was well-served with routes. It was the converging centre for all routes from the important centres of the Mughal Empire, and routes from Agra used to go to Kabul, Kandahar, Persia and other important places via Lahore or Multan." There were also routes in Southern India which were connected with Agra. (1) Golconda via Burhanpur and Daulatabad ; again Golconda via Goa and Bijapur to Surat and then to Agra via Ahmadabad and Ajmere.

Tom Coryat says "that Muslapatam was a very important port well connected with Burma. China and the Arabian Sea countries. Its hinterland was the kingdom of Golconda and other neighbouring territories. Spices were carried by carts or animals from Muslapatam to Golconda and then via Burhanpore and Daulatabad to Agra."

Nearly all the travellers admire the good shady roads of the grand Mughals. Generally on both sides of a road high shady trees were planted at convenient distances, so that each side of the road should have enough shade for the protection of the travellers at hot hours of the day. "Tom Coryat admired the, "Long walk" of 400 miles in length shaded by trees on both sides." These trees were mostly fruit trees so that the weary travellers might enjoy the shade and eat the fruits and pray for the long life and prosperity of the king.

Pukka spacious Sarais, sweet-water pukka wells, mosques, Dharm salas and police thanas were adequately constructed all over the Imperial roads for the comforts and protection of the travellers. At the time of planning a road great consideration was made of the fact that it should touch as many big and important towns and Mundis (Markets) as possible, care was taken to connect the big Qasbas and even road side villages if found convenient. Sometimes roads were made crooked in order to join them with some suitable river Ford. In certain cases a road was given a long curve to avoid the territory of any un-ruly tribe or to escape from some topographical difficulties such as a swamp, a narrow defile or rough and hummocky ground. Efforts were also made to avoid a dense forest where there was always a great danger of loot and of wild animals. I am of the opinion that all the imperial roads were kucha roads like our second class roads but they were broad, about 40 ft, neat and smoothly levelled. Father Houserrate describes, "About this time the army was compelled to halt for some time owing to a violent tempest which rendered the roads impossible by reason of mud and sudden torrents. As soon as the weather cleared, the

advance resumed." M. S. C. 99. We also have records of foreigners to prove that they were paved or otherwise made pukka at places where it was unavoidable and therfore essential *i.e.* they were paved at places where they were frequently spoiled either by excessive rain or by some other such reasons. Father Monserrate says, "He (Akber) reduced the gradients on the roads, and paved them in soft and marshy places.". M.C. p. 77.

Wherever necessary and possible roads were made continuous by bridging rivers and nallas. The system was borrowed by Ferozshah Tughlak's works of public utility. Father Monserrated in his description of Delinum (Delhi) writes "He (Ferozshah Tughlak) built bridges over torrents, rivers, and ditches."

Bridges.

De Laet in his famous book "Description of India and Fragment of Indian History" states that "from Acharbarpor (Akberpore) to Jaunpore is 30 Cos. This town (Jaunpore) stands on the bank of a river which is crossed by a fine bridge." J. S. Hoyland's trans: Page 65. Further he says "not far from these ruins (the city of Tughlakabad) a branch of the river Jemim (Jumna) is crossed by a stone bridge (the bara palate bridge leading to Humayun's tomb) from which a broad avenue, thickly shaded by tall trees, leads to the tomb of Humayun". De-laet Page. 47.

Father Monserrate about the same bridge says "Leaving Panipatum (Panipat) and passing by the town of Camaris (Karnal) we came to a tributary of the Jumamis (Jumna). The infantry crossed this by a stone bridge, without any crowding or tumult which sometimes occurs in narrow places. The elephants, camels and cavalry, in accordance with the orders which had been given to them, crossed by a ford." M.C. 98.

The same author writes further "On the next day the army crossed the Bibasis (Beas) by a wooden bridge, and advanced nearly ten miles" (M.C. 104) again he writes advancing from Calanurnm (Kalanor) the army crossed the river Baobi (Ravi) by means of a bridge which was built for the purpose. (M.C. 108). The Father about Narbada writes that "In the stormy season the very wide and deep bed of this river (Narbada) is filled with rapidly flowing muddy water, so that it can only be crossed by means of a bridge or a boat. But in summer, when the water of the rains has subsided, it can be crossed on foot". (M.C. 15). *A Boat Bridge.* Father Monserrate describing a boat bridge says "It is the custom in India to make temporary bridges of boats, which are tied together only by grass ropes. Over these boats is laid a road-way made of branches of trees, bushes and hay,"

(M.C. 81). To satisfy the conditions of travel of those days it was essential that the roads should be provided with shady trees on both sides, wells, sarais and police posts should be built at such convenient distances that the travellers may enjoy comfort and have necessary protection, for this purpose the Dikhu was bridged near Ghargoan after three unsuccessful attempts and a detachment was sent under Abul Hasan to reach Lakhugarh via Gajpar and Debargoan, along a circuitous high road summoning by the way of Saringh and the Hills south of Ghoargoan. Complete success attended Abul Hasan's enterprise. The long lost connection with the fleet was revived, and large quantities of provisions reached Ghargoan both by land and water in the last week of Oct. 1662. (Fatheyah (J. H. S. B). 1872 P. 92 (343). M. M. E. F. P.

Bridges and Ferrcis Tavernur, S. K. I Page 64-65.

There is a large bridge at Paterki Saria, with six large arches and the river which flows under it is called Quari Nadi.

At Dholpore there is a great river called Chambal. You cross it by a boat bridge and it discharges itself in the Jumna between Agra and Allahabad.

At Mania (ki Sazia) there is a river called Lagon nadi, you cross it by a long bridge built of cut stone, and called Looulcapoul (or the bridge of the Jajou).

Sarais and their administration.

He (Sher Shah) sent orders throughout the land to build Sarais at a distance of twelve leagues from each other, where travellers could take shelter. To provide attendants at these sarais, he bought a number of married servants (slaves) and appointed them and their wives to look after travellers, to prepare their food, to provide cool water for them to drink and warm water for washing their bodies, a bedstead to rest upon furnished with mattresses and sheets, and they were to wait on travellers just as if they were their own private servants, and provide food for way-farers free at the cost of the king.

Since the time of Humayun, many more sarais were built upon the royal high ways throughout the realm, from one end of it to the other. Several charitable persons were building new sarais with gardens, reservoirs and tanks to perpetuate their own names. In these sarais travellers are "pestered by dealers, who offer for sale different kinds of cloth, not only white, but coloured; also by muscians, dancing-

boys, women dancers, barbers, tailors, washermen, farriers with horse-shoes, endless cheating physicians. and many sellers of grass and straw for the horses. All these things are cheap " (Mamcci Page 116 Vol. I).

The Sarais :

The (Sarais) were like fortified places with their bastions and strong gates ; most of them were built of stone or of brick. In every one was an official whose duty was to close the gates at the going down of the sun. After he had shut the gates, he called out that every one must look after his belongings, picket his horses by their fore and hind legs, above all that he should look out for dogs, for the dogs of Hindustan were very cunning and great thieves.

At six o'clock in the morning before opening the gates, the watchmen gave the warnings to the travellers, crying in a loud voice that every one must look after his own things. After these warnings, if any suspected that any of his property was missing, the doors were not opened until the lost thing was found. Thus the thieves when they heard a complaint made, dropped goods somewhere so as not to be discovered. These sarais were only intended for travellers (soldiers did not go into them). Each one of them might hold, more or less from 800 to 1000 persons, with their horses, camels, carriages, and some of them were even larger. They contained different rooms, halls, and verandas, with trees inside the court yard, and many provision shops. There were separate abodes for the women and the men who arranged the rooms and the beds for travellers.

" We carried the body at once to a sarai called Saria (Hodal) between Agra and Delhi. The official of the sarai sent notice to the local Judicial officer who hastened to the spot, and putting his seal on all the baggage laid an embargo upon it. (Mauric Vol. II p. 68.)

Sarai of Jahan Ara Begam at Delhi.

This princess to preserve her memory gave orders for the construction of a Sarai in the square which is between the fortress and city (The site is now occupied by the Queens Garden). This was the most beautiful sarai in Hindustan, with upper chambers adorned with many paintings and it has a lovely garden in which was an ornamental reservoir. In this sarai there put up none but Great Mughal and Persian merchants. The king went to view the work that had been done for his beloved Begam Sahib, and he praised her energy and liberality. Sadulacan (Sadullah Khan) said.—(Agar firdus bar rooai zamin ast—Hamin asto hamin asto hamin ast.)

General Rules :—

1. Free accommodation was given to the travellers without any distinction of caste or creed. There were several examples one of which was quoted above that the Indians and Europeans all used to stay side by side in the Sarai rooms without any distinction or hinderance.

2. No person was allowed to stay in a Shahi (Imperial) Sarai for more than 3 days.

3. Entry of correct name of the traveller, his father or guardian's name and place of residence was made at the gate of the Sarai in a register.

4. Hulia of the traveller was entered in the register.

" Most of these Caramossoras (Caravan Sarai) are located on high roads frequented by travellers. They are some times erected at the expense of neighbouring villagers, sometimes at the cost of princes or rich and powerful men, who erected them in order to keep their memory green or to satisfy their consciences, and large sums are left for such works, which in their opinion are works of piety and acceptable to God.

Design. They are usually built in a square, like cloisters in a monastery and are divided up into dwelling rooms and chambers, with a male and female regent ; for women can also carry on this occupation. These attendants are called respectively maters and materaihs. Their business is to keep these rooms free from rubbish and clean.

(2) and provided with cots, but without beddings, which travellers in these regions almost all carry with them. The bedsteads are constructed with strips of woven material two or three inches wide called webbing or with ropes of various material. This makes them so pliant that they surpass those heaps of over soft mattresses we use in Europe. People carry a Godorin or mattress of cotton (Gadha or Toshak) which is light and not bulky.

(3) Those servants are also entrusted with the preparation of the food for guests.

(4) As well as doing all other duties essential to comfort within the house, even to providing hot water for washing the feet.

Hence on reaching a caramossora all that one has to do is to send out and purchase food in the Bazaar or market and leave other matters to these attentive servants.

(5) Besides these duties, if the guests have horses, they are required also to cook mung (green grass) or chickpea, which is given instead of the barley we feed such animals on in Europe.

Note:—These matres and materaihs, who are the stewards of these inn are so obliging that they are content with one delema, (Dale or dub which is still used for the local copper coin in certain Indian states.) A real of 8 was worth about 45-6 d, so this delma was worth about ½d (Hobson—Jobson) which is so small a coin that a half real of eight contains 56 delmas, or pais, They surpassed over stable and inn keepers of Europe., outwardly and inwardly. (Travels of Sebastien Maurinque Vol. II page 102, in the years 1629—1643.)

Traffic—Professor of Transportation and Commerce Dr. E.R. Johnson in the introduction of the second chapter (The Locomotive and Power Development) in his famous book "Principles of Transportation", writes, "Transportation was once accomplished by the use of muselas, now mechanical power is employed." As in production, so in carriage and haulage, men have called to their aid steam, electricity and gas ; all of which they are applying with even increasing efficiency. For most countries, this is a mechanical age Power is fundamental. The degree of ability of men to apply power economically and effectively to the work to be done determines the rates of their material progress.

Transportation is heavy work—the movement of passengers in large numbers and with speed, the carriage of freight in great quantity and long distances—and is especially adapted to mechanical performance. Indeed, in this economic service or task as much as in any other, the machine can be made to labour for man, to lighten his burden and to multiply many times the possibilities of his unaided performance. Power, as the motive force of transportation has remedied and is ever changing the structure of social and business life, it has made society dynamic." P. J. Johnson Pagell. The above paragraphs give us an idea of the use and efficiency of mechanical power in transportation which is an essential characteristic of the modern age. In this paper we are dealing with the life of people of India and, transportation condition of the 17th century.

It was the period in the life of the people of India when they had for the first time a liberal, tolerant and progressive state. The great Mughals had to do much more work in this densely populated country for political, social and economic development than Lincholean had to do in the United States. In India before Akbar as has already been described in detail

roads were bad, unsafe and few. There was no supervision and state control on river traffic, foreign trade was a private concern of a few communities of coastal population or of the suburban provincial officials.

Mechanical power was in its early stage of use in western Europe. Coal as fuel was coming in use. Big furnances were constructed for smelting large quantity of Iron. These (coal and iron) were greatly advancing industrial output ; big factories were started, by which hand labour and animal labour results were increased several hundred times. For all this raw material was in need, new markets for surplus manufactured goods, which was enormous, were sought for. Thus there was a great problem of a new and advanced transport system. Sailing ships failed to meet the requirements of industrial era. Ships of the desert, camel transport looked like a radiculous and tiresome business. Pukka roads came in fashion, stage coaches began to run. But all failed to satisfy the requirement of the rapid and on a large scale heavier and voluminous traffic. Fortunately just then the use of steam power for steering ships and pushing locomotives were discovered. This discovery greatly saved the difficulties of the rapidly progressing nations of temperate Europe. It should be clear in mind that industrial era, rather reformation period, awakened the people of Europe and formed them into religiously and politically democratic bodies. Church and state both were reformed or were being reformed. Individual liberty of conscience, action and speech were recognised by state and church.

In other words public opinion was much developed and shaped and was a strong force in the management of state.

In India the period between 1556 and 1656 is the time of the reigns of benevolent monarchs. Akbar the Great after a laborious career of a conqueror kept himself busy for about 30 years in the consolidation and administrative organisation of the Empire.

Akbar should be credited for his great task and achievement of nation building and for the erection of the structure of a true national empire, or for Equality of status and toleration of religion. "The Emperor (Akbar) who had conquered these lands (1588) from the Heathens had given his words, taking an oath in the mossaffa of his Holy Prophet, that he and his successors would let them live under their own laws and customs, he therefore allowed no breach of them and free distribution of state posts to the members of Imperial subject without any consideration of caste or creed,

were made the key stone of the arch of Empire Edifice." People had made some advance but even up to the period of disintegration in the 18th century people could not be educated as their contemporary generations on the continent of Europe. We are sorry to remark that upto this date of the 20th century we are much inferior to the position of the subject people of the British democracy, than the people were in England in the reign of Queen Elizabeth.

Passenger Traffic.

Wheeled transport was not much favoured by the people. Generally man travelled on a horse back or on a camel. Otherwise an elephant was used by the nobles and wealthy people for riding purposes and the poor people used to ride on a donkey, a mule, a pony or even on a buffalo.

Shorter distances were travelled by the nobles and wealthier people in a Palkee, within towns *takhtai ravan* or *havadar* was very common. Daily in the morning after two Ghari *i.e*, at about 6 o'clock travellers started on their journey, some with the government convoy and others with their companions. It was not necessary that a police guard should accompany each and every group of travellers. The usual custom was that the intended passengers when assembled at the door of a city form wall where the government dak with the police guard was to be conveyed to the nearing town. Thus a big Qafila was made which started under the protection of the General Police guard. A police officer or constable was made in charge of the travelling whose duty was to look after the plight of the weak and poor travellers particularly because sometimes on account of infirmity or some such other causes these people could not keep pace with other members of the Qafila. Quarrels among the travellers themselves or among the travellers and the people at stage houses were decided immediately by the police officer incharge of the Qafila or the stage house. Serious matters were referred to the local district authorities and in such cases parties concerned were detained. e.g. Sebastien Maurinques describes that "after leaving the city of Gelas or (Jelasor in Orissa) (we stayed in a Hindu village between Jelasoa and Narangor) Here party was accommodated in a cow-shed by a villager. In this shed his peacocks used to take rest in the night. A mohamadan companion of ours caught a big one and killed it. Feathers were burried in the ground but on account of darkness of the night some smaller feathers remained scattered in the room. The owner of the house saw these feathers in the morning and made a cry. We tried to escape but a party of the villagers followed us and when we reached the city of Narangor and stayed in

the Caravan Sarai, the Complainant went to the house of the Sequider (Shiqdar) or Governor of the city...the sigaidar sent twelve sipahis or soldiers, to arrest us and bring us before him in the morning. These zealous officers came to the sarai in the midnight arrested us and tied our hands tightly behind our backs. They then took us to the house of the Governor and confined us in a dungeon below ground. Here we were for the voluntary and sadden greed displayed in eating the peacocks. It was about one in the morning (*i.e.* 1. A. M.) when we placed the doors open and the police officials came in and without saying anything they took us out of the dungeon and into the presence of the Judge. He was seated in his tribunal and asked me in a severe tone what I was...(Page. 110-11.)

Individual travellers performed their journey without any police guard. The imperial roads in the northern sobahs were safe, such as the roads between Agra and Lahore, Agra and Ajmere or Agra and Jaunpore or Agra and Gwalior were perfectly safe for any sort of traffic and at anytime of day or night.

Usual time of Journey:—Foot travellers in cold season used to travel in the hotter part of the day and in the summer from 4 o'clock in the morning, till 10 or 11 o'clock A. M. and then for a couple of hours in the afternoon. In summer days moon light nights were generally utilised for travelling but sometimes journey was performed in day time also. Early in the morning one would see at a gate of a town hundreds of people of all description coming and going to the town, such as the horse and camel riders, hati wala, a donkey driver, cattle drivers, sheep and goats flock, men Banjaras, fruit and vegetable sellers, a foot-traveller, sadhoos in their Bhaboot and a party of fishermen. Night travelling was avoided also because sometimes there was a danger of wild beasts such as wolves or hyenas or in the eastern and south western parts of the empire of leopards and Indian tigers, wild elephants and boars. As in those days only a smaller portion of the provincial area was under cultivation and rest of the ruqba was usually a wood or a dense forest full of all sorts of game animals as Edward Terry Says "They have no want of vension of divers kinds, as red deers, yellow deers, elkes, and antelopes. The whole kingdom is as it were a forest, for a man can travel no way but he shall see them, and except within a small distance of the king's shikargah they were every man's game. Ed. Terry page 296.

Travellers to their convenience used to enjoy hunting in the course of their travelling as is the case in these days also Ed. Terry remarks, "To these they have great store of harics; and further; to furnish out their feasts,

varieties of fish and fowl. It were as infinite as needless to relate particulars to white of their ğees, ducks, piğeons, partridğes, quailes, peacocks, and many other singular ğood fowls. " Early Travel in India page No. 276)

Some common forms of carriages or other conveyance for passengers and goods.

We must admit frankly that inspite of havinğ one of the larğest levelled plain of the world and inspite of old wealthy towns in countless numbers toğether with the religious and social obligations of journey, we could not develop any ğood system of wheeled conveyance. It is strange that with the construction of ğood levelled roads decorated with shaded trees, horse driven carriages were not made. Since the days of the Hon. E. I. C. when roads were made pukka horse drawn carriages of different sizes and designs soon multiplied in the length and breadth of the country which even now survive in ğreat number. Some of them are Shikaram or four-wheeled horse carriages. It was built on the style of a stağe coach and was used for carrying sarkari Dak under the ğuard of two to four police constables. Before the construction of the railways, ekkas, tonğas, victoria, ğig tomtom, bamboo cart chariots etc. were commonly used for lonğ and short travels. But in the period under review none of the above mentioned horse drawn vehicle was known in our country.

Bullock carts were the only common vehicle used in those days both for conveyinğ passenğers and ğoods. The bullock cart used for carryinğ passenğers was no doubt better and lighter than the Chakkra or cart for loadinğ ğoods. The Ain Abul Fazal mentions of these bullock carts. " They are of two desiğns one (Chatri-dar) or a covered bullock carts. " havinğ four or more poles (which support the chatra, or umbrella). These carts were without a chahtri also. They were called Bahals. The were used for carryinğ parda women also.

Old type of Rath with two domes as their chahtri was also used. At another place Abul Fazal says, "a ğreat many people in this sobah (Gujarat) ride in carriağes drawn by oxen. Further he says " that the Bhail and chariots were very common as passenğers conveyances.

In a Bhail when used on even ğround several may sit toğether and travel, the camel and horse drawn carriağes are also mentioned by Abul Fazal in the description of royal stable. They were ğenerally used in royal

artillery. We find the mention of an Enğlish carriağe (Rathe-Firanğe in Tuzak-i-Jahanğiri.) It was presented to the kinğ by the Enğlish merchants.

Palkee, miana, and dolee were conveyance more or less of the similar type, as we find in these days. They were carried by 2 or 4 Kahar or coolies on their shoulders. Sookhasan and takbti rawn were of superior desiğns of conveyance of the above class. Later on Hava-dar phencies were improvements on tabkti rawn and Sookhasan. Palkee, Miana and Dolee continued their popularity till the beğinninğ of the present century and in same parts of old towns they are still in use.

Huda and Amari were some sort of saddles used to be placed on the back of an elephant for seatinğ the passenğers. On the back of a camel a mahmal or Kajawe was tied for carryinğ pardha ladies of rich class.

Conveyances for carrying goods.

Bainğies and the Chhakra were the common conveyance for carryinğ ğoods. Banği is a bamboo pole made flexible and on each end of it is tied a net of stronğ hamp cards for carryinğ ğoods on the shoulder of a khahar. This is a very convenient and handy form of service for the transport of a few maunds of weight to a shorter distance of a few miles.

Indian bullock cart has a ğreat history at its credit. It was this conveyance which was used by Feroz Shah Tuğhlak for brinğinğ Asok's pillar from the North to Delhi. All marble and other material of the beautiful Taj was brouğht from its place of origin either on camels or on the chakhra usually drawn by two oxen, otherwise by any number of bullocks as required; for instance in imperial stable carts, particularly in the imperial bath and ğun carriağes, 100 or more bullocks were yoked to draw the load. " Some heavier ğuns were drawn by several elephants and thousands of bullocks ". Ain Abul Fazal.

Elephants :—In a land of muds, quağmieres, nalahs, hills and forests, elephants were indispensable not only for land-fight and stormin ğ of forts, also for purposes of public transport or for carryinğ the infantry, soldiers or ğunners and heavy pieces of artillery. In connection with the Muğhal war of 1636-38 the padshahnama mentions 1000 elephants as belonğinğ to the Assam kinğs. Here are some examples of the use of bullock-carts quoted below from the records of the foreiğn travellers. " He sent them besides three carts and six bullocks to carry their loads, and 3 horses for them to ride, all of which were of ğreat service to them.

The son of the Great Mogol had with him at that time only 4 or 5 thousand horses ; but it was said that twenty thousand had already gone on in advance, with 4 hundred elephants, seven hundred camels, forty or fifty dromedaries four thousand bullocks." Jarrie page 56.

Manucci travels from Dehli to Lahore in a Bullock-cart. "Every day we halted at noon to feed the animals ; and at two in the afternoon we resumed our march, until we reached another sarai before sun-set...When the time came to start again my cart men could not be found, and the convoy set out. I know not what to do, for after a good deal of effort I was unable to get hold of my cart- driver. By this trouble I was much put out, for I found the oxen would not obey me." Mauci: page 307 Vo II.

The remainder of the survivors were taken off in the rath to Rajapur in the same year. Page 47 foot note 3. The travels of Petermundy Vol. V. 1608-1667.

A bullock cart described by Edward Terry. 1616-19.

The inferior sort of people ride on oxen, horses, mules, camels, or dersmedareis (little women like the men) or else in slight coaches with two wheels, covered on the top and back, but the forepart and sides open, unless they carry women. They will conveniently hold two persons, beside the driver. They are drawn by oxen, one yoke in a coach, selected colour, but many of them are while, not very large. They are guided with cords, which go through the fanting of their nostrils and so twist their noses into the coach-man's hand. They feed and keep them as their horses. They are naturally nimble, to which use make them so fitting to perform that labour as that they will go twelve miles a day or more with good speed. 311-312-Ed. Terry.

Resume.

Going through the history of the transport system of the Mughal days we find that the land transport department had a huge task before it inspite of several short comings and some serious defects, the work done by the department deserves great appreciation. The pains taken and the patience shown by the officers must be highly praised. To criticise the work of those days is quite easy for us but when we compare the work of the Mughals with the work done by the Britishers almost in the same period of two hundred years, we find that the Mughals much surpassed the Britishers both in the quantity and quality of their work. For instance all travellers of foreign countries in these days describe the roads of India as bad roads in a very miserable condition, while the foreign travellers of

the Mughal days always praised the broad and shady roads of the great Mughals.

Again the scheme of the roads made by the Mughal engineers was very perfect and practical. We can judge its soundness by the very fact that chief roads of the scheme as planned by the Mughal engineers are the same trunk roads of India even in these days.

With the planning and construction of the roads, comforts and protection of the travellers were two most difficult problems before the Mughals. Journey in the 17th century was both difficult and dangerous everywhere in the world, what to say of India. But the Mughals in their empire made it a thing of pleasure and comfort, as we have shown several places in this article by the evidences of the foreign travellers. It was indeed a great success of the state. The rich and the poor both were safe and comfortable. Thousand miles away from Delhi and Agra, all rules and regulations of the protection and comfort of the travellers, *i.e.* the rules and regulations concerning the maintenance and protection of roads and inns were very rigidly and promptly followed and worked upon.

Throughout the empire all royal roads (Shah-rah) were free for all people the rich and poor, or the Indians and the outsiders alike, no tolls or taxes of any kind were charged from any one at any stage of the journey. By the firmans of the Emperors the Indian states were also forbidden to charge any sort of road tax. It was indeed a great improvement on the transport system current in those days in England and France and also in other civilised countries of Europe and Asia.

Quality of Roads:—As adequately discussed in the article at several occasions, the royal roads of the Mughals were

1. Broad-about 40 feet.
2. Straight-as far as possible.
3. Having easy gradients
4. Paved at places liable to be damaged by floods etc,
5. Properly and carefully maintained in good condition throughout the year,
6. Profusely by shaded with the trees planted on either side of the road,

and 7. Well provided with wells and inns for the comforts of the travellers.

But all the roads were Kachha roads and at some places they were very dusty. In the rainy season, they were unsuitable for heavy traffic as we read the complaints made by the factors of the East India Company.

An Important Question:—The question is why were the Mughal roads not made pukka i.e. metal topped?

It is really a very perplexing question for a student of the Mughal history. The Mughals as the great builders and transport engineers failed to realise the importance of the pakka roads, especially when they had some specimen of good paved and metal topped avenues and streets.

After consulting the literature of that period it is suggested that the Mughal roads could not be made metal topped on account of the following causes :—

Causes:—1. The people all over the world had not realised the value of time in those centuries. In Asia even in these days time has not much importance and value.

2. For form of vehicles, used for the transport of goods and passengers in those days, kuchha roads were very convenient and suitable. In these days people complain that the pukka roads damage the hoofs of horses.

3. The vastness of the length and breadth of the Empire and the heavy cost of the construction of the pukka roads, discouraged the Mughal engineers.

4. The limited resources of the Empire and the absence of any good banking system did not permit the state to take up such a huge scheme in its hand.

5. Akbar and Jahangir were contented with the completion of the royal scheme of the roads and it was possible that the existent royal roads would have been made pukka during the reigns of Shah Jahan and Aurangzeb.

Shah Jahan made himself busy in the construction of the Taj Mahal and the new town of Dehli or in the designing of the pea-cock throne or in the internal and external expeditions.

Aurangzeb on the other hand wasted his resources and energy in the Deccan in the wars against the Deccan states and the Maharattas.

6. Indians had not fully realised the importance of pukka roads Even now in the middle of the twentieth century roads of our villages and Qasbas are kuchcha and hopelessly bad; but there is no public cry against it. In those days a village had not even heard of a pukka road.

7. With the help of European engineers the scheme of pukka road could be carried out. We find that the European travellers and ambassadors never made any such suggestions with which any improvement of any sort in the general life and working of the Empire would have been possible.

8. No Indian of position ever made a journey to any European country *e.g.*, England, France, or Portugal, hence he had no experience of the life of the European countries, or of the working of their administration.

9. The material necessary for the construction of pukka roads was not available, in the required quantity. It was not possible to make pavement of stone slabs or bricks on roads of the whole Empire.

However, we find that attempts were made by the Mughal engineers to provide pukka roads and streets in some big forts and newly made towns. For instance some bazaars of Agra and roads inside Fatehpore Sikri were paved with flat slabs of stones. Similarly we find that roads of the forts of Chanderi, Gwalior and Rai Sen (Bhopal) were made pukka with Kankar and the brick concrete mixed with lime.

In the city of New Dehli (built by Shah Jahan) Chandni Chowk streets were made pukka with stone slabs. It was like a foot-path on either side of a canal which was passing through the heart of the city. Small lanes in the new city were made of brick kharanja.

Mail Service in the Empire:—Since the time of Akbar, a regular mail service was established for the official dak (mail) throughout the Empire. Everyday in the morning the royal mail bags were carried to the provincial capitals and other important towns by the paiks on mail runners. For nearer distances mail boys or paiks (*i.e.* foot runners) were used to carry the mail bags; but for longer distances horsemen were appointed to carry out the duties of mail services. For this purpose Chukis or postal stages were fixed and stables were built, where a number of horses were kept ready for carrying mail bags. Thus we find that from Agra to Lahore, Gwalior, Burhanpor, Ahmadabad, Ajmer, Rajmahal (Bengal) and such other distant towns royal letters were delivered with in twenty four hours.

Private letters were also accepted for the royal mail bags on the payment of some postal fee which was not very high. In the sandy regions of the Empire camels of fast speed were used for carrying mail bags in place of horses.

The royal treasury was brought to Agra or Dehli from the provincial towns in the bullock carts under the escort of armed police constables.

NOTE: The river transport system is discussed in a separate article.

Contribution to a Discussion held at the 1947 Indian Science Congress Meeting

ON

"The Teaching of Geology and the Organization of the Geological Services in India"

BY

W. B. METRE

The Burmah Oil Company (India Concessions) Ltd., Digboi.

1. The economic development of the mineral wealth will soon have a high place in the Industrial planning of the country and there is soon likely to be a greater demand for qualified geologists and therefore, the question of education in geology is of paramount importance.

2. It is generally conceded that in India the standard of education in geology is not as high as in the western countries. Most of us had to start our training in geology without a sound foundation in physical geography. I consider that education in geology cannot attain the high standard desired, unless there is an improvement in the quality of geography syllabus and in the teaching of the subject in our schools and colleges.

3. It is fortunate that the importance of geography as a science is gradually being realized and the subject is being developed into a well systematized science. However, it still remains the most neglected subject in the curriculum of several of the Indian Schools and it is only in recent years that a few Indian Universities have added geography as a subject for degree courses. Moreover, the poor quality of the standared of teaching in this subject is due to lack of teachers competent to teach the subject (usually on account of inadequate remuneration and also paucity of materials and equipment needed to make the teaching successful.) In addition there are very few text books suitable for use in Indian class rooms. These defects should be remedied as soon as possible and geologists must support the laudable efforts of several Indian geographers in stressing the necessity of making Geography a compulsory subject in all the schools and in improving the standard of teaching of geography in the schools and colleges. Madras and Calcutta Universities have already made considerable progress in encouraging the education of this subject for the degree courses

and for modernizing the teaching in the schools. A few other universities have also started taking a keen interest in the subject. Conditions have certainly improved since our school days, but much more has still to be done.

4. The Indian Geographers have been stressing the necessity of making the High School course in geography comprehensive. Special attempts should be made to ensure that the students possess a sound knowledge of Climatology, Physiography, Geomorphology, Map making (with very elementary knowledge of surveying), and Map reading.

5. Now turning to Geology, one of the conspicuous drawbacks in the teaching of this subject in India is the lack of text books, especially on the subject of general geology, to suit local conditions. Books on modern lines with more Indian illustrations should prove quite useful.

6. As regards possible improvements in the method of teaching, immediate steps should be taken to impart more practical knowledge and greater emphasis is needed on field-work by the students in order to cultivate a habit of accurate observations and foster a scientific attitude of mind. The geological excursions should be very useful in this connection, but care must be taken that these do not degenerate entirely in to pleasure trips. The main defect in the present system is that insufficient attention is paid to the observational work and therefore students do not take an intelligent interest in what they see during these excursions. This can be remedied by confining the excursions to one area at a time and ensuring that the students make their own maps and notes in groups of twos and threes for small portions of the areas after measuring the sections and grouping the different rocks according to the lithological and other characteristics. This alone can lead to a sound training in scientific thinking, which is very essential if the student is to widen his outlook so as to become a qualified geologist afterwards.

7. The first few excursions should be confined to the open country where rock exposures are normally very good. Later, students should be taken to jungle covered areas, where exposures are usually confined to the stream and scarp sections. One of the drawbacks of the present system of education is that the students have absolutely no idea of the methods of geological exploration in jungle-covered country. Therefore, when they become geologists and work in such areas they are inclined to follow the same methods as used in the open country and sometimes the results are disastrous. I personally know of an instance of a geologist, with much good work to his credit in the open country, who whilst working in a jungle covered area found himself very much at sea.

8. Visits should also be arranged to Central Museums where the students can become familiar with the different rocks, minerals, fossils, etc.

9. No university or institution should be allowed to have courses in geology unless there is provision for a geological laboratory and museum (including charts and models for explaining various geological structures etc.) and sufficient funds are likely to be made available for undertaking excursions to areas of geological interest. Teaching of geology is not likely to be of much use, unless there are facilities for turning out men with more practical knowledge of the subject.

10. Most of the students in post-graduate courses have to carry out some independent investigation, but it is unfortunate that sufficient advice is not available whenever students are working in an area away from the University centres. Areas should be so selected that the Professor can pay frequent visits to the area, so as to get thoroughly acquainted with the area and guide the student throughout the investigation. Advice from experienced geologists with the knowledge of the area and specialists like Petrologists and Palaeontologists should be sought whenever possible. No teacher can hope to be successful in his work of turning out efficient geologists unless he himself keeps in close contact with several workers in different areas and is prepared to seek their co-operation to the best advantage of his students. Whenever possible, lectures by these specialists should be arranged and the students should have ample opportunities of meeting 'old students' of the institutions, especially those who have specialized in some branches of the subject and have a thorough geological knowledge of some particular areas. It is specially important that all colleges giving instruction in geology maintain cordial relations with the Geological Survey of India. It would be a great advantage to students if some arrangements could be made to attach post-graduate students to some Senior Officers of the Survey during the field-season.

11. It is unfortunate that neither the Government nor the University authorities appreciate the necessity of providing sufficient funds for having a well qualified staff for the teaching of geology. There has, in the last few years, been considerable improvement in the remunerations offered to the professors and teachers, but in several institutions the scales for lecturers and demonstrators are such that it is difficult to get well qualified and experienced staff. Those who come in, take the first opportunity of leaving whenever there is a chance of a better job. It is certainly ridiculous that demonstrators should be expected to work on remunerations much less than what their students can normally expect to get after completing their

education! No professor or reader can hope to run the department efficiently unless he has able assistants to second him in his work. Too frequent changes of staff are, therefore, to be deplored.

12. The question of the interchange of staff between different universities is being seriously considered in other spheres of scientific activities. In case of geology, such an interchange is of vital importance to the maintenance of high standard of instruction. This interchange, however, should not be confined to the Indian Universities and help from abroad should also be sought. The senior staff may even be encouraged to take periodical leave for overseas visits, both short and long-term so that they can keep in contact with the more recent advances. In addition there should be some provision for research and travelling scholarships for post-graduate work and in some cases such scholars could be given part-time teaching work.

13. Whilst on the subject I should like to refer to the tendencies in certain quarters to bring in racial and communal considerations in the appointments of professional staff. I think the only considerations to be applied to these appointments should be qualifications and the ability of the candidates to teach and guide the students. It is to be regretted that teaching ability is not sufficiently tested during these appointments and it is often forgotten that a brilliant academic career does not necessarily indicate ability to teach. It is worth while considering whether candidates for these posts be given an opportunity to prove their abilities by asking them to deliver lectures to the students before making a final selection. In some cases it is even desirable to attract, at least for short periods, men who have already established their reputation in the teaching of the subject and I strongly favour importing highly qualified men, if men of similar qualifications are not available in the country. This, in the long run, will be cheaper than encouraging students to go abroad for higher studies!

14. It will be readily agreed that the necessary reforms should be carried out as speedily as possible. I therefore suggest that the Central Government be requested to appoint 'a Committee on Geological Education in India'. The Director of the Geological Survey of India or a retired member of the Survey of similar standing should be the Chairman of the Committee, which should include representatives of Universities and large employers. The functions of the Committee could be defined somewhat on the following lines :—

(*i*) To ensure compulsory instruction in Geography in all the Indian Schools and to suggest ways and means of mordernizing the teaching of Geography in the schools and colleges.

(*ii*) To devise methods of popularizing geology in the schools and later to investigate possibilities of introducing it as an optional subject in the school curriculum.

(*iii*) To arrange publication of suitable Text Books for both Geography and Geology.

(*iv*) To supervise the teaching of Geology and to co-ordinate the activities of the different institutions.

(*v*) To prepare schemes for standardization of the syllabus in Geology in the different Universities and investigate the possibilities of specialized courses (e.g. palaeontology, petrology, oil technology, geophysics, aerial photography, ore prospecting, etc.) in different institutions.

(*vi*) To arrange interchange of teaching staff between the different institutions and wherever necessary transfer of teaching staff to the various geological surveys and *vice versa*, so as to ensure that men suited for teaching and with considerable experience are made available for the teaching work.

15. On the subject of the organization of the Geological Services in India, I have not much to say. I suggest that in any scheme of organization emphasis should be laid on attracting the best possible men to the profession. This can only be done by ensuring that there are equal opportunities for all and that the remunerations and privileges offered by the Government, States, Universities, and private concerns are based on qualifications and abilities and not on racial considerations.

16. The Colonial Paper (No.197) on the organization of the Colonial Services observed that such a service must now provide "a framework in which the right man or woman can be put in the right place, irrespective of race or colour; in which there is equality of treatment and opportunity for all, on the basis of merit and efficiency .....". The White paper also suggested that the salaries of all posts in the public service should be determined according to the nature of the work and the relative responsibilities, irrespective of the race or domicile of the individuals occupying the post. These observations have been made in connection with the organization of the Colonial Services but they are general remarks which can be applied to all services and it is specially important that they should be very carefully studied in organizing the geological services in India.

17. Another point of great importance in attracting the best men to the profession is that the intending students should have a clear idea of the prospects of employment that lie ahead and should therefore have an advance indication of the requirements of the Geological Survey of India, Provincial and State Surveys, Universities, and the private concerns. Such information could be made available to the public periodically.

Cotton in Ceylon.

BY

M. F. CHANDRARATNE, PH.D.

(Paper read before the Ceylon Geographical Society.)

Several species of *Gossypium* contribute to the cotton of commerce. A discussion of the complex botany of the genus is not attempted here. All that is necessary for most commercial purposes, is the recognition of classes based on the length of staple. Three classes are commonly recognized by the trade, viz—

(*a*) *Fine-Staple Cottons.* These have staple lengths exceeding 1 1/8 inch. The Egyptian cottons with staples ranging from 1¼ to 1 5/8 inch are the best known types. Sea Islands possess the finest staple known; the staple length of certain strains exceeds 2 inches. They, however, tend to be fastidious in their climatic demands—at present they are grown almost exclusively in the West Indies—and their yields are low. American long staples and some Uganda cottons with a staple of over 1¼ inch also come into this class.

(*b*) *Medium-Staple Cottons* :—Staple lengths range from 7/8 to 1 1/8 inch in this class which contributes over 50% of the world's production. American Upland varieties represent the bulk of this class which also includes Indian Long Staple.

(c) *Short-Staple Cottons* :—This class embraces varieties with staples under 7/8 inch. Most Indian cottons fall into this category.

Early Experiments with Cotton in Ceylon.

Formal experiments with cotton may be said to date with the establishment, in 1903, of the Experiment Station, Maha-Illupalama. At the time of the restoration of the tanks in the north of the Island, it was felt that cotton was likely to be a more profitable crop to grow on irrigated land than rice. Irrigation facilities were, however, not available in the earlier Maha-Illupalama experiments, and cotton was raised as a purely rain-fed crop. In *maha* 1904—05, 52 acres on the station were planted with cotton. The yields of all the varieties tested were satisfactory, and the performance of two fine staples was unexpectedly good.

TABLE I

Variety	Acreage	Yield per acre in lbs. Seed cotton	Lint
1. Egyptian ...	31	417	119½
2. Sea Island ...	17½	403	116
3. American Upland	3½	539	180

The quality of the lint of all the varieties was reported on favourably by the British-Cotton-Growing-Association brokers. These results inspired so much optimism that Mee & Willis (1906) suggested that cotton might be grown profitably "anywhere north of a line extending from Negombo to Trincomalie, or south of one extending from Matara to Saticaloa".

In 1909, Mr. J.S.J.McCall, Director of Agriculture, Nyasaland, visited Ceylon, and reported on the extension of cotton growing in the Island. He considered Egyptian cotton ideal for growing under irrigation in the North Central Province, but, rather surprisingly, pronounced, the soils of the Province unsuitable for Sea Islands. Mr. R.H. Lock, Acting Director, Royal Botanic Gardens, on the other hand, interpreted the Maha-Illupalama data as indicating that Sea Island cotton was indubitably the type best suited to Ceylon.

In 1910, Professor W.R.Dunstan of the Imperial Institute, London, visited Ceylon on behalf of the British Cotton Growing Association. He argued that little reliance could be placed on the much discussed Maha-Illupalama experiments of Mee & Willis as those had been ill-conceived and had been set down with unacclimatized seed. Pending the availability of reliable data, he suggested that improved Upland strains may be profitably tried under unirrigated conditions.

Professor Dunstan's recommendations regarding systematic and properly conducted experiments were not implemented, the country's interest in cotton and in Maha-Illupalama died. The years 1921—23 saw a recrudescence of interest in cotton, but the scene had changed to the Hambantota District. This interest had been provoked by the encouraging results abtained with Cambodia seed supplied by the Ceylon Agricultural Society, to growers in the Hambantota District. The results of experiments carried out at Ambalantota and Kiula were extremely promising.

TABLE II

Variety	Yield of Seed 1921–22	Cotton per Acre 1922–23
1. Cambodia ...	622 lbs.	379 lb.
2. American Uplands — (Durange...	690	1037
South African) ...	...	985
3. Karanganny ...	453	...
4. Sea Island ...	593	522
5. Egyptain (Sakellarides) ...	312	559
(Assili) ...	444	...
(Ashmouni) ...	288	...

Durange gave in the year 1922—23, the spectacular yield of 9 cwt per acre. The yield of the Sea Islands averaged 5 cwt per acre.

In 1925, Mr. G. R. Hilson, Cotton Specialist to the Government of Madras, was invited to report on the possibilities of cotton growing in Ceylon. He considered the tract in which Hambantota, Ambalantota and Lyangahatota lay, the most hopeful. He recommended the growing of Cambodia and Durange types. He believed that by growing an early type of cotton like Durange, it should be possible to avoid boll shedding caused by unseasonal rains in January. The establishment of a small ginnery in the Hambantota District was recommended.

Passing these early investigations in review, one is impressed by a certain unanimity of opinion among visiting experts and resident observers, that Ceylon can produce satisfactory yields of good quality cotton. Considerable divergence of opinion, however, exists regarding the choice of variety.

The Cotton Purchase Scheme.

In 1923 a considered attempt was made by the Department of Agriculture at promoting cotton growing in the Mambantota District. Chena permits for growing cotton were issued and a Purchase Scheme was started by agreement with the Wellawatte Spinning & Weaving Mills. Under this agreement the Mills bought all locally produced seed cotton at a price fixed for each season by arrangement between the Department and the Mills, distribution of planting material, collection and transport of seed cotton to the Mills being organized by the Department. In the years following 1927, world prices slumped, and the price paid to the grower under the Purchase Scheme fell from Rs. 20. 50 in 1927 to Rs.10/ in 1931.

The imposition in 1932, of a 5% *ad valorem* import duty on raw cotton seriously damaged the business of the Mills which two years later went into liquidation. In 1930 Government entered into a contract with the Provident Investment Company, which acquired the Mills, whereby the Company in return for the privilege of importing its requirements of raw cotton duty free, undertook to buy at a price fixed for a three-year period, locally produced seed cotton up to a maximum of 10,000 cwt. The price was fixed at Rs.12/ per cwt. The arrangement was due to terminate at the end of 1938, but was renewable at the option of the Company for a further three-year period. The quantities of seed cotton marketed under the scheme, and the prices paid are tabulated below :—

TABLE III

Year	Quantity of Seed Cotton Cwt.	Price Per Cwt. Rs.
1936–37	4031	12
1937–38	4228	12
1938–39	2328	12
1939–40	3069	12
1940–41	2315	12.50
1941–42	4299	12.50
1942–43	551	14
1943–44	16	22
1944–45	...	25

The provision of an assured market and of a guaranteed price undoubtedly contributed to the expansion in the acreage under cotton. In war time, the shift of emphasis to food production and the restrictions on the issue of cotton-chena permits caused a shrinking of the acreage.

The Botanist's Recent Work on Cotton Selection.

Mr. Hilson had recommended the continuance of the issue of Cambodia seed. The material available at the time consisted of seed derived from introductions by the Agricultural Society. In 1929, a fresh supply of Cambodia seed was imported by the Department from India, but no attempt was made at maintaining its purity. Since 1937, the Mills have complained with increasing frequency and vehemence, of the decline in quality of the Cambodia cotton supplied under the Scheme. Samples of local Cambodia

were accordingly sent by the Botanist, to the Technological Laboratory of the Indian Central Cotton Committee, Matunga, for report. The report on samples from 1938—40 seasons are given below :—

		Season 1938–39	1939–40
1. Mean Fibre Length (inch):			
(*a*) By Ball Sorter	...	0.90	0.85
(*b*) By Baer Sorter	...	0·88	0.86
2. Mean Fibre Weight Per Inch (millionth of an oz.):	...	0.162	0.137
3. Maturity Percentages :			
(*a*) Mature	...	68	67
(*b*) Half-Mature	...	12	19
(*c*) Immature	...	20	14

According to the Secretary, Indian Central Cotton Committee, who was consulted in this connection in 1937, "Cambodia has staple length of 0. 80—0.9 inch as per Balls Sorter". The Matunga estimates of 0.85—0.90 inch provide little evidence of the decline complained of by the Mills.

Despite the encouraging reports from Matunga, on local Cambodia, it was felt that the Department should attempt the continued maintenance of the purity of strains issued to growers. The Botanist was instructed to undertake the acclimatization of imported cottons with a view to subsequent selection and breeding of superior strains. In connection with this programme, 19 strains—5 fine and 14 medium staples—were introduced by the Botanist from India and Africa during the period 1937—1941. Information on those cottons derived from their countries of origin are summarised below :—

TABLE IV

Strain	Country of Origin	Staple Length (inch)	Ginning Outturn (%)	Hairs Weight Per Cm. (10—5) mgm.	Year of Introduction
1. Cambodia—Co. 2.	India	27/32	...	171	1937
2. U4/4 ...	S. Africa	1	...	139	1937
3. SG. 29 ...	Uganda thro' India	1 1 /16	...	144	1937
4. BP. 52 ...	Uganda	1 5/16	31	132	1940
5. BP. 79 ...	Uganda	1 9/32	...	152	1940
6. BP. 116 ...	Uganda	1 9/32	30.5	144	1940
7. 514 3 x Cambodia.	S. Africa	...	...	...	1940
8. (5143 x Cambodia 5143 ...	"	...	...	...	1940
9. Mwanza local ...	Tanganyika	1 1 / 8	...	...	1940
10. Mwanza 457 ...	"	1 1 / 8	...	...	1940
11. Mwanza 561 ...	"	1 1 / 8	...	...	1940
12. Mwanza 613 ...	"	1 1 / 8	...	...	1940
13. Domains Sakel ...	Sudan	1 1 /16	33	130	1940
14. X 1730 A ...	Sudan	1 9 /16	33	140	1940
15. NT. 2/38 ...	Sudan	1 19/32	33	135	1940
16. Sind-Sea Island 2/4 ...	India	1¼	31	132	1940
17. Sind-Egyptians Boss—111–16 ...	India	1 3/16	31	115	1940
18. Cambodia Co. 3 ...	India	...	...	...	1941
19. Cambodia Co. 4 ...	India	...	...	...	1941

The seed of 5143 x Cambodia and (5143 x Cambodia) 5143 obtained from the cotton Experiment Station, Barberton, Transvaal is of special interest. One parent, 5143 is the latest U.4 strain to be put into commercial cultivation there. The Cambodia parent originally obtained from Coimbatore, had been altered considerably by subsequent selection. Material of 5143 x Cambodia was F1 seed, and that (5143 x Cambodia) 5143 was unselected bulk seed from the first generation. This material would possess a high degree of genetic variability and should accordingly respond to selection. Of the Mwanzas, 561 is reputed to have some measure of Jassid resist-

ance Domains Sakel and x 1730A are the most popular strains of Egyptian cotton grown under irrigation in the Sudan. NT 2/38 is a selection within Domains Sakel.

Seed of each strain was sown at the Cotton Breeding station, Tissamaharama, in extents varying with the availability of planting material. At flowering time in each season plants selected for trueness to type and desired characters were bagged. Selfed seed obtained in this way was used for sowing the next season's crop. In the first few seasons following the introduction of a foreign cotton, yields fluctuated wildly. With its eventual acclimatization, a more uniform performance is obtained. The minimum period necessary for acclimatization is three years, The yields in the 1943-44 season of some of the better performers are given below:—

TABLE V

Strain	Season	Yield of Seed Cotton Per Acre	Mean Halo Length
		lb.	m m.
1. Cambodia ...	Seventh	967	23.3
2. U-4/4 ...	"	693	26.2
3. SG. 29 ...	"	806	27.7
4. B.P. 52 ...	Fourth	693	26.7
5. BP. 29 ...	"	833	29.5
6. BP. 116 ...	"	332	28.5
7. 5143 x Cambodia ...	"	285	28.3
8. (5143 x Cambodia) 5143 ...	"	725	29.3
9. Mwanzo local ...	"	453	19.7
10. Mwanza 457 ...	"	686	21.3
11. Mwanza 561 ...	"	707	21.5
12. Mwanza 613 ...	"	888	21.3
13. Domains Sakel ...	"	47	25.9
14. X 1730 A ...	"	77	28.3
15. NT. 2/38 ...	"	155	55.3
16. Sind-Sea-Island 2-4...	"	...	...
17. Sind-Egyptian, Boss III—16 ...	"	...	...
18. Cambodia—Co. 3 ...	Second	718	...
19. Cambodia—Co. 4 ...	"	948	...

All the strains, except Co. 3 and Co. 4 were at least in their fourth year, and were presumably fairly well acclimatized. The yields were gratifying : five of the strains gave yields of over 7 cwt., seed cotton per acre. The estimated staple length of all the medium-staple cottons was over 0.9 inch. BP. 52, BP. 79, BP. 116, (5143 x Cambodia) 5143, 5143 x Cambodia, U 4/4 and SC. 29, were estimated to possess a staple length of over 1.0 inch. The depressingly poor performance of the Egyptians was evidently connected with the fact that they had been selected for growing under irrigation.

In the 1943-44 season, a replicated trial was set down at the Cotton Breeding Station, Tissamaharama with five of the most promising strains, viz. U. 4/4, BD. 116, BP. 79, 5143 x Cambodia and (5143 x Cambodia) 5143, U. 4/4 was in its seventh year and the other four cottons were in their fourth year. The five strains were tested in a randomized block design of five replicates of five (1.75 acre) plots. The land which was a heavy loam of considerable depth was ploughed to a depth of six inches on November 1,1943, and received on the following day, an application of five tons of cattle manure per acre. It was disc-and chain-harrowed on November 11. Seeds were dibbled at the rate of 5 per hill, in hills spaced 3 ft. x 2 ft. Heavy rains and consequent saturation of the soil resulted in numerous vacancies which were filled on November 11. The area received four intercultivations. All the varieties commenced flowering during the period December 31,1943—January 4,1944. U. 4/4 developed excessive vegetative growth. The first pick became available on March 14. Harvesting continued till May 14. The yields of seed cotton are presented in Table 6, and Table 7 gives the analysis of variance of those yields. The variance ratio for varieties was significant at the 0.1 per cent point. BP. 79 and (5143 x Cambodia) 5143 significantly outyielded 5143 x Cambodia U.4/4 and BP.116. BP.79 and (5143 x Cambodia) 5143 were pre-eminent in the matter of both yields and staple length, and are obviously the cottons to grow in this country.

Samples of lint BP.79 were sent to the Technological Laboratory of the Indian Central Cotton Committee for spinning tests. These tests indicate that this cotton is suitable for spinning up to 41s. When it is remembered that the Wellawatte Mills complain that the Cambodia cotton supplied them under the Purchase Scheme dose not spin a 30s count, the progress achieved in the instance of BP.79 will be appreciated.

TABLE VI. YIELDS OF SEED COTTON.

Strain	BLOCKS I lb. oz.	II lb. oz.	III lb. oz.	IV lb. oz.	V lb. oz.	Total lb. oz.
B.P. 79 ...	23–15	29–12	30–10	26–46	32– 0	142–11
(5143 x Cambodia) 5143 ...	27–12	24– 9	32– 3	24– 6	26– 6	135– 4
5143 x Cambodia ...	15–15	26– 0	23–13	18–10	22– 3	106– 9
U 4/4 ...	20– 8	16–11	17– 6	11–10	23–10	89–13
B.P. 116 ...	21–12	18–10	21– 8	13–14	12– 4	88– 0
	109–14	115–10	125– 8	94–14	116– 7	362– 5

TABLE VII—ANALYSIS OF VARIANCE OF YIELDS OF SEED COTTON

	DF.	SS	MS	VP.	.01. per cent point
Varieties ...	4	132048	33012.0	10.12	7.94
Blocks ...	4	26203	6550.7	2.01	...
Error ...	16	52148	3259.2	...	...
Total ...	24	210399	...	...	...

Significant difference between strain totals—23 lb. 13 oz.

Choice of Variety.

The poor yield of the strains of fine staples in the Botanist's trials do not completely rule out the possibility of successful cultivation of these types. With Sea-Islands, however, even after cultural and breeding questions are solved, the marketing of the crop may present difficulty. Sea Island cotton possesses the finest staple known, and is used, on that account, for the manufacture of lace, and superfine fabrics. On account, of its very specialized use, it has often been difficult to maintain a steady demand for Sea-Island cotton. In the years 1930-31, for instance, changes in women's fashions nearly wiped out the industry. By judicious advertisement the West Indian Sea-Island Cotton Association formed in 1933, has succeeded in creating a fair but precarious demand in the manufacture particularly of underwear and men's shirting. The total annual West Indian production is about 5000 bales. Apart from their limited use Sea-Islands are shy yielders West Indian yields average one cwt. of lint per acre.

Successful crops of Egyptians may be possible under irrigation, but until the Department decides on rotating paddy with cotton, the question of growing irrigated Egyptians need not be further explored. Future policy should aim at exploiting the medium-staple strains which the Botanist's selection work has placed at the disposal of the grower.

Climatic and Soil Requirements.

Medium-staple cotton is a 5½-6 months crop. The seed germinates within a week of sowing. The interval between germination and the appearance of the first flowers is roughly two months. The first pick becomes available two months after flowering, and subsequent picks may be spread out over a period of 1½ months. The crop can mature with 25 inches of rain; but can tolerate 40 inches if the distribution is satisfactory. The seed should be sown with the earliest *maha* rains, *i.e.* towards the end of September; the plants will then be sufficiently large to stand up to the heavy rains later in the season. If the rains in October and November are excessive, the plants may run to leaf. The precipitation during the period October-December should preferably not exceed 25 inches. January should not be too wet, as heavy rains in this month may cause soil saturation and consequent shedding of bolls. Picking begins in February and continues into March; these months should accordingly be dry. The areas selected for cotton should preferably have no definite South West Monsoon, as the early *yala* rains will spoil the tailend cotton. Areas with the type of precipitation stipulated above occur in the South-East and North West corners of the Island. A few rainfall distributions suitable for cotton are listed below :—

TABLE VIII : RAINFALL IN INCHES

(The figures represent 20 year averages.)

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total Sept.—March
Ambalantota ...	2.63	6 03	7.81	6.90	3.56	0.90	3.76	31.59
Bata-ata ...	3.67	6.33	8.03	5.85	3.59	1.39	4.50	33.36
Batulu-oya ...	2.49	9.25	10.81	5.08	2.79	0 75	3.84	35.01
Hambantota ...	3.08	4 83	7.76	5.63	3.75	1.03	3.83	29.91
Kalpitiya ...	1.19	7.79	7.60	5.87	3.17	0.62	3.12	29.36
Liyangahatota ...	2.69	7.97	9.83	7.17	3.71	1.83	6.46	39.66
Mamadola ...	3.05	6.46	8.31	5.77	3.42	1.53	4.58	33.12
Mannar ...	1.31	7.01	9.86	7.86	3.91	1.77	1.69	33.41
Nrnichchukadi ...	1.28	6.33	9.18	7.25	3,71	1.20	1.97	30.92
Nachchikkali ...	1 55	7.37	8.52	4 87	2.75	0.77	2.70	28.53
Palavi ...	1.90	8 90	10.19	6 33	3.26	0 95	3.57	35.10
Ponarippu ...	1 14	6.97	[illegible]	7.02	3.48	0.72	3,02	30.79
Puttalam ...	1 84	8 12	[illegible]	6.16	3.55	1.02	3.33	33.94
Ridiyagama ...	2.81	6.38	[illegible]	[illegible]	3.47	1.90	4.35	34.77
Tissamaharama ...	2.07	5.21	9.40	[illegible]	4.31	1.24	4.26	33.65

It will be found, of course, that the soils of some of the areas with a suitable rainfall are not ideal for cotton. Certain soils in the coastal belt for instance, are too light for cotton. Cotton prefers loams of considerable depth: the plant has a deep root system. Very fertile soils should be avoided as vegetative growth may tend to be excessive, and the yield may be low. Moreover, on such soils, plants produce fibre of low tensal strength. Cotton is sensitive to wet feet, and cotton soils should be well drained.

The size of the cotton holding

If cotton growing in this country is to extend and prove profitable, it is necessary that the crop should become the component of a rotation in a settled system of arable farming. The reason for this insistence is *the low profit margin per acre which necessitates an increase in the size of the cultivated unit, if the cotton crop is to be profitable.* The size of the holding that a farmer could work will ultimately be a function of the efficiency of his implements. If the unit is to be enlarged, the *mamoty* must be replaced by the tractor, or, at least, by bullock-drawn implements. Tillage with heavy implements is possible only on stumped land, with bullock-drawn implements, a single family, assisted at picking time by hired labour, should find it possible to work a 10-acre field of cotton. If the land is tractor-farmed a larger unit is possible. Other reasons for the insistence on a system of rotational farming include :—

(*a*) The marked depressant effect of weeds on the cotton crop. (Satisfactory weed control is not possible in chenas)

(*b*) The more efficient exploitation of cotton lands that this system of farming permits.

References

1. Mee, C. J. C. and Willis, J. C. 1906 —Cotton Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon. Vol. III. No. 18. pp. 243—261.

2. McCall, J. S. J. 1909 —Cotton Cultivation: Its Extension in Ceylon. *Ibid.* Vol. IV. No. 19. pp. 165—178.

3. Haigh, J. C. 1941 —Cotton Cultivation in Ceylon. The Tropical Agriculturist. Vol. XCVII. No. 4. pp. 190—201.

Discussion

The following points of interest were revealed in the discussion which followed :—

1. The Tamil name for Point Pedru is "Paritti-Thurai' and means "Cotton-port" Paritti- 'cotton', Thurai- 'port'. Since Cotton is even now grown very close to the town, Ceylon cotton might, in the past, have been exported from here, hence its name.

2. The presence of lime in the soil is in no way harmful to the cotton plant. The western half of the NORTH WEST area of the island is a region of miocene lime stone, but this factor does not prevent the region from becoming an area eminently suited to the propagation of Gossypium

3. The ginning and baling of cotton in the regions of cultivation would reduce bulk considerably, and thus cut down costs of transport and of production.

4. The N.E. part of the island (Mullaitivu-Trincomalee) is not suitable for cotton cultivation because of the heavy N. E. monsoon rains, since picking operations begin in February. Heavy rain at such time would be most unsuitable, and tamper with the picking considerably.

Notes on the Historical Geography of Ceylon

(*Contributed*)

Geographical Location

Taking the Indian-Oceanic position of Ceylon, one can notice certain effects on this country's history. In early days it was the practise of navigators to sail along the coasts and make use of *headlands* as land marks to steer the ships by. Ships sailing East from the coasts of Arabia or Africa would inevitably touch Ceylon on their way to the lands on the shores of the Bay of Bengal. Such ships would touch the North-West coast of the Island and it is not at all surprising to find "Hippuros" or "Kudremalai" "Horse headland" on this side. Similarly, ships sailing West would come to the East Coast of Ceylon and places like "Triconamalai," "Arugam Bar" etc. were connected with this route.

About the second century A. D., Hippalus, a Greek sailor, made a discovery of great importance. He found out that one could leave the Western part of the Indian Ocean with the South-West Monsoon and return home with the North-East. Equally significant is the course set by *currents and drifts*, for these were used by sailors to take their ships on their way. Constant reference to this is made in certain of the Jataka Tales. The currents and drifts set up with the South-West wind go past Cape Guardafui and the Island of Socotra, reach the West coast of India and sweep round the south coast of Ceylon north to the Bay of Bengal and then south-east to the Straits of Malacca. We are sure that this course was used by ships. For example, Cape Guardafui was called the "Cape of Spices", and the name Socotra is derived from the Sanskrit "Sukhadara dwipa". Ships for the East assembled at Eudaemon Arabia, modern Aden, and set out when the winds and currents became established. Such vessels would come to Ceylon because on the way East they *had* to go past the South of the Island. This route no doubt brought to Ceylon the PERSIAN and the ARAB merchants. Some of the former were Nestorian Christians, and the stone Cross from a Nestorian Church has been found at Anuradhapura. Arab merchants had quarters in the same city for Fa-Hian tells us that among the finest houses in the city were those of the merchants of "Sapoh" or "Sabea". Later, when Islam became the creed of Arabia, muslim merchants brought with them their faith. This is why Islam and Muslims are found near such ports as Puttalam, Mantota (Mannar district) Beruwala, Colombo, Galle, Hambantota and Batticaloa. The Muslims of this last named town and district have

been among those who were once settled there by Kandyan kings when the intolerance of the Portuguese drove them from the seaboard of the South-West. Thus the ethnic composition of the people of Ceylon and their geographical distribution is related to geographical factors. The tamil people are found to the North and North-East, the Muslims on the seaboard near ports, old and new, while the agrarian Sinhalese are inland, and the earliest hunting community is confined to the forests.

The visitors to Ceylon from the East Indian Ocean were the Chinese. They waited for the North-East Monsoon to begin and sailed with them to the West. They too inevitably touched Ceylon at the East ports or southern harbours. The abundance of Chinese coins and the references in Chinese records to embassies from Ceylon testify to this. It is worth noting that a trilingual slab was found in Galle. The Chinese record relates to contributions made in connection with similar festivals at Adam's Peak. The Persian record too deals with similar Muslim festivals, and the Tamil with the great shrine at Dondra. Galle thus appears to have been a town where merchants had their quarters. To this day there is a "Chinese quarter" in this town.

When Portugal expanded her trade in the East, Ceylon once came within the realm of her ambitions. Portuguese power was built on securing the key positions in the Indian Ocean from which to patrol the commerce of the sea and destroy all intruders. Such key points were in the East at Malacca; in the West at Mozambique and Sofala on the African coast; Aden at the entrance to the Red Sea, and Ormuz at the gates of the Persian Gulf. But above all, Ceylon stood as a sentinel watching the trade across the Indian Ocean. The Portuguese realised that for the complete and effective control of the Indian Ocean trade, Ceylon had to be occupied. We have a letter from the King of Portugal ordering the Viceroy at Goa to do so and to make Ceylon the headquarters of his realms. In this way the Portuguese arrived in Ceylon and ruled the coastal districts for 150 years. With them came Roman Catholicism and the Catholic Missions. Catholicism today is an important factor in the life of certain sections of the Ceylonese. The Church has also greatly influenced the thoughts and literature of the Sinhalese and the Tamil people. The existence of an indigenous Catholic literature is proof of this. The work of Fr. Gonsalves is to be remembered in this connection.

The next sea power to control the trade of the Indian Ocean was that of the DUTCH. They too realised the importance of the location of Ceylon, as well as that of her agricultural possibilities. The Dutch established

themselves in Ceylon and left the results of their work to after times. The Dutch were town dwellers because they were merchants and artisans. Hence the term "Burgher". The descendants of the Dutch are to this date town-dwellers and while trade has been lost to them, they yet have a share of the clerical work connected with modern trade. Roman-Dutch law profoundly changed the status of individuals and helped to destroy feudal ideals. The development of land and trade also helped to change the economic conditions of Ceylon. But more influential has been the contribution made by the establishment and spread of Protestant Christianity, with its democratic attitudes, and the use of the Bible in the mother tongues of the peoples of Ceylon. In this way a new force was felt in the life of the people.

The BRITISH came to Ceylon as a result of the wars against France. The British East India Company realised that they had no naval bases on the shores of the Bay of Bengal. The Dutch held Trincomalee, the only available base for the refitting of ships. The Dutch threw in their lot with France—war ensued and Trincomalee was taken. The English had no intention of retaining Ceylon but the Treaty of Amiens allotted Ceylon to them !

THE INDIAN GEOGRAPHICAL SOCIETY,

1947

President.

Dr. M. S. KRISHNAN, M.A., Ph.D., etc.,
Superintending Geologist, Geological Survey of India, Madras Circle,
Bheemasena Gardens, Mylapore, Madras.

Vice-Presidents.

Sri Rao Bahadur
C. M. RAMACHANDRA CHETTIAR,
B.A., B.L., Advocate, Coimbatore.

Miss A. R. IRAWATHY, B.A. (Hons.),
B.Ed., Lecturer in Geography,
Queen Mary's College, Mylapore, Madras.

Mr. KEDARNATH SRIVASTAVA,
M.A., B.T., Lecturer in Education, Vidya
Bhavan, Teachers' Training College, Udaipur.

Mr. G NARAYANASWAMY AIYAR,
M.A., L.T., Lecturer in Geography,
Teachers' Training College, Saidapet.

Mr. V. S. MATHUR, M.A., (Lond.),
Lecturer in Geography,
Government College, Lahore.

Secretary.

Dr. GEORGE KURIYAN, B.A., B.Sc.,
Ph.D., (London), Head of the Department of
Geography, University of Madras.

Treasurer.

Sri K. RAMAMURTI, M.A., M.Litt.,
L.T., Dip. in Geog., Lecturer in Geography,
Vivekananda College, Madras.

Assistant Secretary.

Sri V. KALYANASUNDARAM,
M.A., L.T., Dip. in Geog., Junior Lecturer,
Dip. in Geography, University of Madras.

Editor.

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

Executive Committee.

Prof. T. N. MUTHUSWAMY AIYAR,
M.A., L.T., Professor of Geology,
Presidency College, Madras.
(elected by the General Body).

Mr. A. M. SATYA, M.A., L.T.,
Dip. in Geog., Assistant,
Wesley High School, Royapettah, Madras,
(elected by the Council).

Members of Council.

Mr. M. P. RAJAGOPALAN, B.A., L.T.,
Dip. in Geog., Assistant, Sir M. C. T. Muthia
Chettiar High School, Vepery, Madras.

Mr. A. M. SATYA, M.A., L.T.,
Dip. in Geog., Assistant,
Wesley High School, Royapettah, Madras

Prof. R. S. MANI, B.A. (Hons.), T.D. (Bom.),
Professor of Geography,
Vivekananda College, Madras.

Mr. P. KOCHUNNI PANICKER, M.A., L.T
Dip. in Geog., Professor,
Government College, Coimbatore.

Mr. V. S. GANANADHAN, M.A., L.T.,
Dip. in Geog., Lecturer in Geography,
Pachaiyappa's College, Kilpauk, Madras.

Mrs R. RADHA, M.A., L.T.,
Assistant Lecturer in Geography,
Queen Mary's College, Mylapore, Madras

Printed by Mr. [illegible] Ravaimanickam, at Gordon Press, 768-770, High Road, Triplicane Madras
and published by Dr. G. Kuriyan, Wellclose, Cathedral Post, Madras.

Paper Issue Card No. 97—Q.H. MS. No 53,—12-7-47.