The Journal of
The Madras Geographical Association

VOLUME XI, 1936-37

PUBLISHED BY

The Madras Geographical Association,
Gopalapuram, Cathedral Post, Madras

ANNUAL SUBSCRIPTION
INCLUSIVE OF POSTAGE
RS. 8

SINGLE NUMBER RS. 2.
FOREIGN SUBSCRIPTION
INCLUSIVE OF POSTAGE, 12s. 6d.

CONTENTS

VOL. XI. 1936-37.

No. I. April 1936.

No. 2. July 1936.

No. 3. October 1936.

No. 4. January 1937.

LISTS OF MAPS, CHARTS, ILLUSTRATIONS, ETC.

INDEX OF AUTHORS

INDEX OF TOPICS.

The Journal of
The Madras Geographical Association

Vol. 11 April, 1936 No. 1.

Earthquakes and Seismic Activity in India

By

MR. M. VIVEKANANDA B.Sc.,

We have heard of, or sometimes seen the disastrous effects of Thunder, Lightning, Volcano, Deluge or Typhoon. But Earthquakes are the most dreadful of all the natural phenomena, because of their stupendous effect, colossal magnitude of destruction, and their unheraldic sudden occurrence. However, geologically they are insignificant when compared to the great crustal and mountain building movements. But the destruction wrought by earthquakes on life and property is inestimably great. To quote a few instances, in September 1923, 100,000 lives were lost as a result of the Tokyo Earthquake besides huge loss of property. In another earthquake the city of Caracas with 10,000 of its inhabitants was destroyed in about half-a-minute. One-and-a half million people perished on account of the Chinese shocks between the 11th and 12th centuries. Mallet has estimated that at least 13,000,000 lives were lost during the course of 4,000 years. Such is the appalling destructive power of earthquakes over which man has no control and which is still as great as ever. In fact, this power is greater than what it was formerly, for man has aggregated millions of his kind and has housed himself in death-traps and has thus paved the way for Nature's demonstration of the fact that she brooks no control of her forces by him.

WHAT IS AN EARTHQUAKE ?

An earthquake as the name implies simply means the quaking or shaking of the earth. As sound is merely the elastic vibration of the air, so some define earthquake as merely the elastic vibration of the earth-mass. This may be effected by some disturbance in the earth, say the sudden subsidence or slipping down of a huge rock or the falling down of the roof of a subterranean cavity, causing slight tremors or severe shocks in the surrounding soil and superficial mass. The same can be illustrated artificially by the explosion of a dynamite. In fact two curious earthquakes have been produced naturally and artificially. One known as the Turkestan Earthquake of 18th February, 1911, was finally traced to an enormous landslide in Pamirs—a fall of over 500,000,000,000 tons of rock slipping 1,500 to 2,000 ft. The other was the result of the explosion in Badische Analin and Sodafabik at Oppau in Bavaria on the 21st September, 1921, of 4,500 tons of the double salt, ammonium nitrate and ammonium sulphate. Both produced weak earthquakes but the tremors of the former have been received in Canada, whereas the latter was not noticed beyond 30 miles. But the term " Earthquake " is generally restricted to some natural subterranean concussion or to a sudden subsidence or slipping of the rocks under accumulated strain, ranging from slight tremors to disastrous shocks by which houses are levelled, rocks dislocated, landslips precipitated and human lives destroyed.

ORIGIN OF THE ELASTIC WAVES

Every phenomenon has got its own cause and effect. In the case of earthquakes particularly, we must have a clear conception of these two factors. Because what appears to be the cause may be the result or what appears to be the result may be the very cause. For instance, the landslide just described in the case of the Turkestan Earthquake was the cause of the earthquake, while such landslides are generally the accompaniments or in other words the result of earthquakes. Buildings in ruins, fissures, huge cavities and sand-vents accompanying an earthquake do not constitute an earthquake, nor do they give any adequate clue as to its origin. These are only the results, or the eternal manifestation of an earthquake which can be seen on the surface, while the origin and root cause lies at some depth below the soil and so this is a matter of inference. Before we enter deep into its origin we must bear in mind that the present state of our earth with its elevations and depressions has not been brought about all of a sudden, but is the work of ages and is subject to continual change which is brought about mainly by two processes to which the term " tectonic processes " may be applied. They are (1) Folding and crumpling of the rocks (which keeps them in a state of strain), (2) fracturing and subsequent displacement (by which strain is released). Of the two, fracturing is sudden, coming as a relief to prolonged strain. This fracturing leads to fault slipping by which friction is generated. This consequently sets up a series of elastic waves of either compression or distortion or both. These become more or less complicated according as the media through which they pass is heterogeneous or homogeneous. Eventually when they emerge out of the surface they impart motion to the soil and superficial rocks whose vibrations produce the sensible earthquake. These are called waves by analogy. Being propagated in virtue of the elasticity of the material through which they pass, these are called elastic waves.

AUTOGRAPH OF AN EARTHQUAKE

Some preserve with great esteem the autographs of great men as a token of their visit and greatness. No less valuable and instructive is the autograph of an earthquake to a seismologist, except the difference that the latter is received at a distance, say several hundreds of miles off. In fact the greater this distance the better the stroke received. The nearer the receiver, the more the vehemence with which the earthquake sends forth its stroke and the greater the chance of the destruction of the receiver. Such was the case in the recent earthquakes when the seismographs (the recording instruments) at places near the epicentre were thrown out and got out of order, while those at distant places recorded perfectly well. Astrologers read the character of a man from his horoscope, so do the seismologists, the character of an earthquake from its autograph, technically speaking the seismogram.

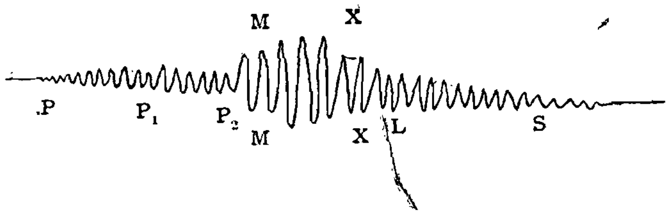


Fig. represents the seismogram (autograph) of an earthquake. P and P_1 are the first preliminary tremors recorded when the seat of origin is several hundred miles from the recording station. These are caused by compressional or longitudinal waves travelling at the rate of 6·75 miles per second (375 miles per minute). P_1 and P_2 is the second preliminary tremor representing a transverse wave motion travelling at a slower rate. MX represents the main shock (when maximum intensity of the shock is reached). LS represents the later phases (subsiding stages).

LOCATION OF THE FOCUS

As the time interval between the two preliminary tremors is proportional to the distance traversed, the distance between the seat of the shock and the seismograph can be calculated. By computing such distances from at least three separate stations a common intersecting point can be arrived at and that gives the locus of the earthquake.

THE NATURE OF THE WAVES AND THE MESSAGE THEY BRING ABOUT THE INTERIOR OF THE EARTH

The study of the seismic waves is the most complex and yet the most useful part of the subject. The complexity arises because of the fact that the waves pass through highly heterogeneous media, namely the earth's shell, which consists of several different layers of solid rocks, soils, alluvia, shaly strata, etc., with different densities. According to the undulatory theory whenever a vibration reaches a bounding surface it undergoes reflection. When it reaches a medium of different density it is refracted. Thus it becomes still more complex. Putting aside the possibility of complication arising from reflection and refraction, three main types of waves have been distinguished.

The first wave to reach an instrument is the fastest of the three waves and is known as the Primary or P. (Push) waves. They are short waves of a to-and-fro motion and are transmitted through the fluids and solids, and they gain in velocity as they pass a denser medium. Some of these waves travel as fast as 6·75 miles per second (375 miles per minute). They could thus traverse the diameter of the earth in about 20 minutes. The next rapid wave is the Secondary or S. (Shake) waves. These are distortional waves with vibration transverse to the direction of propagation. The third type is the ground or (Raleigh) waves which travel along the earth's surface, like the waves of the sea with a rotary movement. These waves though slowest in speed cause the greatest damage.

As to the message they bring about the interior of the earth, some important geological deductions have been drawn from a study of the velocity and the propagation of these seismic waves, which otherwise would have been inaccessible.

(1) They have revealed the condition of the interior of the earth to be 1·5 times as rigid as steel.

(2) As the velocity increases with the density of the material they traverse, and since they take an arcuate course, the presence

at the centre of the earth of a core composed dominantly of metals (iron, nickel and many others) has been revealed.

WHY EARTHQUAKES ARE SO DISASTROUS

The popular conception of the extent to which the ground moves to and fro or up and down during an earthquake is a great exaggeration of the truth. Measurements taken from delicate instruments reveal the fact that the range of horizontal motion is exceedingly small; only a fraction of a millimeter in the case of a slight shock and seldom exceeds 3 or 4 m.m. When the motion exceeds 10 m.m., it is dangerous. It is estimated that the range of movement, even as small as ¾ inch, will destroy a city; ⅜ inch is a severe shock and $\frac{3}{16}''$ is enough to shatter the chimneys. In a severe earthquake at Tokyo in Japan, on the 20th June 1894, the range of movement indicated by the instrument was as much as 63 m.m., i.e., 2½ inches. The vertical motion also appears to be small. Why so small a movement causes so much damage is not difficult to answer. The appalling destruction is not due so much to the range of movement as to the great velocity of the movement; the other factors that contribute to the severe destruction being (1) the loftiness of the buildings, (2) the poor construction, (3) the poor foundation such as loose alluvium or made ground, (4) waves passing obliquely 30° or 50° to the surface. Observations show that tall buildings are subject to severe shaking. During the Tokyo earthquake, 110 out of 240 chimneys that were over 45 ft. were completely destroyed. Low structures are generally little damaged. But the construction goes a great way in determining the fate of the building. Dr. A. M. Heron observed that heavy roofed mud buildings although only single storied had generally collapsed in the Baluchistan earthquake of 1909. In the recent Bihar earthquake of 1934 the scene of the greatest damage was at Monghyr and is attributed to the loose alluvium on which the houses are built. The greatest damage wrought by earthquakes occur when the wave reaches the surface at an angle of 30° to 50° and not directly over the epicentrum as in that place the movement is only up and down. Besides the damage due to earth vibration, fires accompanying earthquakes bring great catastrophe, as do the Tsunamis (sea waves) that are produced so commonly by submarine earthquakes. Most of the Japanese earthquakes are followed by fires and the most deplorable fact is that the conflagration becomes uncontrollable as the water mains get severed up during the earthquake. The Tsunamis on the other hand may even rise to 60 or 70 ft. high and thus might inundate the coastal regions. Such was the case in the great Lisbon earthquake when the waves rose up to 60 ft. and caused much damage. These secondary results are in the main responsible for the prodigious loss of life and property.

SHALLOW DEPTH OF THE FOCUS NOT EXCEEDING 20 MILES

With all their stupendous surface effects sometimes shaking an area of one to two million square miles, the one remarkable feature of earthquakes is their seat of origin at a comparatively small depth below the surface. The nature of elastic waves consequent upon fracture leads us to the conclusion that the depth of origin is within the limits of the solid outer crust. That the depth of focus seldom exceeds 10 miles is the opinion of many seismologists. That it never exceeds 30 geographical miles is perhaps an undisputed fact, though the advocates of the volcanic theory favour a deep-seated origin. According to their theory earthquakes are due to the direct transmission of elastic wave motion from the sub-crustal region. The low depth origin is further based upon the fact that there is invariably a well designed area of maximum intensity followed by regions of diminishing intensity as the distance from the central area increases. Another important feature of the seat of origin is, strictly speaking, not a point but is of considerable length. This is because the original impulse or the elastic waves consequent upon fracture start simultaneously from a linear fracture. This is the reason why the epicentral tract or zone is somewhat longer and oval with the longer axis almost parallel to the seat of origin. Another notable feature is that this longer axis is in many cases found to lie approximately parallel to the great mountain chains. So it is that the places most strongly affected in the Bihar Earthquake of 1934 and the longer axis of its epicentral zone are roughly parallel to the general configuration of the Himalayan chain having a north-west—south-east trend.

THE ORIGIN AND CAUSE OF EARTHQUAKES

Various causes have been attributed to earthquakes according to the nature of the shock, the locality and other circumstances. But it is finally traced to two principal causes: (1) The development of strain; (2) the release of strain. Accordingly earthquakes may be broadly classified into two classes: (1) The Volcanic earthquakes and (2) the Tectonic earthquakes. Of course, minor earthquakes are caused by (1) the falling of the roof of a subterranean cavity, (2) the sudden snap of deep-seated rocks subject to prolonged strain, (3) steam by its evolution and condensation in the ground beneath and (4) by the tidal waves set up in the liquid interior of the earth by the attractive influence of the sun and moon.

Taking at first the Volcanic earthquake, their origin or cause is traced to the activity of Volcanoes. Some old advocates of the Volcanic theory held the view that the earth's interior was composed of molten matter and that volcanic action was the chief geotectonic agency. Humbollt regarded volcanism as being the reaction between the hot interior and the cold exterior and considered volcanoes as safety valves.

Whatever be the kinetic cause, there is reason to believe that so long as the crater of a volcano continued to steam freely and to discharge regularly puffs of dust and lapilli, there is little danger of any 'quakes being produced in the vicinity. Once the crater turns out of action, this cessation of activity necessarily means accumulation of strain underneath. This sudden development of strain when it is too great is manifested in the form of an earthquake or many 'quakes which though come unheraldic yet act as forerunners of a worse-approaching calamity resulting in a great volcanic action. Such in fact was the case with cities that suffered repeated destruction at the base of Mount Etna and the severe 'quake of Hawii preceding the great eruption of 1868. (But a great number of shocks follow an eruption owing to re-adjustment within the lavas and the surrounding rocks beneath the surface). The cause, therefore, of those earthquakes preceding or following a Volcano, occurring in the close vicinity of a volcanic region is volcanic in its nature. These earthquakes are no doubt very severe in intensity though local in surface extent and this is a characteristic feature of most volcanic earthquakes. So it was held by former scientists that earthquakes were related to volcanoes. But no relationship, however, has been found existing between earthquakes and volcanoes. On the other hand the contrary was proved. For instance, in Japan, which is at once a typical volcanic and seismic region it has been determined that earthquakes were more numerous in the non-volcanic region than in the volcanic region. Further some volcanic regions are singularly free from earthquakes.

The majority of earthquakes have a tectonic origin, the ultimate cause being, to put it briefly, the relief of strain whatever be the source of strain. The great mountain chains which are in close proximity with the earthquake zone or belt have much to do with the cause of earthquakes. In fact the great majority of tectonic earthquakes are directly or indirectly connected with the mountain-building movements. Three such movements have taken place from the earliest times. They are (1) the Caledonian movement (Silurian); (2) the Hercynian (Permocarboniferous); and (3) Alpine (Tertiary).

The Caledonian system can be traced in Wales, Scotland, Scandinavia, Siberia, Africa, Australia and South America. The Hercynian movements account for many of the mountains of Great Britain, Germany, the Urals, and the Appalachians. The Alpine system includes most of the present great ranges from the Pyrenees to the Himalayas, the Rockies and the Andes. These Tertiary formations are therefore of recent birth and geologically young and the production of earthquakes close to these regions might perhaps be taken as echoes of the dynamic forces concerned in their formation. This is well illustrated in the present marked seismic cataclysm in India which is, here, practically confined to one such Tertiary formation, namely, the Himalayas and their extensions. Himalayas are of recent birth and, therefore, geologically young, still growing in altitude as a result of which the recent Bihar Earthquake, as some hold, was given birth to.

It is true that great mountain systems such as the Himalayas are elevated at intervals with long intermediate stages of quiescence. It is equally true that earthquakes are in many cases, the inevitable accompaniments of such growth. But what are the evidences to show that mountains do grow in altitude? Are the mountains higher than what they were before? Why should they grow at all? These are questions the answers of which seem relevant for a better understanding of the course. It is no doubt an indisputable fact that young mountains of recent birth such as the Himalayas do grow in altitude. But the growth, as are all geological actions, is so slow and man's life so brief that it may not be perceptible. The occurrence of earthquakes is perhaps the only perceptible evidence. There are, however, other evidences. For instance, that the mountains are really growing in height is very well illustrated by L. R. Wager from a study of the Arum River. This rises on the Tibetan Plateau at a height of 22,000 feet, flows east for some distance and then turns south to cut through the Himalayan mass between Everest (29,000 ft.) and Kangchenjinga (27,600 ft.) forming an enormous gorge. He points out that this was originally continuous and for the river to cross it at its present height, it would have had to flow up-hill. But the course, he suggests, could have been formed if the original height was only 16,000 feet (4.9 K.M.) i.e., the present height of the southern part of Tibet. Within the main mass the volume above and below this level are nearly equal. Wager therefore infers that lightening of the crust due to denudation has led to a general uplift of the Himalayas which were originally merely the southern edge of the Plateau, 11,000 or 12,000 ft. high. Further, Wager's study of the sediments laid down by the river, in its upper course confirms the view that mountains were rising after the river took its present course. Why mountains grow or how they maintain their height in spite of denudation may perhaps be explained by the principle of Isostatic conservation. This may be briefly stated as the flow of the earth-mass from the areas which have been receiving great loads of sediments, towards the areas which have been denuded to supply them. The rivers coming down from the mountains naturally remove a lot of material from the upper portions and deposit them in the sea. Strictly speaking this denudation is far less in the actual summit than on the lower slopes and valleys. However the removal of the surface rocks requires an inflow below to restore isostasy and this raises the whole region. So for this reason also the Himalayas are still growing in altitude. How far this tends to the production of an earthquake is not far to seek. Consequent upon the rising movement some instability may be caused at the foot and that is enough to produce an earthquake, or some original fracture might be accelerated to action, thus producing the so-called elastic waves whose exit at the surface, as has been explained already, might produce an earthquake. Such was exactly the cause of the recent Bihar Earthquake of 1934. Since a detailed account of the cause has already been published by the authorities concerned, it is not desirable to repeat the same. But the more important general factors that might have conspired in the production of the earthquake may briefly be stated : (1) In the first place the regions more strongly shaken lie in the seismic belt passing through India and this practically covers the northern border of the Peninsula. (2) The abrupt border which the Himalayas present to the plains of India shows the greatest amount of plication, fracture and thrust. It is true that places in and near this abrupt border are more unstable than those, for example, in Tibet on the gentler slope. But so far as the Bihar Earthquake was concerned those who were in charge of the field-work attributed the cause, not to any visible fracture or thrust, but to the movement along thrust plane at an unknown depth hidden under the alluvium. (3) The occurrence of one or two fractures below the Gangetic alluvium between Motahari and Purnea seems quite probable. (4) The probability of a zone of tension along the northern edge of the

Peninsula induced by the accumulating weight of the deposits in the Gangetic Valley and this must have added some cumulative strain. (5) The area roughly bounded on the north by the Himalayan foot-hills, on the south by the Ganges River and stretching from Meerut to beyond Darjeeling is according to Dr. J. De Groaff-Hunter, C.I.E., a zone of excessive underloading in the earth's crust. The area of underload is flanked both on the north and on the south by regions of overload. These regions of great loading anomaly must cause very great stress differences in the earth's crust which supports them. The region of underload and the amount of underloading are, according to Dr. H. Jeffrey's estimation, sufficient to cause fracture in the lithosphere. (6) The loose alluvial soil offers a suitable media for the amplification of the earthwaves and for their complexity. Thus it might have amplified the intensity of the shock though it cannot by itself form a cause.

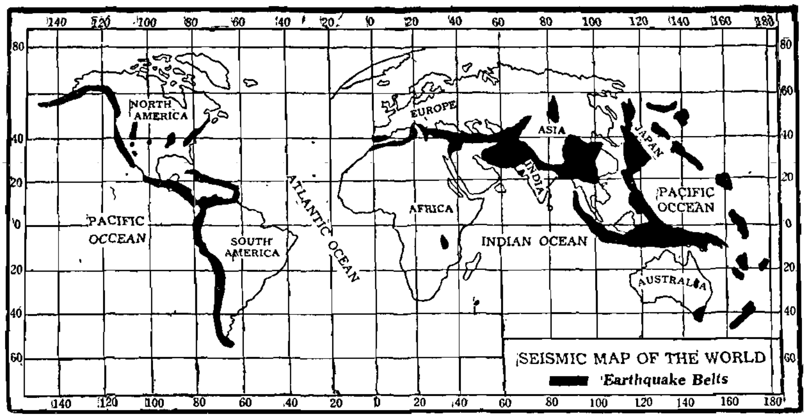
So far we have seen that instability is caused on account of the growth of mountains in altitude. Let us now discuss whether any such instability is caused in the ocean-beds where sediments accumulate. The overloading of the sediments must naturally cause some cumulative strain. Whether it is so or not this much we can say : The great mountains on land form the lofty anticlines and the steep depressions in the ocean form the deep synclines. As the mountains grow in altitude, the deep synclines sink deeper still as more and more sediments accumulate. The sinking of the ocean-bed must necessarily cause a state of strain which is released now and then, generating the so-called sub-oceanic 'quakes. Sometimes the elevation on land and the sinking of the ocean-bed may both conspire to produce enormous strain, especially in the case of vigorously growing young mountainous region, forming deeply shelving continental borders.

This is well illustrated in Japan, a typical seismic region where earthquakes are numerous and frequent. They are a group of islands arranged in a festoon, convex towards the east and south-east. On the west lies the sea of Japan into which the ocean-bed slopes gradually while on the eastern side, to which our attention is particularly drawn, the ocean-bed shelves rapidly downwards into the well-known basin called the Tuscarola Deep, the depth of which is about 4,655 fathoms. It is from this steeply-submerged eastern continental border that a great majority of the earthquakes in Japan, originate. No doubt earthquakes do occur on the gently-sloping western side, but they are few when compared to those on the eastern side and also less in intensity. Compared to the Himalayas, Japan with its mountains is considered as a young and vigorous structure, in a less advanced stage of growth. Hence some far-sighted geologists point out that the frequent occurrence of innumerable earthquakes in that district may be taken as indices of steps in the process, which in far-distant geological ages yet to come, will culminate in a great mountain range overlooking the Pacific.

We have just discussed one aspect of the tectonic 'quakes. Coming to the other aspect—the forces that have elevated the mountain ranges and depressed its borders below the level of the sea were also responsible for the great deformations to which the rocks had been subjected. In some places they have been tilted, bent and compressed. At other places they have been broken through by fractures causing great displacements. All these deformations involve the exercise of great forces. We know that for every action there is an equal and opposite reaction. Whether it is here equal or not this much is evident, that the natural rigidity and cohesion of the rock act as the opposing or resistant force. When this resistance is small, the deformation may go on gradually. As it becomes greater the strain accumulates. But when it goes beyond the limit, the resistance is suddenly overcome with an earthquake as the result.

Let us see how far this holds good in the case of the recent Quetta Earthquake. The mountains of Baluchistan form the western extension of the Himalayas and are therefore regarded as young. Moreover the oldest rocks in Baluchistan are of carboniferous age and the mountains round Quetta are of comparatively recent birth, if not still in the process of formation. Secondly, there is a sharp bend in the general north and south alignment of the mountains thus forming a re-entrant angle in the regions of Quetta and Sibi. The Bolan Pass situated between Sibi and Quetta marks the biggest end of this re-entrant and it is in this area that the rocks are most highly disturbed. The re-entrant angle with its apex near Quetta indicates a condition of special strain. It is no wonder, therefore, that Quetta becomes noted for its seismic susceptibility by virtue of its position and poor foundation !

A careful scrutiny of the history of the earthquakes that have occurred in Baluchistan in the past 83 years from 1852 to 1935 reveals one characteristic feature, i.e., the epicentres of a great majority of these earthquakes are found to lie in and around this re-entrant angle and this confirms W. D. West's view that that place indicates a condition of special strain which is now and then released with earthquakes as the only perceptible evidence.



DISTRIBUTION OF EARTHQUAKES

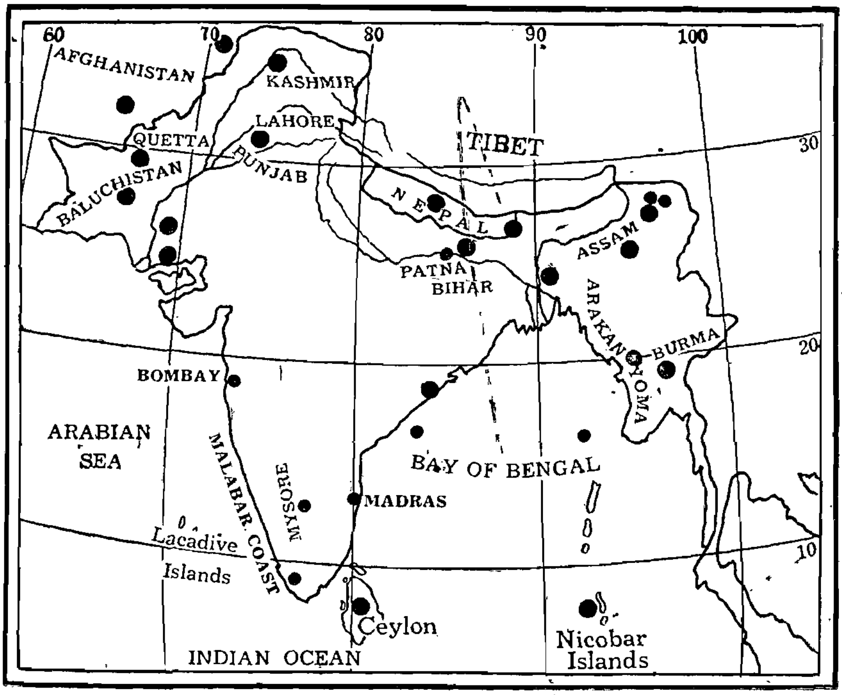
No place either terrestrial or sub-oceanic is exempt from earthquakes. There are, however, two well-defined belts or tracts as indicated in Fig. along which earthquakes are more frequent and numerous. One is known as the circum-Pacific belt which follows the western coast of North and South America, the Aleutian Islands and the island groups along the eastern coast of Asia. The other belt includes the Mediterranean, the Alps, the Caucasus, the Himalayas and continues into the East Indies. That there exists a close relationship between geography and geology is borne by the fact that the seismic belts connecting unstable regions almost coincides with the mountainous and volcanic regions. There is of course a strong evidence to the belief that there is no relationship between earthquakes and volcanoes ; yet, they seem to agree in a common cause in the distribution of the lithosphere.

Instability being the main cause that is taken into consideration in the distribution of earthquakes, there are various factors that contribute to it and that explains the above coincidence. They are (1) young mountain chains, (2) the short and steep flank of a chain, (3) deep declivities especially if they border young mountain ranges and (4) sharp deflection in the general alignment of mountains. These are zones of weakness in the earth's crust where strain is released at intervals causing earthquakes.

SEISMIC ACTIVITY IN INDIA

In Japan hardly a day passes without the record of an earthquake. In India it is not so. But she is at present passing through a period of marked seismic activity. What little we can gather from the history of the Indian Earthquakes leads us to believe that the seismic activity is practically confined to the whole of the northern border of the Peninsula extending from Baluchistan on the west to Assam, Arakan and Burma on the east. The earthquake belt passing through India practically covers these regions. Though the places situated in and near this belt are the most unstable and highly susceptible to earthquakes, it does not follow from this that other places are immune to earthquakes.

MAP OF INDIA SHOWING **CHIEF SEISMIC REGIONS**



Starting from the west, we have Baluchistan. Much has been said regarding its instability and the cause of earthquakes there. The next seismic region close by is Afghanistan. The mountains of Afghanistan have also suffered great disturbances in the past, and according to Count F. De Montessus de Ballore's account, we learn that earthquakes were many and frequent all along the Kabul Valley, and so it is regarded as unstable. In north-western Himalayas, Kashmir is said to be the most unstable and the instability is attributed to the great deflection of the Himalayan fold where they have been twisted and even crushed. These naturally indicate the probability of great dislocation owing to the change in direction. There have been a certain number of shocks in the Punjab, due, it is inferred, to the dislocations of the Salt Range.

There are also records of a severe shock in September 1803, and another in 1831, with its epicentre near Derabund, when the eastern side of the Sulaiman Range was violently shaken. The Punjab is, however, considered as rather stable. The whole of Nepal is highly unstable. Mention is made of a severe earthquake which occurred in August 1833 and was felt all over the centre and east of Northern India especially Nepal. The shock seems to have extended over the same area as that of the Bihar Earthquake of 1934. Katmandu and Monghyr which suffered most in the Bihar Earthquake of 1934 were also the theatres of a similar catastrophe in the past. Compared to these areas, Tibet on the northern slope of the Himalayas is more stable and less susceptible to earthquakes, by virtue of its position on the gentler sloping side unlike the abrupt southern border. The next seismic region and the most typical in India is Assam. The Assam Earthquake of June 12, 1897, the after-shocks of which continued for nearly a year, is considered one of the greatest ever recorded. It has thus earned an international fame and the earthquake is ranked among the great earthquakes such as the Lisbon and the Californian earthquakes of 1755 and 1903, respectively. R. D. Oldham has suggested in his report that Assam being a vast thrust plane, the earthquake might have originated from a general movement of the peneplain under a strain of compression. Whatever might be the cause, Assam is the most unstable part in India.

Arakan and Burma are also noted for their seismic susceptibility. The mountain chain of Arakan, Upper Burma and south-eastern Tibet are much folded and this folding strain, it is inferred, may be the cause of earthquakes in these regions.

Coming to the Peninsular India, it will be a relieving feature to South Indians to note that it is the most stable and least susceptible to earthquakes, in the whole of the Indian Empire. It is a triangular piece of land with its base running from the mouth of the Ganges to that of the Indus and with its apex at Cape Comorin. Apart from the evidences in the seismic records, there are certain geological evidences that contribute to its stability. These are (1) the almost complete absence of recent foldings, (2) the regularity with which the lavas of the Deccan trap have been deposited, (3) the long period during which dry land conditions have prevailed and (4) the almost complete prevalence of ancient archaean rocks of which it is formed.

It is however not entirely free from earthquakes and some shocks here and there have been recorded in the past. Some shocks are reported to have been felt on the eastern side of the Vellakonda Range, which is somewhat steeper. Some are reported to have been felt along the Malabar Coast particularly in Travancore. It is on this coast at Quilon that marine pliocene strata have been deposited; and from this, M. De Ballore suggests that the Indian Peninsula was cut off from Africa at this epoch and then received its actual outline. The few slight shocks that are felt there now and then perhaps indicate the survival of the once dynamic forces which dismantled the old Gondwana Continent. Shocks have been felt in various other places, too, in Madras, Salem, Ongole and Nellore. Nearly six shocks seem to have visited Madras in the past, some accompanied by severe cyclone and heavy sea-waves. M. De Ballore suggests that shocks felt at Madras might have proceeded from the Nellore Ghats. But there are no evidences of true epicentres regarding the shocks felt at various places. Though there is no continuous record or data to work upon, it is evident that there have been no severe earthquakes in the whole Peninsula as can be compared to those felt in Northern India, both in magnitude and frequency. Hence the Peninsula deserves to be called the safest part in India.

CEYLON

The Island is formed of archaean rocks especially at the southern part, an indication that it once formed geologically part of the stable peninsula. The occurrence of a few shocks, may, however, be attributed to the central high mountainous region and the steep slope on the southern side.

BAY OF BENGAL AND INDIAN OCEAN

Some submarine shocks have occurred in the past in the Bay of Bengal, the most important of which occurred on 31st December, 1881 and shook an immense area. Some have been felt in the Indian Ocean. As a result of one such shock in February 1865, it is reported that one of the Maldive Islands disappeared.

When will India be free is perhaps a question which everybody looks forward to with some eagerness for an answer. No definite answer is possible. Since the release of strain is the main cause of earthquakes, a long period of quiescence is likely to follow at places where the strain has been once released. Such places may be regarded, if not the safest, at least safer than those places where the strain has not been released. The old North-east Indian Earthquakes of 1833, 1843, and 1869, the great Assam Earthquake of 1897, the Kangra Earthquake of 1905, the Baluchistan 'Quakes of

1909 and 1931, the Bihar 'Quake of 1934 and the recent Quetta 'Quake, 1935, not only reveal this truth but show that earthquakes were and will be a regular feature which will continue perhaps till the Himalayas cease to grow and thus become too old to cause any instability at its foot. If earthquakes are to be a regular feature, is there any possibility of averting the same ? To this also we must say " No ". The rich and fertile resources of the Indo-Gangetic alluvial plain has lured many thousand inhabitants, and as Dr. L. L. Fermor has pointed out some of the richest cities in the East have been built on this geologically unstable region, little dreaming that their opulence and magnificence rest on a powder magazine within a few miles of their foundation. Unless man resorts to the most primitive method of living there is no possibility of minimising, much less averting this danger. Man may reach the most inaccessible heights and pass from one peak to another with a triumphant look upon Nature. Still earthquake is a challenge to show that the mysterious workings of nature are yet to be unravelled by man. Such are man's limitations and helplessness in spite of his divine inventions.

The Study of Soils

By

Mr. B. M. Thirunarayanan, B.A., (Hons.) London.

Soil science, or Pedology, is a quite young branch of knowledge, which owes its origin and development largely to Russian soil scientists, who laid its foundations in the course of their investigations of the soils of the Russian territories during the last fifty years. It was the prominent feature of the tschernosem or black earth soils of Russia, their occurrence under widely different circumstances, and the facilities for comparative study over a large area which mainly directed the Russians along the right lines and led them to discover and enunciate the general principles of soil formation. American and other European pedologists have, especially after the last war, followed up in their own countries the work of the Russians. Much progress has thus been made, and soil science has been definitely established as a distinct field of study.

In the past, soils had been studied chiefly by geologists and by students of agriculture, and their investigations had been confined mostly to studying the soil in relation to the underlying rocks or to the crops raised on it. The independent study of soils for their own sake had to await the coming of the pedologist, and his discovery of the complexity and the significance of the pedogenic or soil-forming processes. To him the soil ceased to be merely the weathered surface-layer of the earth's crust reflecting in general the character of the rocks from which it was formed, or just the surface layer of the earth on which plants grow. It is " the layers of material lying on the surface of the earth, or near it, which have been changed by natural processes under the influence of water, air, and living and dead organic matter." (Dokutschajeff, 1886). " It is the product remaining in situ, including all the material down to the depths reached or affected by the weathering processes." " Weathering includes the whole of the complicated physico-chemical changes which take place in every kind of the formation on the earth's surface, exposed to the influence of the atmospheric forces on the one hand, and to the life processes and products on the other." (*Glinka* : The Great Soil Groups of the World.)

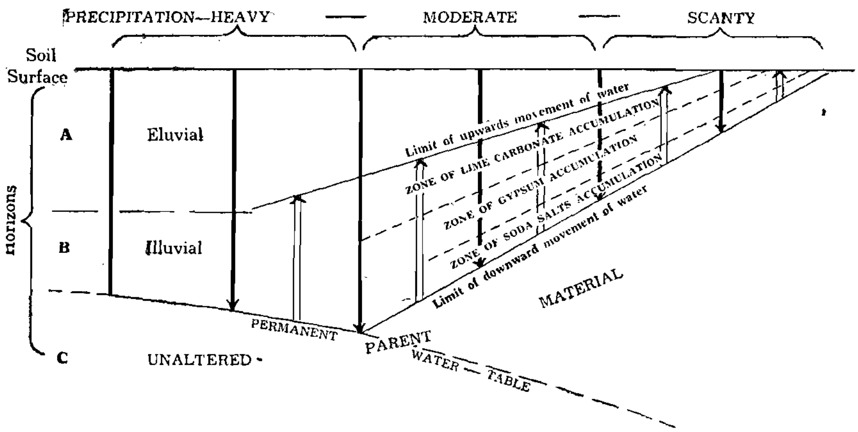
Soils are developed from soil material consisting of geological deposits of various kinds, under the influence of external forces acting on it through the soil-forming processes. The course of development of soils is marked by progressive changes in them, and it has been suggested that the successive stages could be described as those of infancy, youth, maturity and old age. Maturity of development is possible only where, as already indicated, the soil-forming materials have remained undisturbed throughout the several stages of development; in other words, only where the land-surface is sufficiently smooth and level, and not liable either to denudation or to deposition. Where the surface soil is being removed by erosion the soil remains immature through the continuous removal of its upper part, and such soils are known as immature, truncated soils. On the other hand, where fresh material is constantly deposited, the soils are being continuously rejuvenated. On this basis, soils may be classified as follows:—

- Soils
  - Mature, in level areas.
  - Immature
    - Temporarily, in level areas, during the youthful stage of development.
    - Permanently
      - Truncated, on slopes liable to surface erosion
      - Rejuvenated, where soil material is deposited on the surface

Mature soils are those which have reached a stage of development marked by the geological features being practically absent, and by the great predominance of features acquired during development, which reflect the nature of the soil-forming processes at work; for instance, certain sub-soil characteristics, such as the formation of concretions and hardpans. On the other hand, the characteristics of embryo or skeleton soils, since they are nothing more than freshly accumulated and little-changed geological material, will depend entirely on geological processes. It should also be noted that though the external soil-forming forces are of great importance, they have not produced everywhere the same results. The chemical composition and physical character of the parent rocks affect the development of the soil-types that could naturally evolve under the influence of the external factors.

The important part played by atmospheric or climatic forces in soil development is achieved in the presence of moisture in the soil, and through their influence on the amount of soil-moisture and its movements within the soil layers. The moisture content of the soil is derived from two sources, viz., (*a*) atmospheric moisture, received as precipitation, which is generally the more important source of supply, and (*b*) underground supplies of water. The amount of moisture present in various soils is dependent not only on the quantity of the precipitation, but also on the temperature and the humidity of the atmosphere, the relief of the land, the character of the parent rock, and the plant cover. Of the precipitation received at the surface of the soil, only a portion soaks into it, the rest being lost through evaporation and surface run-off. The water which sinks into the soil tends to move downwards, and when sufficiently large in amount, reaches the water-table and becomes part of the ground-water supply. During the dry intervals between periods of precipitation, the surface layer of the soil generally loses moisture through evaporation, and this tends to draw upwards the moisture from the lower soil layers, thus setting up an ascending movement of moisture in the soil. In the course of such movements within the soil, various constituents of the soil are carried by the water in solution and in suspension, impoverishing those layers from which such materials are removed, and enriching others in which they are deposited. The layer or zone of impoverishment is designated the A or " eluvial " horizon, and the zone of enrichment the B or " illuvial " horizon. Below this is the C horizon, comprising layers of parent material, unaltered because it is either beyond reach of the soil forming processes, or protected from them by being permanently saturated. All these horizons are distinguished by characteristic features and differences whose significance is brought out by a careful study of the entire soil profile and a comparison of its component parts with one another. Thus, for example, the surface A horizon is usually dark coloured, because of the presence of organic matter, and the soil becomes lighter, deeper down ; both A and B horizons will show characteristic differences in chemical composition when compared with the C horizon ; or the A horizon may show a bleached or " podsolised " layer, as in the soils of the coniferous forest regions of Eurasia, which is due to the reduction, by organic acids, of the brown or reddish iron compounds which usually give the soil much of its colour.

Soil development is also greatly influenced by temperature conditions. The temperature determines the rate of evaporation of moisture from the soil, and in this way influences all other related processes, such as the upward movement of moisture, the processes of salt crystallisation, the rate of decay of organic matter,



NOTE:—(1) With decreasing precipitation, the range of movement of water also decreases, and correspondingly also the depth of the soil. (2) The order of occurrence of the lime, gypsum and saline horizons in the illuvial zone suggests that the deposition of these salts by the soil solution is in their order of solubility, the less soluble salts being deposited earlier, while the more soluble ones are carried farther, to deeper levels. (3) With decreasing precipitation and range of movement of moisture, the accumulation of secondary minerals becomes more concentrated.

and, in general, the energy of the pedogenic processes. "In comparison with those of the temperate zones, tropical conditions are extreme conditions. In hot climates temperatures are higher by 10° — 20° C., and all chemical reactions proceed at from twice to four times the speed usual in temperate climates." In cold and temperate climates the feeble activity of climatic agencies is for a considerable part of the year still further restricted by the winter months, whereas, in the tropics there is no winter to interrupt the course of soil forming processes. "By reason of the 10° — 20° C., increase in mean temperature (to say nothing of the maximum temperature) together with rainfall which can be very heavy, all chemical processes occur with increased intensity in the soils of the hot zones. If one bears in mind that there is no interruption by winter, one will hardly err in estimating that over the whole year and in relation to temperate climates the intensity of weathering in the tropics is increased at least tenfold." (*Vageler*: Introduction to Tropical Soils.)

The aeration of the soil has also a potent influence on soil formation. The degree of aeration of any soil is determined by its texture and structure in the first place, and secondly by its moisture content. The total space occupied by the soil is shared between its solid, liquid, and gaseous contents; but whereas the solid portion of any particular soil remains more or less constant in amount, the water and air within the soil fluctuate very much, competing with each other for the available space. Thus an increase in the moisture contained in a soil would diminish its aeration. The aeration of the soil determines very largely the rate of oxidation of the mineral as well as organic constituents of soils. The depth of aeration is usually shown by the reddish or brownish colour of the soil, the brighter shades indicating greater intensity of oxidation of the iron compounds present in the soil-forming materials.

Climatic influences have, besides the direct influences noted already, an equally powerful indirect influence on soil development through the natural vegetation. The plant cover of any soil is the source of its content of organic matter. The amount of organic matter present in any soil is, however, dependent on the rate of decomposition of the organic matter, as well as on the rate at which it is supplied by the plant cover. Decomposition is most rapid when air, water, and heat are abundantly present, and least rapid when one or more of these are markedly deficient. This is why, even though the tropical and sub-tropical rain-forest has the greatest yearly production of organic matter, approaching, on a cautious estimate, one hundred tons per acre, from which, in temperate climates, there would result a layer of humus many yards thick, as a rule, even where growth is most vigorous, the layer of litter or humus reaches only an inch or two (Vageler, op. cit.).

The following table shows in a comparative manner the decomposition of organic matter in the soil under different conditions :

- Aerobic conditions.
  - Arid conditions. — Very little organic matter supplied by vegetation; accumulates partly as humus and partly as undecomposed plant remains. Ex. Brown and Gray desert soils.
  - Semi-arid conditions.
    - (*a*) Organic matter supplied by vegetation still small in quantity; largely present as humus, because it is decomposed more rapidly under moister conditions. Ex. Chestnut Brown soils. (Carbonate zone as in (*b*) below.)
    - (*b*) Organic matter more abundant, and gives the soil a characteristic dark colour. Carbonic acid evolved during decomposition combines with alkaline earth bases and forms alkaline earth carbonates which accumulate below the dark humus horizon as concretions or hard-pans. Ex. Tschernosem or Black Earth soils.
  - Humid conditions.
    - (*a*) Temperate climates.— Organic matter decomposed slowly into relatively less soluble humus and more soluble organic acids; the humus and undecomposed organic matter accumulate as a top layer, below which is a bleached or "podsolised" horizon. Ex. Podsol soils.
    - (*b*) Tropical climates.— Organic matter decomposed rapidly into easily soluble organic salts and other compounds which are quickly bleached out. Ex. Laterites, Red loams.
- naerobic conditions. — Acid soil conditions set up. Organic matter accumulates. Ex. Peat and Moor soils.

"Climate impresses itself on the soil even as it does on the plant cover."* This is, indeed, doubly demonstrated by the vertical arrangement of soil types which has been observed in the Caucasus and elsewhere, and by the correspondence of climatic and soil belts in Russia and the U. S. A. Further, the soil is not merely the product of climatic forces acting through soil-forming processes on the materials of the earth's surface. It represents, even as the natural vegetation of a region does, a delicate adjustment to its environment, and every change in that environment will necessitate and eventually result in a readjustment of the soil characteristics as well. The soil should therefore be regarded no longer as inert matter, but as something capable of, and, in fact, always, adjusting itself to its environment. This is, indeed, the main discovery of the soil scientists and the basis of soil science.

The important role of climate in the development of soils provides a convenient basis for the comparison and classification of the soils of all parts of the world. The climatic classification has, further, the great value of enabling soils to be classified at the same time on a genetic basis. Many such classifications have been proposed in the past, which are all inevitably provisional in character, because soil science itself is still in its youth, and also since information of the kind required is still very incomplete for soils of many parts of the world.

Classification of soils, according to Glinka. ("The Great Soil Groups of the World.")

I. *Endodynamomorphic Soils,* i.e., soils whose development and characteristics reveal the preponderance of the influence of internal conditions, viz., the character of the parent rock.

(*a*) Rendzinas; (*b*) Various skeleton soils. These are chiefly immature soils, which may occur in any climatic region, and within any belt or zone of mature soils.

II. *Ektodynamomorphic Soils,* i.e., soils whose development and character show the preponderance of external influences, viz., climate and vegetation. They are grouped into six classes, as shown below, on the basis of the relative amounts of moisture that reach the surface horizons in various parts of the earth during the operation of the soil-forming processes.

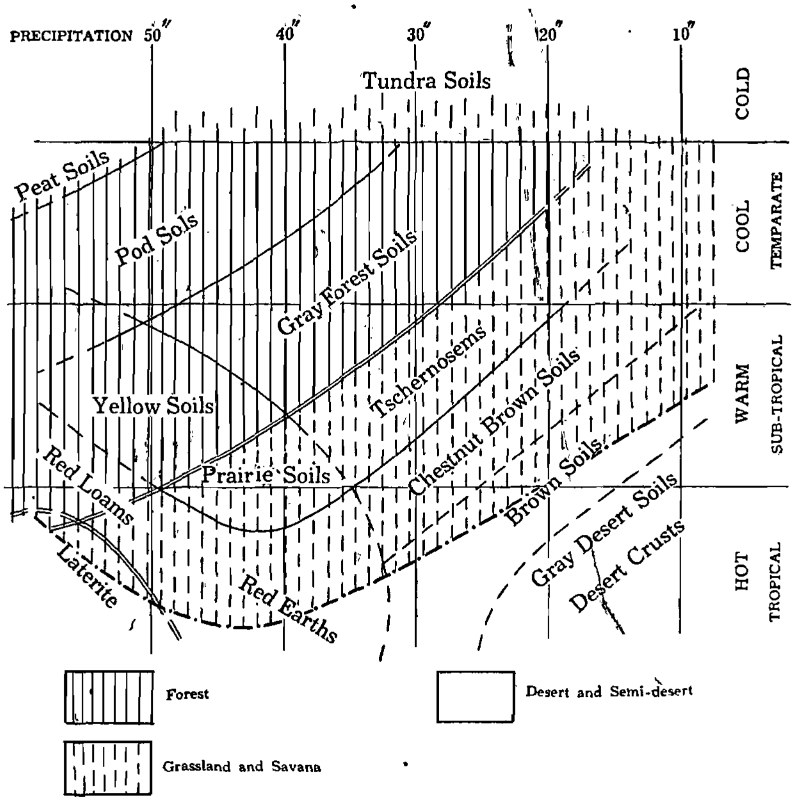
* "Wie in der Pflanzendecke, so pragt sich das Klima auch in der Bodengestalt ans." *W. Koppen*: Grundriss der Klimakunde.

Conditions of moisture under which soils are developed.	Soil Types or Groups.	Indian Representatives.
1. Optimum moisture.	(*a*) Laterite. (*b*) Terra Rossa. (*c*) Yellow soils.	Indian laterites.
2. Average moisture.	(*a*) Podsol soils. (*b*) Gray forest soils. (*c*) Degraded Tschernosem.	In the Himalayas. Do. Forested western parts o Dekkan.
3. Moderate moisture.	Tschernosem.	Dekkan black-cotton soil o Regur.
4. Insufficient moisture.	Group A :— (*a*) Chestnut-coloured soils. (*b*) Brown soils. (*c*) Gray soils. (*d*) Red soils.	 In Hyderabad State, and o the Indo-Gangetic plain. Do. In Hyderabad State, and o the Indo-Gangetic plain an in the Thar desert. In the Peninsula (Teri sand of Tinnevelly district ?)
	Group B :— (*a*) Brown crusts. (*b*) Lime crusts. (c) Gypsum crusts.	 In the Peninsula and Tha Desert ? In the Peninsula. Do.
5. Excessive moisture.	Group A :— Moor soils (Peat & Muck soils.)	 Peat bogs of Nilgiris.
	Group B :— (*a*) Mountain Meadow soils. (*b*) Peat soils of dry Tundras and Mountain Peaks.	 ? ?
6. Temporarily excessive moisture.	(*a*) Solonety soils. (*b*) Solonschak soils. (*c*) Transition forms of (a). (*d*) Transition forms of (b).	In the Indo-Gangetic plain; Reh, Usar, Kallar.

The first four classes have been developed under the influence of atmospheric moisture. The last two classes occur in areas of negative relief which have received their moisture not only directly from the atmosphere, but also in the form of seepage from surrounding higher lying areas and from the ground water of the immediately underlying layers. In the first four classes of soils the soil horizons have developed normally and typically, i.e., under the influence of downward percolating moisture. In the last two classes, which are developed under the influence of ascending moisture, the " Glei " horizon is often present.

In distinguishing the six grades of moisture, Glinka did not specify definite amounts in each case, but made only general comparative statements. Such definite information has, to some extent, become available subsequently, and is utilised in the follow-

Climatic, Vegetational and Inter-relationships of Soils.



NOTE:—(1) Relatively less reliable portions of boundaries shown as broken lines.

(2) Temperature conditions are shown only in a general comparative fashion, and the dividing lines do not correspond to any specific temperatures.

ing diagram, based on data available in the works of Glinka, Marbut, Robinson and Vageler. (See references at end.)

In conclusion, it should be noted that all that has been said above refers particularly to natural or virgin soils and not to those under cultivation. Cultivation involves interference with and modification of the soil as well as of its environment. It means, firstly, the replacement of the natural by a cultivated plant cover. Irrigation or drainage would alter the moisture conditions of the soil, modifying to that extent, the influence of climate. The surface layers of the soil are broken up by tillage, and its structure, aeration, etc., are modified thereby. The very great practical importance of studying the effects of cultivation on the soil cannot be overemphasised. It is shown only too well by the costly mistakes which have been made in many parts of the world and realised only too late, through the adverse conditions that have resulted, such as the rapid loss of fertility of tropical red soils under improper management, the destruction of extensive areas of productive land through soil erosion, and the ruin of other large areas by the accumulation of alkaline incrustations in the soil because of irrigation without adequate sub-soil drainage.

This brief and simple account of soil-formation has been prepared primarily from the geographical point of view, and is based on the works cited below, which are very much more detailed and sometimes rather technical, and not addressed to the geographer, primarily.

1. *K. D. Glinka* : The Great Soil Groups of the World.

2. *Shanty* and *Marbut* : The Vegetation and Soils of Africa.

3. *Robinson* : Soils, their Origin, Constitution and Classification (2nd Ed. 1936).

4. *P. Vageler* : Introduction to Tropical Soils (1933).

5. *Comber* : Scientific Study of the Soil.

Human Geography of the Amaravathi Basin

By

Mr. C. S. Subbaratnam, B.A., L.T., Dip. Geo.,

INTRODUCTION.

The Amaravathi is one of the important tributaries of the Cauvery in South India. It rises in the Anamalais 10° N.Lat. and 77° E.Long. and runs for nearly 140 miles in the plain country before it joins the Cauvery near Kattalai, the present name of the place being Mayanur. The plain country through which the river flows comprises of Udamalpet and Dharapuram Taluks of Coimbatore District, a part of Palani and Dindigul Taluks of the Madura District, and Karur and its neighbourhood of the Trichinopoly District. From the peak of the Palani Hills, the Plain country looks like a Basin.

OUR METHOD OF STUDY.

The Region through which the Amaravathi flows forms a hydrographic Unit. It comprises of portions of three administrative districts. But the general dry climate of the Region makes it eminently a pastoral area. Our method of study of this region is first to understand the past history of this region, and then to analyse its physical features, its soil and climatic conditions as determining factors for its productive power and then to trace the influence of these on the human factor as reflected by the distribution of population.

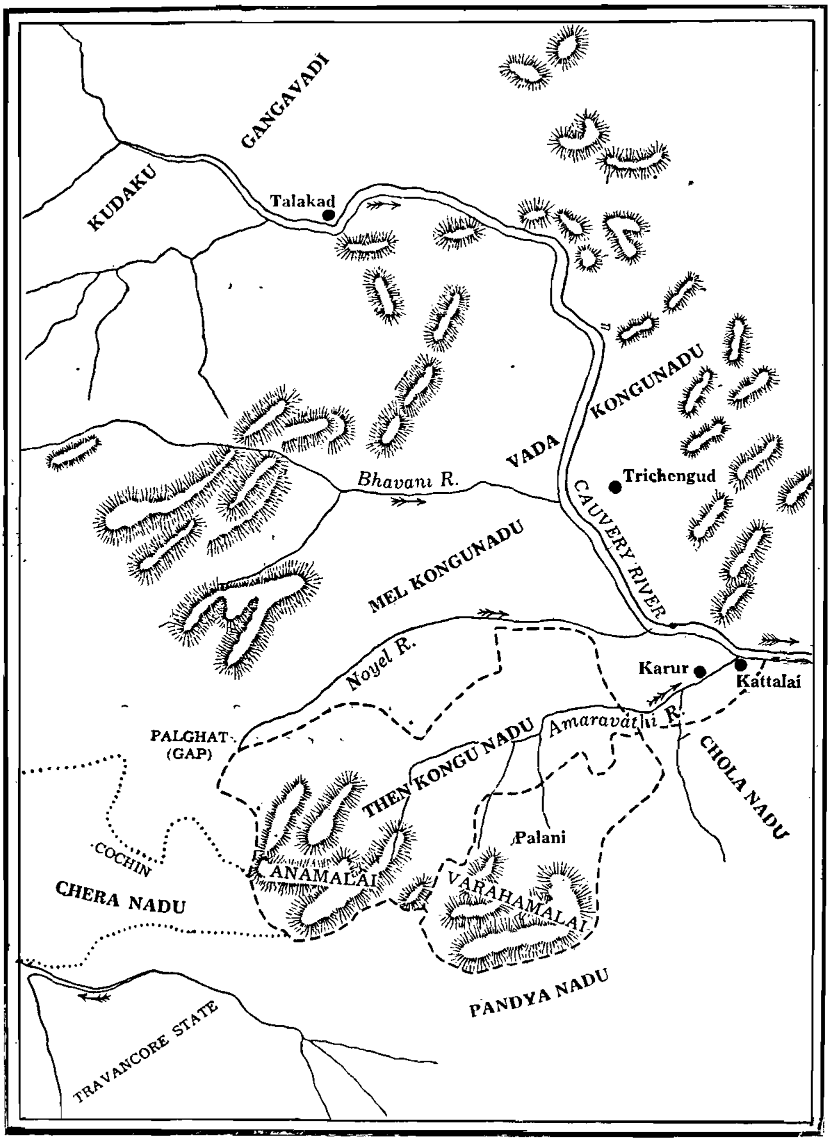
1. HISTORICAL BACKGROUND.

The main interest of the Amaravathi Basin lies in the fact that it was once the seat of Kongu civilisation of the ancient Tamils. In the days of the Silappathikaram this region was ruled by the kings known as Kosar and later on Retti dynasty ruled it perhaps with Karur as the Capital. Then Ganga dynasty annexed this territory with their own called Gangavadi, and ruled this land from their capital Talakad. During the days of the Chola ascendancy, although this territory lost its independence, it resumed its separate existence under the semi-independent Viceroys known as 'Kongu Cholas' by the Historians. Another version says that the Kongu

---

* A summary of the lecture delivered under the auspices of the Geographical Association, Coimbatore Branch.

Nadu was more or less under the sway of the Chera Kings on the one side and Ganga Kings on the other. It is not proved with the evidence of the Hoysala inscription that the region was under the



A Sketch Map to Illustrate Historic Background of The Amaravathi Basin.

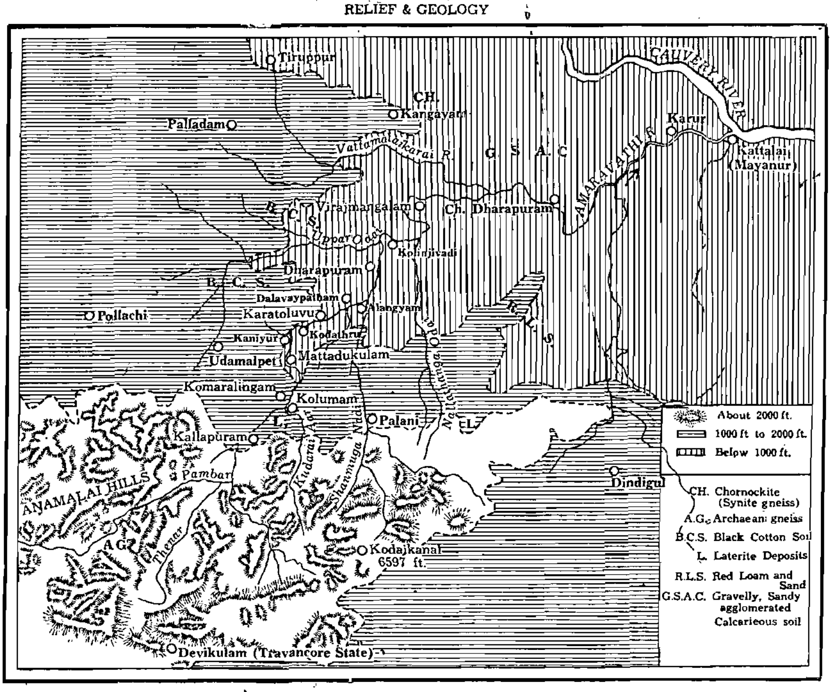
sway of the Hoysalas. But it is a fact that this region was long retained under the suzerain power of the Pandyas. Later on, it served as a 'bone of contention' between the Vijayanagar governors and the growing power of Mysore. In 1559 A.D. under Viswanatha's Viceroyalty, here existed a kind of Feudalism, the relic of which is the Pattagar of this region. During the days of Chikka Devaraya in 1704 A.D. the region was brought under the rule of Mysore, and later on, in the war between the Mysore Sultan and the English, this region was 'a scene of incessant marches and counter-marches' and finally in 1799 it was acquired by the East India Company.

In Tamil Literature this region is referred to as 'Konganam' and according to their regional classification this comprises of Mullai with an admixture of Kurinji where the Anamalais and the Palanis rise aloft to the sky. Mullai is the region where the milk and milk products are abundant and wool and cotton weaving developed in the New Stone Age, and where millets and dry crops are raised. These conditions continue to this day as of old.

2. PHYSICAL FEATURES.

Relief and Structure.—The general topography of the region shows the continuation of the Western Ghats in the west and the south as Anamalais and Palani Hills, the average elevation of which is above 4000 ft. The rocks are composed of archaean gneisses buried to a considerable extent under surface alluvium. In certain places at the lower heights of Anamalais, we find laterite deposits

THE AMARAVATHI BASIN
RELIEF & GEOLOGY



which in these places owe their origin to sub-aerial decomposition *in situ* of the rocks due to warm, humid, monsoonic climate. Between the laterite cap and the under-lying rocks may be noted a transitional lythomarge rock usually called the bole. The plain country stretches more or less from the foot of the hill towards the north and north-east. The relief map shows that Udamalpet is 1297 ft. above sea level, and Dharapuram 997 ft. and Karur 497 ft. The valley forms a meandering course for the Amaravathi to flow through, meandering more between Dharapuram and Karur than between Kallapuram and Dharapuram. The uniform level of the plain is sparingly broken at irregular intervals by small bands of numbers of charnockite rocks, by one small band of syenite gneiss near Kangayam, and by upstanding crags and ridges of crystalline schists.

Soil conditions.—The soil of this region is neither fine nor sufficiently deep over vast areas; but it is not so barren as extreme dryness of the several parts of the region makes it appear. The red sand and gravel are good for dry cereal cultivation, but there are considerable areas of red and black loams which yield a variety of good crops with fair rain and efficient cultivation. Under dry cultivation which is little expensive black cotton soil yields bounteous harvest, while the red loam under garden cultivation and the black loam under river irrigation are remarkably productive. Dharapuram and Karur are covered almost entirely with thin gravelly, sandy or agglomerated calcareous soil, but Udamalpet consists more than 1/6 of the cultivable area of black cotton soil, in contrast to Pollachi which contains red loam.

General Drainage conditions.—Thenar and Pambar are the two hill streams of the Anamalais that supply water to the Amaravathi; and Kudarayar, Shanmuga Nadi, Nallathanga Odai, Nanganji, Kodavanar, Vadamalai Karai and Varatu Karai are some of its important tributaries that join the river in the plain country. Except the Shunmuga Nadi all the others are no bigger than jungle streams, and they carry water only during rainy seasons, and during the rest of the months these streams are practically dry.

When they are in flood the flow of the stream is too rapid to be of any use for irrigation. Kudarayar, Shanmuga Nadi, Kodavanar etc., drain the northern slope of the Palani Hills; and Vadamalai Karai, etc., drain the surface of the northern region of the basin, the average elevation of which is about 1000 ft. The Amaravathi alone is the perennial stream of this region. Even this for a few months in summer contains little water near Karur.

3. CLIMATE OF THE REGION.

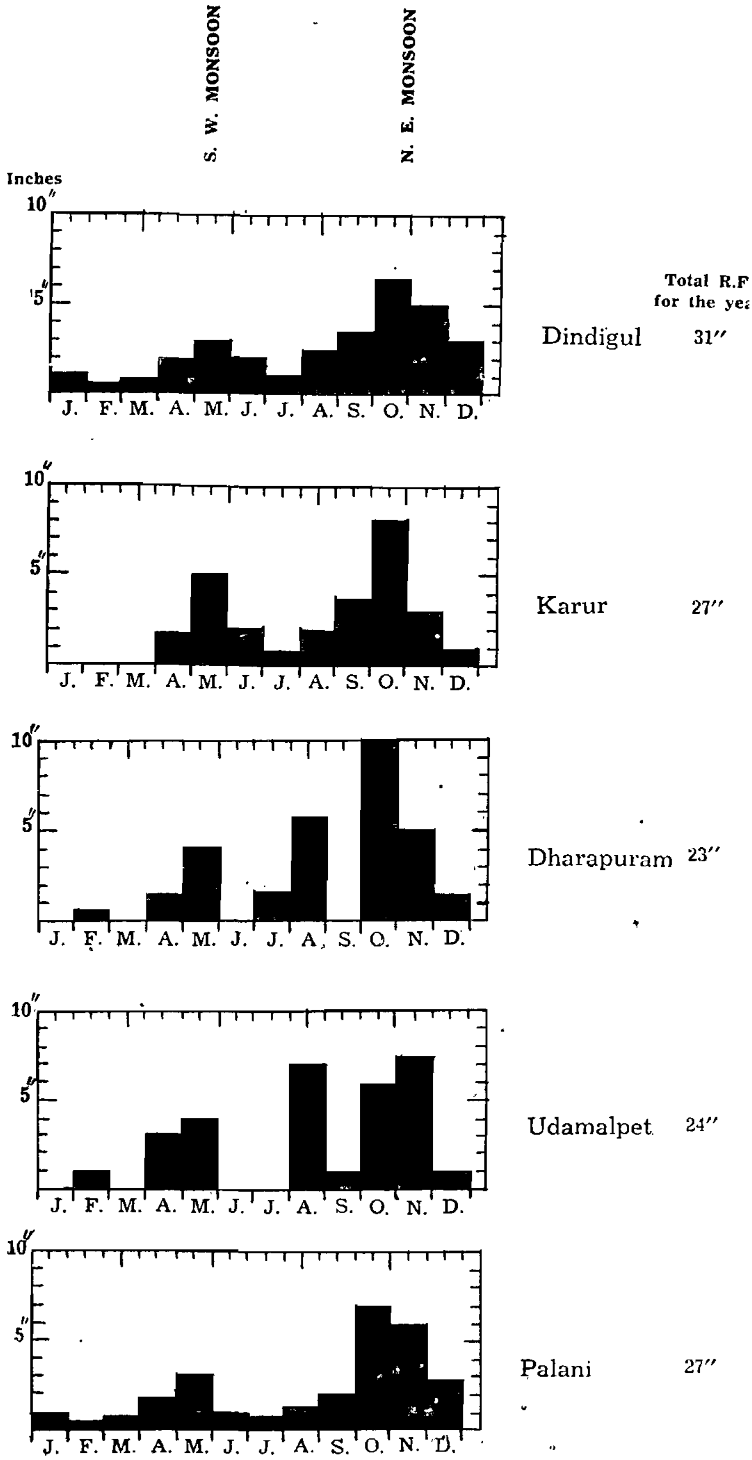
According to the rainfall and temperature conditions there are four well-marked seasons in this region. I. Cool dry season comprising of January, February and part of March when there is very little rainfall in the form of light showers. 2. Hot dry season comprising of last half of March, April and May when in addition to little rain there will be thunder-storm and the river is nearly dry. 3. June, July and August when S. W. Monsoon breaks and with it comes flood in the river. 4. October, November and December when N. E. Monsoon breaks and the whole region receives its annual rainfall.

The climate of this region is by itself not propitious to agriculture, and it is one of the driest regions except along the banks of the Amaravathi. The mean annual rainfall of this region is about 25 inches only, though the precipitation on the Anamalais is more than 50″, for the Amaravathi Basin is in the leeward side of the Western Ghats. The heat of the region is generally modified by the cool air currents from the west coast through the Palghat gap. The dryness of the region is to a certain extent modified during the time of the S. W. Monsoon when moisture laden air rushes over the plain and increases the humidity. The mean annual temperature based upon the record of 25 years ending 1925 is 79.6°F. The hottest months are from March to May with a mean temperature of 85°F.

The large area of dry crops in this region depends solely on the S W. Monsoon (*Kar* crops). The rain from January to March is of no use to the agriculturists. The summer rain benefits but slightly the crops under wells, tanks and channels. This region shares in the rains of N. E. Monsoon to the extent of about 12″ on an average, facilitating the cultivation of *Paruvam* Crop. At times due to abnormal rainfall on the Ghats west of Udamalpet unexpected flood comes in the Amaravathi, which cause damage to a number of channels in the Udamalpet Taluk. Generally there is much uncertainty as to the possible amount and distribution of rainfall and the region is liable to long drought, and to frequent cycles of deficient rainfall.

The prevailing winds are from north, north-east and east from January, and they continue into March when southerly winds begin to blow and become still more frequent in April. In May the direction becomes more westerly and the south and south-west are the prevailing quarters until September when the wind backs round to south and later on to north-East. By November the N. E.

Rainfall Graph for Important Stations in the Region.



Monsoon is thoroughly set in and continues throughout December. The southerly wind blowing into this region through the Palghat gap blows with the greatest mean velocity of 6½ miles per hour, throughout the whole period of the S. W. Monsoon. During June and July the winds blowing persistently in great volume are notorious for their great violence. The N. E. Monsoon winds are much lighter, the mean velocity being about a mile and a half per hour. The climate of Udamalpet between mid-March and mid-May is cool and pleasant, of Dharapuram hot and not oppressive, and Karur hot and oppressive.

4. THE FORESTS OF THE REGION.

The total area of the region is about 2954.5 sq. miles out of which 381.83 sq. miles is Reserve forest. In Udamalpet Taluk the forest area is about 199 sq. miles, i.e., 35% of cultivable area of the region. Palani comes next with 7.84% and Dindigul is next with 2·1% and Dharapuram with 1%, while in Karur area of the region there is no reserve forest.

The low hills of the region contain for the most part deciduous type of trees. On the Anamalais and Palanis the forests become more and more evergreen and after a few thousand feet on the hills we enter the tropical rain forests. On the Palanis one will be familiar with rolling downs covered with short grass, intermingled with well-known *Sholas* which occupy so many of the moist depressions on the plateau. The Forest Officers tell us that these *Sholas* serve as moderating agents on the hills. In winter time it has been noticed by them that there is marked rise in temperature as soon as one enters the *Sholas*. The important type of plantation trees on these high hills is mostly teak. In some portions of these hills there is a combination of agriculture and forestry due to interesting developments of comparatively recent years in Madras Forests. Some of the most backward hill tribes have for generations been in the habit of cutting down and burning the forests and sowing food grains in the area. Their habit is to use the same place for one or two years and then cut down a fresh bit of the forests and repeat the operation. Needless to say, this is extremely destructive and is forbidden as per Forest Code. However, the Department has devised a means of utilising the form of rough agriculture to profitable ends. In an area on which the Department desires to raise a Teak Plantation, they first fell and remove all saleable trees and then hand over the area to the Jungle Tribes who cut down the balance of the trees, burn them and raise a crop of food-grains usually Ragi or paddy. At the same time as they are preparing the ground for their cereal crop the Department plant teak stumps, usually at an espacement of 6 ft. and these grow up with cereal crops. The Hill-men weed their cereal crop and look after the teak trees with the result that after the cereal crop has been harvested the Department will have a teak plantation on the area. In the Anamalais the Tea plantations are important. The labour to work on the plantations is recruited from the plains, mostly from Pollachi and Udamalpet. There are several estates on the hills, many of them financed by European capital. It is an interesting fact to know how the Anamalais Rope Way Co., projected in 1926, by several planting companies working on the Anamalais, is now able to have easy transport of plantation produce and other articles from the estates to the Railway station at Pollachi. The bottom station of the Rope Way is near Vannan Thorai Bridge at the foot of the Anamalais Ghat Road and the top terminal station, is on Iyerpadi Estate. The total length of Rope Way is 9½ miles. The system is a mono-cable one. The erection of Rope Way involved many other subsidiary work such as dams across two rivers, a hydro-electric power station, Bangalows, staff quarters, etc. The work was completed in June 1928. It is worth while going on an excursion to these Tea estates on the Anamalais.

5. IRRIGATION.

Irrigation has played an important part in the development of agriculture in this region. Nearly 44,000 acres are irrigated by the Amaravathi. In Udamalpet Taluk there is a number of channels such as Kalavaram Channel, Ramakulam Anicut Channel, Kumaralingam Channel, etc., which feed nearly 11,000 acres. In Dharapuram Taluk about 11,000 are under paddy cultivation. Among the tributaries of the Amaravathi, Shanmuga Nadi irrigates about 13,000 acres and Nallathanga and Nanganji about 7,000 acres. Once there was a system of Kudimaramath, i.e., a system of customary labour volunteered by the ryots to construct a temporary dam or 'Korambus' which is now almost defunct owing to the great difficulty caused by the absentee landlordism/and the prevalence of factions among the ryots. Now the usual practice is to collect the contribution in cash from the ryots and the Government through the minor irrigation overseers carry on this work. The irrigation under Komaralingam Raja Vaikkal is the best in the region since it is remodelled and resluiced by P. W. D. in 1910. In Karur and its neighbourhood the Amaravathi irrigates about 2400 acres; and Pallapalayam Anicut is the only permanent dam across the Amaravathi in this region. The silt in this region is plentiful and very rich. About 90% of the irrigated area in this region is under well and tank irrigation. The highest number of wells is found in Dindigal and Dharapuram Taluks, but the efficient wells are in Palani Taluk. There are also cultivable lands of *manamvari* type, where farming directly depends on the rain.

6. CROPS.

One is struck with the great diversity of crops raised in this region. Some of the most important are paddy, cholam, cambu, ragi, varagu, samai, almost all condiments and spices, sugarcane, groundnut, tobacco and other narcotic drugs, fodder crops, fruits, vegetables, etc. Out of 2·4 M. acres of land in this region about 50% of the land alone is under crops. About ·6 M. current fallow, ·1 M. cultivable waste, ·3 M. not available for cultivation; and according to 1931 Census the total population of the area is 1·34 M. Hence per capita holding of land is about an acre. Hence more than productivity of land it is 'the man behind the plough' that is a very important factor in determining the wealth of the region.

Name of the crop.	In thousand acres.
Paddy	.. 100.
Cholam and cumbu	.. 200 & 300.
Ragi	.. 60
Cotton (chief money crop)	.. 129.
Groundnut	.. 58.
Chillies	.. 7.
Tobacco	.. 25.
Sugarcane	.. 5.
Oil-seeds.	.. 45.

In this region there is scope for the growing of fruits; and the total acreage of orchards is 14,000.

Live-stock:—Next in importance to crop is live-stock rearing, which has been the chief characteristic of this region. Kangayam is well-known for its breed of cattle. There are two varieties of Kongu cattle, a large and small one; the larger variety is to be found in Karur and Aravakurichi, and the smaller is numerous in Kangayam and Dharapuram. The lighter soils which are usually shallow with uncertain rainfall but sufficient to retain enough moisture for the growth of a kind of grass called 'Kollukattai Grass', the botanical name being 'Pennisetum cenchroides', are the most favoured condition for breeding and rearing. The red loam full of kankar gravel, known as 'Odai jelli' is excellent for the formation of bone and sweetness of pasture. Among the breeders in this region the Pattagar of Palaikottai is the largest breeder; and in his herd may be seen the breed in its purest form. There is not another land-lord in the whole of India who pays so much attention or carries out breeding on such systematic lines as the Pattagar of Palaikottai, and the Amaravathi Basin is justly proud of the development of animal husbandry on indigenous lines.

7. THE PEOPLE OF THE REGION.

The man behind the plough :—The man behind the plough is the pivot of all agricultural activities. Encomiums have been showered on the skill, industry, patience and prudence of the cultivator of this region particularly on the three important classes who constitute the bulk of the peasant proprietors, the Kongu Vellalas of the Dharapuram area, Vellalas of Karur area, and the Kammas of the Udamalpet, Palani, and Dindigul areas. The defect in the art of agriculture in this area is largely the result of unfavourable climate and soil and want of capital rather than of practical knowledge. A full purse in the hands of Kongu Vellalas will conquer season and soil. His wet-land farming is excellent. In garden lands the ryot is the past master of his art. Unless it be his water lift, it is doubtful if there is anything to teach him. Inspection of his cultivation from fallow to reaping will show that all the minutiae of good cultivation are elaborately attended to. Dry land cultivation is not so elaborate ; but the higher classes of lands are thoroughly well-tilled, especially when cotton is grown. Compared with the peasant proprietors of Europe, particularly of France, Switzerland, Saxony and Prussia, the peasant in this region has neither the minute and patient industry of the French nor the agricultural knowledge of the educated peasant of the European countries. The striking feature of the rural economy of this region is want of energy and thrift in dealing with space and time, which has, however, come to be modified by co-operative organisations which now work in the villages.

8. THE VELLALAS AND OTHERS.

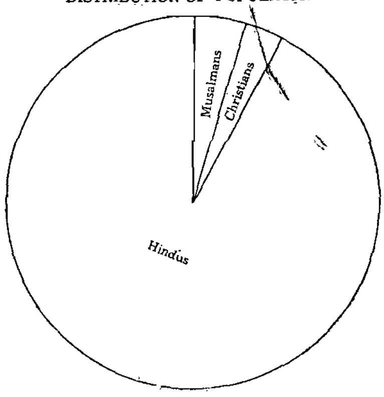
The Vellalan is a word derived from ' Velanmai ' which means cultivation. This is a caste entirely devoted to agriculture. The Kongu Vellalas are confined to the four centres of concentration of this caste, Kangayam, Pudupalayam, Pudur and Kadyaiyur ; and the chief of the land among them is the Pattagar. ' Nattamaikaran ' is the recognised head and wiseman. His orders in social matters are regarded as final. The marriages are presided over and celebrated by ' Arumaikaran and Arumaikari '. The Vellalas are simple and in many cases ignorant. Litigation and resort to Law Courts is a great drain on their wealth. Now, for the last few years there is some change for the better, for they are seriously taking to education.

The trade of the region is mostly carried on by the Arya Vysias or Komuties, although the trade in cotton is entirely in the hands of Kaikolas and Kammas. Arya-Vysias trace their descent to one of the primary castes of the Aryans of Hindustan, and they are religious and ceremonious in their outlook. In this region, the Arya-Vysias form 1500 strong in Karur town. In other parts they are not so concentrated, yet they are the traders of the region. Kaikolas are the hereditary weavers of the region, but now these people have become leading merchants and cotton commission agents.

Kammas, another important class of the people found in this region, trace their original home to Andhra Desa and it is now nearly 4 or 5 centuries since they have come to settle down in this region. Most of them are cultivators of land, and a few of them for the last twenty-five years or so, have turned to industry and commerce. Several of the Mills such as Venkateswara Mills and Dandapani Mills in Udamalpet and a number of ginning factories found in all important towns of this region have come to exist due to their enterprise.

Within the last fifteen years much change has come over the life of the people in this region. Owing to the great impetus given by the concentrated acreage utilised for growing cotton in this region, and the present changing outlook of the Indian Nation, there is a boom in this region for Mill Industry. Mills, nearly 20, started in Coimbatore, Udamalpet, and Tiruppur absorb about 60,000 labourers which in a great measure relieves the too much pressure on land.

DIAGRAM
Showing
DISTRIBUTION OF POPULATION



9. POPULATION.

The total population of this region is nearly 1.34 M out of which 90% are Hindus. Musalmans are only 55,849, and the Christians 43,215. Among the Hindus there are many castes. The depressed classes mostly work on lands ; and they are mostly menial servants to the farmers of the region. The other labouring classes of this region are Kollan, Kammalan, Oddan, etc.

10. OCCUPATIONS OF THE PEOPLE

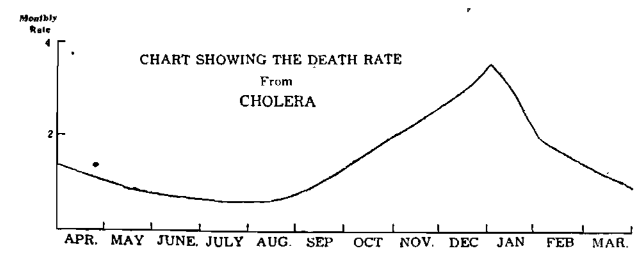
The pastoral and the agricultural classes form about 70% of the total population of the region. Industries form about 9%, and trade about 6%. The rest of the population is distributed variously under the heads of fishing and hunting, transport, public administration, etc. Under each one of these items it is less than 1%. Under the head 'Indefinite' the figure shows more than 9%.

11. INDUSTRIES.

The chief industry of the region is weaving. Handloom weaving is carried on in villages as a cottage industry ; the woven cloths are usually intended for local consumption. Generally these products find easy sales in the *shandies*. It is estimated that more than 30,000 handlooms are working in the villages in this area. Kangayam is in the centre of palmyra groves. It is believed that a large quantity of palmyra fibres for cordage for ships was formerly supplied from this region. The collection of 'Avaram' bark and of bones is also of importance in this region. There are ginning factories in Karur, Dharapuram, Udamalpet, and two cotton mills in Udamalpet. There is sugar industry in this region on a small scale concentrating round Alangyam in Dharapuram Taluk.

12. PUBLIC HEALTH OF THE REGION.

This region has good report of public health. There are no endemic centres of epidemic diseases. Some of the diseases of this



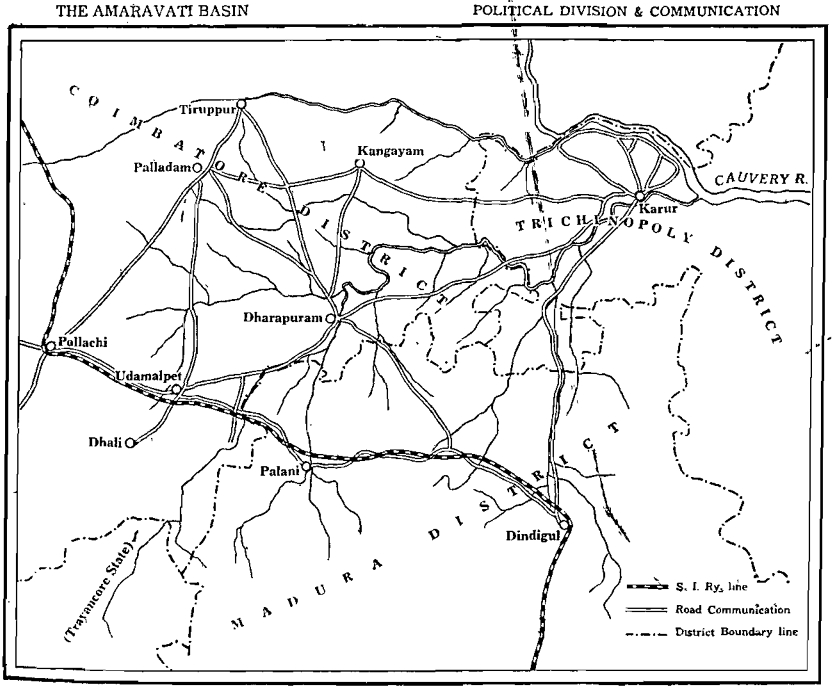
Monthly Mean for 1886-1925

area which cause mortality are cholera, small-pox, plague, fever and dysentery. Fifteen years ago, Udamalpet area was infected with plague, but now such cases are rare. Cholera prevails in some pilgrim centres like Palani and Dharapuram and the greatest mortality from cholera is during the period covered by the North-East Monsoon. (see graph). Small-pox is more or less prevalent throughout the region. The hot weather seems to exercise some influence on the incidence of these diseases. Fever consists of malaria and occasional epidemic of relapsing nature. Since there is much dry area in this region, the general health conditions of the region are always good.

13. COMMUNICATION

The railway runs in the heart of the region through sufficiently populated areas of agricultural and industrial interest. The name of this Railway is 'Podanur-Dindigul Railway'. It is metre guage section. Podanur-Pollachi section of this Railway is owned by the Coimbatore District Board. This was opened in 1915, and was fur-

THE AMARAVATI BASIN — POLITICAL DIVISION & COMMUNICATION



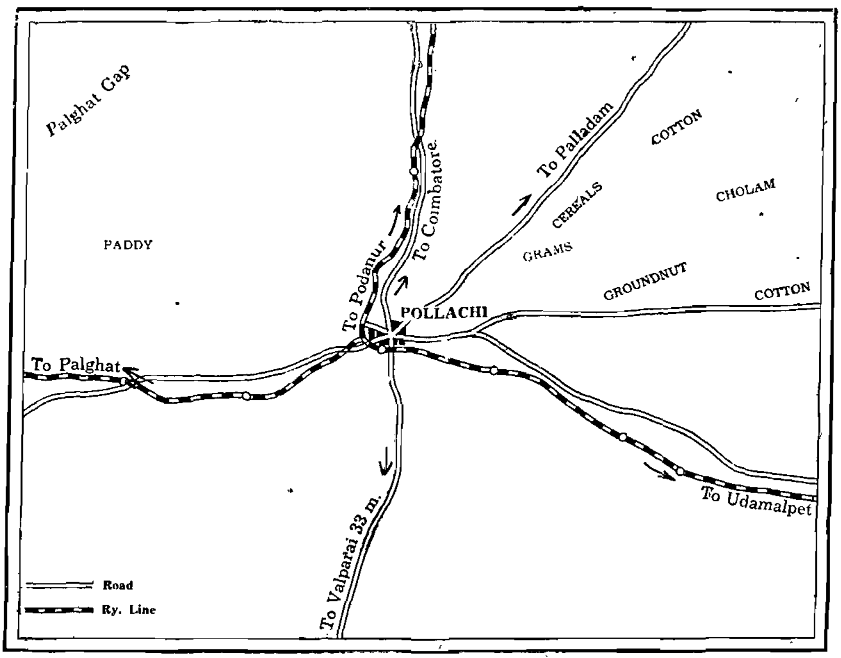
ther extended from Pollachi to Dindigul in 1928. The cost of the line was about 89 lakhs. This serves a fairly populous area in which there are important trading and pilgrim centres, and in future this is sure to open up and develop a prosperous tract of country long in need of railway. This shortens the distance from Dindigul, and the South to the West Coast and the Nilgris by a hundred miles. The Pollachi-Palghat section opened for traffic in April 1932 forms a continuation or extension of the Dindigul-Pollachi Railway to the West Coast, and shortens the railway journey to the West Coast from Pollachi by 20 miles.

The examination of the roads in this region presents at first sight a remarkable net-work radiating from the chief towns. All important towns of this region are connected by means of excellent roads, well-maintained by the Local Boards. Dharapuram is the central place from which roads radiate to all important places of the region including those rural areas along the banks of the Amaravathi, where paddy and sugar-cane are grown.

14. THE MARKETS OF THIS REGION.

The important markets of this region are some of the few important markets of South India. Pollachi market which is not far away from Udamalpet is situated at the mouth of the Palghat gap to com-

SKETCH MAP OF POLLACHI



mand easy access to Malabar Coast. This is the biggest grain market in this region. This is a nodal centre. The hinterland of Pollachi comprises cotton, cholam, groundnut, paddy, cereal and gram areas. The chief export of this region is groundnut. The second important market is Tiruppur which is a big cotton market, well-known as 'The Bombay of south India.' Karur is a market for *mandi* merchants. Dindigul is a cattle market.

15. HUMAN SETTLEMENTS.

Along the valley of the Amaravathi are seen many important villages (see phy. map.) prosperous and progressive, the rural economy of which is based upon paddy and sugar-cane. Dharapuram is in the valley of the Amaravathi. This was the capital of the Virata Desa during the Mahabarata Days, and later on under the rule of the South Indian Kings this developed into a nodal centre, which it continues to be even to-day. It is a Taluk headquarters and a municipal town consisting of nearly 30,000 people. Other municipal towns of this region are Udamalpet, Karur, Palani, and Dindigul. As a Pilgrim centre Palani is famous. Here is a beautiful little hillock dedicated to God Subramanya. Union Motor Service Ltd., Coimbatore, run Bus service in all the roads of this region, hence there is no difficulty of communication between one place and another in this region. Kangayam is in the heart of the pastoral area and is exporting ghee to Madras and other places. Palladam, being a nodal centre, has developed as an entrepot for cotton.

In education this region has not become very much forward, although there are many schools both elementary and secondary. The general literacy of the region is about 14%. It is desirable that education should penetrate into villages and mass literacy should be spread.

Conclusion:—It is interesting and instructive to study the life of man in the Amaravathi Basin, a large dry tract of land which has spread out choice for man to develop agriculture, pastoral industry, and later on cotton industry. The river Amaravathi promotes, 'Unity of Life' in this region. The geographical environment here has reared a simple, hard-working husbandry, which on account of development of communication, and contact with life outside, is now slowly trying to engage itself in textile industry. Simple living and high thinking has ever been the cultural note of this region.

Population and its Distribution*

BY

MR. GEORGE KURIYAN, B.SC., (LONDON)

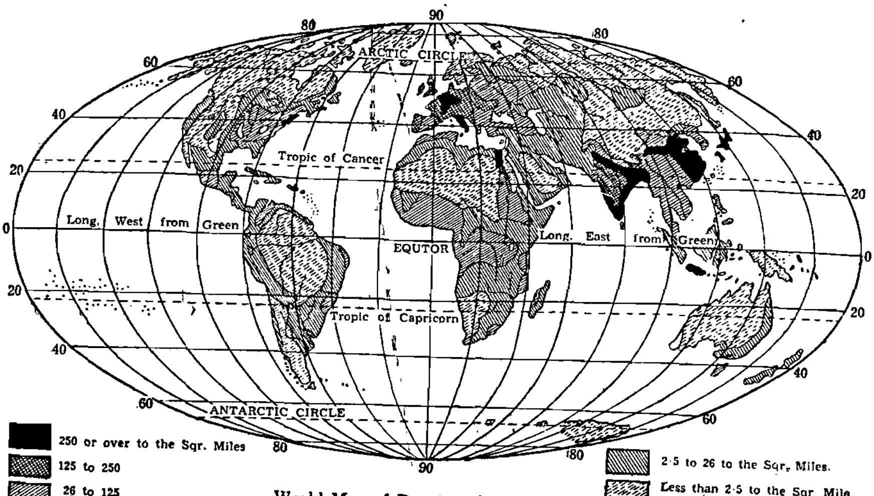
All accounts of population are obtained from the official census returns and by far the most remarkable fact in the last few generations has been the attempt by various governments in several parts of the world to take census returns. The earliest census ever taken was in Sweden in 1790 and in Great Britain by 1801 the first census was recorded. In India the first census was taken in 1851 and it is therefore clear that there are very few countries in the world which have any accurate returns for the last 100 years. It should also be remembered that there are very large tracts of country like China where no official statistics of population of any kind are available.

On a compilation of these census returns, it is found that the total population of the world is about 2000 millions. (The error in this figure may be as much as 20%). During the four decades 1881 to 1921 there has been an increase of population at the rate of 1.159% per annum. At this rate of increase the population will double itself in nearly 62 years and if this rate were to continue steadily there will hardly be standing room on the earth after 1000 years. Taking for granted that this rate of increase has been constant and calculating backwards, it is found that today a progeny of 2000 million would result from 2 people who lived in 180 A.D. This is against all known facts of history, the earth was peopled long before 180 A.D. It is therefore clear that there has been a tremendous increase in the rate of growth of population in the near past. The most important reasons for this phenomenal growth of population are :—1. The industrialisation of several parts of the world, 2. The opening up of the grasslands, 3. The utilisation of improved machinery, tools and manure in agriculture.

During the last census decade, however, it is found that the population of Western Europe and the North Eastern parts of North America has been stationary. These highly industrialised regions have shown a fairly rapid and steady decline in birth rate. The modern women of those regions want as few children as possible due perhaps to the high standards of life and the tremendous economic demands made by a child. Thompson in his " Population

Summary of a Madras University Readership Lecture, problems " says, " It is clear that industrialised man will no longer submit tamely to the hardships of too numerous a family. It is the manner of life brought about by the industrial revolution which lies at the root of the changes in the population growth which have taken place during the last century and a half. The techniques of contraception as well as the motives leading to their use are also among the consequences flowing from the industrial revolution."

Before the industrial revolution 70 to 80 per cent. of the population had to work for feeding and clothing the entire population. Such conditions exist even to-day in regions like India and China. The use of machinery especially in agriculture has made it possible



World Map of Density of Population

for about 20 per cent. of the population to be able to feed and clothe themselves as well as the rest. The other 80 per cent. can therefore be engaged in the production of luxuries and the other necessaries of life.

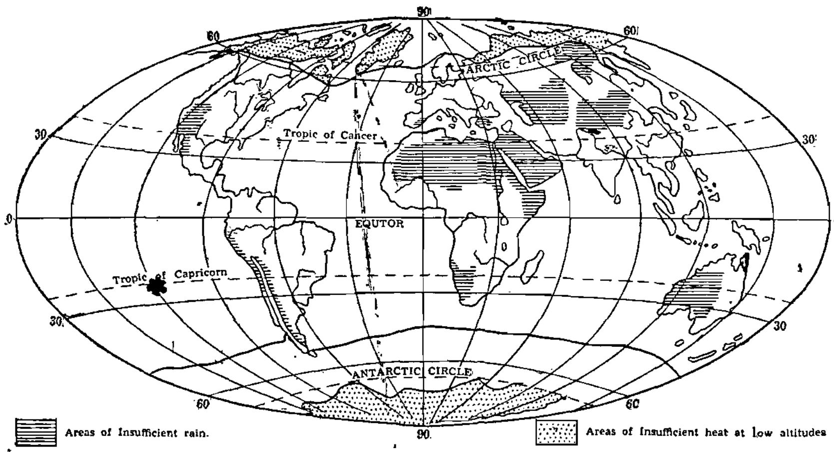
Distribution. The earth has a surface area of 196 million square miles, out of which nearly 140 million square miles are covered with water, the land surface being thus only 56 million square miles in extent. The sea may be a rich food-mine for mankind but its possibilities as a permanent abode for man are negligible. Man is and will be an animal of the land and mankind therefore will have to live on the 56 million square miles of the land surface of the earth.

The whole land surface of the earth, however, is not suited for human settlement, the essential limiting factor being the cultivability of the region. Temperature, rainfall and relief practically determine the extent of cultivable land. In no part of the earth are the surface temperatures too hot for agriculture, but there are large areas of land where the surface temperatures are too low for agriculture. The two essential temperature ingredients for successful agriculture are: (1) The actual surface temperature must be over 50 degrees F. and (2) there must be a minimum period of about 60 to 90 days of frostlessness. The regions lying polewards of the 50° F. surface isotherm for the warmest month are too cold and they constitute the cold deserts of the world. 30 years ago, 120 days of frostlessness was required for the cultivation of wheat, but to-day science has made such improvements that 90 days of frostlessness is sufficient for the successful cultivation of wheat in Canada. The further possibility of evolving types of wheat which mature in a shorter period than this is remote and little. The ultimate limit for some crops will be 60 days but this actually lies equator-ward of the 50° F surface isotherm for the warmest month. Thus it is clear that the 50° F surface isotherm for the warmest month is the effective limit of cultivation. The total area which is too cold to be cultivated is about 10 million square miles.

The total amount of rainfall necessary for agriculture is not constant throughout the world because it is dependent on other factors like evaporation, surface run off, seasonal distribution, etc. In some parts of the world the rainfall is excessive and in others it is insufficient.

Region.	Rainfall excessive if it is more than	Rainfall insufficient if it is less than	Total area with insufficiency of rain
Cool temperate regions	50"	8"	2 M. Sq. Miles.
Warm temperate regions	80"	12"	8 " " "
Hot regions	100"	18"	2.1 " " "
			Total 12.1 M. Sq. Miles.

(No accurate records are available regarding the extent of areas with excessive rainfall, but these are often small and scattered mountainous tracts.) The above table gives the conditions of both excessive and insufficient rainfall in the major climatic regions (other than the cold regions already dealt with) and the total area with insufficient rain in each of such regions. There are nearly 12 million square miles of land in which the rainfall is insufficient for agriculture; thus 10 M. sq. miles is too cold and 12 M. sq. miles is too dry, i.e., 22 M. sq. miles or nearly ⅖th of the land surface is uncultivable due to climatic factors. The remaining ⅗ths therefore



appears to be cultivable, but nearly half of this is uncultivable because either the soils are too infertile or the altitude is too great, or the region has a mountainous topography or it is occupied by forests (practically impossible to be cleared as in the equatorial regions) marshes, houses, roads, etc., i.e., nearly 17 M. sq. miles of the land surface is cultivable or 30 per cent of the land surface is cultivable.

This cultivable land, however, is not evenly distributed, there are actually three large patches: (1) W. Europe including Russia but excluding Norway and Sweden; (2) India, China and Japan and (3) Eastern parts of U. S. A. These are actually the regions of high density of population.

In the Far East in China and Japan approximately in an area of 2 M. sq. miles there are about 500 M. people, in India in about 1 M. Sq. miles there are about 300 M. people, in Europe in about 3 M. sq. miles there are nearly 450 M. people and in N. America in 2 M. sq. miles there are about 100 M. people, i.e., on a total area of about 8 M. sq. miles there are about 1,350 million people; or more than ⅔rd the population of the world is concentrated in about ⅐th the land surface. This is clearly a very uneven distribution.

It is because of the more favourable conditions for agriculture in the past due to fertility of the land (true even to-day of regions like China and India) and the possibilities for industrial development (true of W. Europe and parts of N. America). Originally the total population of an area depended on the agricultural possibilities of its immediate neighbourhood; but to-day it is dependent only on its capacity to import food.

It may not be out of place to consider something about the maximum population which the earth can support. A. Penck estimates that the world can support 8,000 M. people; Thompson thinks that the earth can support 5,000 M. people based on the present-day European yields of crops, but these figures seem to be too high. In conclusion it may be mentioned that synthetic food has been produced and based on a synthetic food-producing capacity the earth can support a much greater population than any of these estimates, but whether it will be sufficiently cheap and whether it could completely replace the natural food is a matter which time alone can prove.

Presidential Address of Mrs. P. S. Sundara Raj

To the Teachers of the Summer School of Geography, April 1936.

Mr. Chairman and Fellow Teachers,

We are met today to inaugurate yet another Summer School in Geography, and I feel it is a great honour to be asked to deliver the inaugural address. Geography teaching is slowly coming into its own and schools such as these ought to play a very important part in increasing the knowledge and the enthusiasm of teachers of Geography. Much effort has been expended in obtaining a place for Geography in the school curriculum. It is for teachers to show that the effort has been worth while. It is not for the sake of adding one more subject to an over-elaborate time-table, or to give one more text-book to be swallowed by unappreciative school-boys, that the fight has been waged to give Geography a proper place alongside other subjects in school and college, but because it is believed to have values of its own. Therefore to those teachers who managed to survive their own early education without being bothered to learn Geography, and now find themselves called upon to teach it, I would say, " Try first to find what value it might have for you, for only when it is worth while for you to teach it will it seem to be worth while for your pupils to learn it.". Of course, those who have had the privilege of Mr. Subrahmanyam's teaching will not have escaped without being thoroughly infected by his enthusiasm, and it is such people who have a great part to play in carrying this infection into any school in which they may find themselves.

One reason why I think Geography has been viewed with suspicion by those who framed our scholastic programmes in the past is that we cannot quite classify it, and in these days of air-tight and water-tight compartments we do like to have everything labelled and put in its proper place. Now the Science teacher we know: we can put him in the laboratory with his little test-tubes and for so many periods a week he teaches what is called " Science ", by which we mean generally Chemistry or Physics. And as scientific study progresses, we find it becoming more and more the province of the specialist: very often the more advanced the research the narrower is its scope, so that it becomes almost true to say that the specialist is the person who knows more and more about less and less. But of course the more specialised the work, the more easily is it labelled, and put away in its appropriate compartment and unfortunately this passion for specialising has invaded our schools and colleges. Education has become the mastering of a series of special subjects, each taught by a specialist teacher, and each neatly arranged in its separate compartment. But school and college should be a preparation for living, as well as being a full and satisfying life in its own sphere. And this I think is where the Geography teacher has an important part to play. The Science teacher looks askance at him because he cannot be put into a pigeon-hole and labelled. The physical side of Geography indeed reaches into the realm of pure Science: these are aspects of geographical study which require the pure specialist. The geographer, for instance, must use the researches of the geologist, but the true geographer is not a specialist; he cannot pitch his tent firmly in the scientific camp, and so he is viewed with suspicion, and perhaps a little contempt, by the scientists.

On the other hand, there is yet another and an older tradition in our schools: the tradition that has come down through many centuries of classical education; the study of language, and from language the study of Philosophy and History. When we come near to the study of great literature, of whatever age or in whatever tongue, we find ourselves studying philosophy and we find ourselves studying life. Here surely the Geography teacher can find fellowship, but the teachers of Philosophy, of History, of Literature are apt to be just as suspicious as their scientific brethren. But the Geography teacher is bound to give some interpretation to the facts which he observes, and so he becomes a philosopher. History also can often be interpreted only through a knowledge of Geography, and so the historian and the geographer find themselves working together. I think therefore that one great value of Geography is that it acts as a bridge between pure Science and the study of the humanities, and in so doing it helps to counteract that tendency to divide up knowledge into compartments with apparently little connection between them.

Geography, properly speaking, is the study of man in his environment. It is therefore vitally concerned with the problems and achievements of every day life. The tendency is more and more to emphasise human as distinct from physical Geography. And here again we must beware lest Geography itself should be cut up into irrelevant sections. Physical and human Geography are not distinct and different subjects, though some teachers and some text-books would appear to think so. It is essential that the unity of the subject should be preserved. The universe is one, even to the most distant star, and all life, including man himself, is maintained on this one tiny unit in the immeasurable universe only by the interaction of conditions which could very easily be thrown out of poise, or so it seems to us. Therefore, it is for the Geography teacher to study and interpret what we may call the "Pattern" of the universe, and show how man fits himself into this pattern and so is able not merely to survive, but to make himself more and more able to understand the factors that govern his conditions and so to subdue them to his own ends. In so far as the geographer has to observe and gather his facts before he can interpret them, he is following the method of the scientist, but there is one essential difference between the work of the scientist and that of the geographer. The scientist looks for the repetition of the same phenomenon, until the same set of conditions have produced the same result so many times that he feels that given such conditions the results will always be the same, and so he formulates a law. The geographer, on the other hand, has to deal with conditions that do not repeat themselves indefinitely, and so he must evolve a technique of his own. And I think it is just here that the geographer has a great opportunity to give his students a training for living. They can learn to arrange the facts that come to them, not as they are endlessly repeated in a laboratory, but as they come, unexpectedly and changefully, to the men and women who have to find a way of living on this earth.

I have spoken so far of the value of Geography as a bridge subject, as it were, linking the researches of the scientist to the study of humanity. But there are other values in Geography that I should like to suggest to you, and this especially in view of the world in which we find ourselves at this moment. What I want to say has been very well expressed by a great geographer, and I cannot do better than repeat the words Sir Halford Mackinder used eleven months ago. He said, "Is not the crisis of today, which penetrates into every human activity and almost every larger thought, essentially geographical in its origin? Mankind has suddenly become world-conscious and has taken fright. The nations have run to their homes and are barricading their doors. They have realised that henceforth they must live in a closed system in which they can do nothing of which the repercussion does not come back to them from the very antipodes. In an age that may become cruel, because imprisoned, their first impulse has been to make sure of their castles of refuge." Every day wireless brings to us the voices of men from the far corners of the world: every day air-liners start from the world's ports to accomplish in a few days journeys that our grandfathers would have required months to perform. The world hardly realised the changes that were taking place, and it woke to the reality with a tremendous shock. Sir Halford Mackinder's words are a challenge to all teachers of Geography. If the crisis of today is essentially geographical in its origin, these geographers have a very real responsibility in helping to create a new and better world consciousness. To come from the general to the particular, I think that in this country especially the Geography teacher has a great opportunity. No one can help noticing the cleavages occasioned by race, by caste, by religion, in this land. Not only are there broad divisions along the lines I have mentioned but there are innumerable local differences and hostilities. It has always seemed to me, that the Geography teacher, particularly the teacher of little children, can help more than most people in counteracting this tendency to communalism, whatever form it may take, and whatever may have been its causes in the past. For children are gregarious, not exclusive, and their sympathies are easily won. They are interested in people, and if they can be taught in their most impressionable period to look upon the people of other lands, and the people of their own land who are so different from them, with sympathy and knowledge, a great deal of prejudice will melt away. Human Geography, seeking for the causes which make the Eskimo different from the South Indian, the South Sea Islander different from the Scotsman will give a new outlook upon the world, and make for tolerance instead of hostility, for understanding instead of contempt. This is one of the most important lessons mankind has to learn, perhaps I should say has to re-learn, and I think that in a great sub-continent such as India is, if the people are even to be welded into a unity, the teachers of Geography, and I emphasise again the supreme importance of the teachers of the very young, have a not inconsiderable part to play.

I should like to point out another value which I think Geography has as an instrument of training. That is, in the encouragement of initiative. It is fashionable to decry the present system of education and so I will be in the fashion and make my complaint also. It cannot, I think, be denied, that the great multitude of those who annually leave our schools and colleges are singularly devoid of a spirit of adventure. So many of them seem to be anxious to pass from the pupil's desk to the office desk. All through their school life they do as their teachers direct them : every bit of an exercise they do must be adjudged and marked by their teacher. They learn what is in the text-book and reproduce it as faithfully as they can, and the teacher carefully awards a higher or a lower mark according to whether the text-book is well and faithfully reproduced or not. Set an examination paper in any University with a choice between questions which bear on the prescribed text, and questions which require original thinking or a knowledge of the latest publications and theories on the subject, and see how many students will attempt the latter. Of course the teachers are largely to blame for this. They are as anxious to keep to the well-beaten paths as their students are to follow them. I have myself seen teachers nearly faint with horror at the idea of allowing their pupils to mark even so simple an exercise as a piece of dictation ; yet here one would think is a very simple way of training children to judge their own work by a given standard. One has only to think also of the suggestion to keep to the same text-book for five years. In this country teachers seem to stick pretty closely to the same class. How could any teacher teach the same book for five successive years and maintain his own interest and freshness of outlook for that period of time ? And if he is not enthusiastic over his teaching, what possibility is there of his pupils being enthusiastic over their learning ? Besides there are few text-books that are not out of date within that time.

Now Geography is a subject that I think is specially valuable in developing initiative and training the critical faculty. In the first place, Geography cannot be learned out of a text-book. Even the best text-book needs to be constantly brought up to date. And I suggest the most useful piece of apparatus in the Geography laboratory is the daily newspaper. Here you have the day to day correction of text-book theories and dogmas. Within a very short period of time great changes have been taking place. One has only to think of air-routes, bringing into prominence ports of call for passenger and commercial planes that before were scarcely on the map at all. Or one can mention the extraordinary migration of heavy industry from the North of England to the Thames Valley : or the rapid increase in the use of oil and oil-products with the consequent growth in importance of oil-producing areas and the reduction in the export of coal. Many such examples can be cited. Such changes in the relative importance of parts of the earth's globe are faithfully represented in the daily shipping lists, in the trade reports of various countries, and in other items of news to be found in the newspaper. I suggest that the constant use of such reports will help to disabuse the pupils' minds of the idea, that seems to be often only too firmly fixed, that when the text-book has been mastered the sum of all knowledge has been achieved. It will show them that knowledge is not attained once and for all, but that new facts must constantly be fitted into the existing framework: that the world does not stand still: that their minds must be alert to compare and to correct, to cast off what is obsolete, to assimilate what is new, and to be ready to check even the new fact by subsequent knowledge. Geography is not something that has been settled once for all and therefore I think it does provide a very valuable means of mental training, a training in mental alertness and in the sifting and correlation of the facts that are observed.

But, even with the most comprehensive and accurate of newspapers, Geography cannot be learned in the class-room, and expeditions form another kind of training ground for initiative and mental alertness. They provide another means of amplifying and correcting the statements of the text-book: they provide opportunity for the display of leadership and self-reliance. There is not much of the globe left for the pioneer explorer but there are many regions in which groups of people could do very useful work. The vastness and variety of India makes it a promising and interesting field for regional surveys. Here is an opportunity for young men and women to leave the beaten path of the text-book and do some original work. There probably was never a time when more young men could be seen going out from English Universities into little known regions and doing solid and sincere scientific work. Although the great days of exploration and discovery may be said to have ended, almost every year sees two or three parties going out from Oxford and Cambridge and other English Universities, with simple equipment and a definite field of study. I think if as Geography teaching is really lively and stimulating we ought to see something of the same spirit of adventure, something of the same desire to add to the sum of our knowledge, in the students of our own universities. It is credibly stated that there are still eleven hundred heights in your own Himalayas of more than 20,000 feet not yet climbed. Here is a chance for initiative and adventure! Yes, the Geography teacher whose students are content to remain in the class-room may be said to have failed entirely in his work as a teacher.

In all that I have been saying, you will have noticed that the emphasis has been laid upon training. I think it cannot be too often or too emphatically repeated that very very little depends upon what a person learns, but everything depends upon how he learns it. Education has been very suitably described as that which remains when we have forgotten all we have ever learnt at school or college. In Geography, as in other subjects that deal with the living changing world, there is much that we can afford to forget. Many of us have seen the map of the world re-drawn since we went to school: if we were to repeat now in an examination paper the answers which gained us marks in those days, we should fail hopelessly. But the power to see, and still more to interpret what we see, the alertness of mind that will not be content with second hand opinions, the ability to grasp the essential wholeness of the universe, the teacher who can give us these things has enriched us for life. We often talk of an "educated man". There is no such person. The expression is in fact a contradiction in terms. Education is a process that cannot stop, and it only remains for a man to believe that he has been educated for anyone to know that he has never even begun to be educated. Of the study of Geography it can indeed be said that it

> "is an arch where through
> Gleams that untravelled world whose margin fades
> For ever and for ever as we move."

The Historical Geography of Indo-China

(Contd. from p. 274 of Volume X.)

BY

PROF. V. RANGACHARYA, M.A.,

UPPER BURMA.

Having studied the historical geography of Arakan and the coast down to Cape Tēmala or Negrais, the latter of which was apparently a corruption of Nāgarēśvara,[1] (Nāgarēś or Nāgarāśi) we shall now turn our attention to Upper Burma. According[2] to the Burmese chronicles the origin of civilisation and government began in Burma in what we would regard as the later Vēdic age. They tell us that there was an expansion of the Āryans from India across the mountains of the north-east some time about B.C. 850. They say that a chief of the Sākya clans (to which the Buddha belonged) left his native country, migrated with an army of followers to the country of the middle Irāwadi[3] (Irāvati), settled there, and built the city of Tagaung the ruins of which still exist. Tagaung or Tagōng has been pronounced to be a variation of Hastināpura, and its foundation has been placed by the interpretation of some scholars at an even earlier date,—about[4] B.C. 923. That Tagōng is identical with Hastināpura is demonstrated by the fact that a Sanskrit inscription dated Gupta Samvat 108 (A.D. 426) and locally discovered calls it Hastināpura situated in Brahma-dēśa.[5] The country about Tagaung in Upper Burma (Katha District) must have been named Brahmadēśa after the Brahmarshidēśa in India, and the name Hastināpura must have been given to the Āryan headquarters in Upper Burma on the grounds of analogy in their ancestral home.

To resume the story of the immigration and settlement as given in the *Mahārājavaṃśa* ; On the death of the founder of Tagaung in

1. It has also been connected with *Nāgadvīpa* and the *Nicobars*. Gerini's considered conclusion is that it was borrowed from the *Nāgarāsa* lake of Nepal, the residence of Karkotaka, in preference to the derivation in *Hobson-Jobson* (p. 623) from *Nāgarāshṭra*.
2. Phayre's *Hist. of Burma*, p. 9.
3. Ptolemy's *Bē-synga* or Elephant-river.
4. Gerini, p. 62.
5. Fuhrer: Arch. Rep. 1894; Gerini, p. 471, footnote 2.

the 9th century B.C. there was a succession dispute between his two sons Kan Rajagyi and Kan Rayangi, as the result of which the elder brother became an exile, and the younger brother ascended the throne. The exiled chief is said to have become the progenitor of two dynasties, one in the Kubo Valley and the other in Arakan. The younger brother and, after him, thirty-one descendants of his ruled at Tagaung for a space of three centuries till some hostile tribes from the east[6] put an end to their power (B.C. 550). The timely arrival of a new Sākya prince, 'Daza Rāja' or Dhaja rāja' by name (Dāsarāja ?) is said to have saved the old royal line from extinction. Endowed equally with the spirit of romance and conquest, the new adventurer, who had first settled at Manipura, entered into matrimonial relations with the exiled queen of the ill-fated 'Bhinnaka', and, with the popular support, was able to establish a second dynasty with his government at Old Pagān near the ancient city of Tagaung. This event took place in B.C. 523. The name Pagān, which is found in Chām inscription[7] of A.D. 1207 and in Chinese records under the variants of Bhukām, Bukām or Pukām, seems to have been an alternative for Ari-mardana-pura, and derived[8] from something like *Bhūkāma,* the delight of the earth.

A succession of sixteen kings are said to have followed Daśarāja, when the pressure of hostile tribes, the blindness of the last two chiefs and other misfortunes led to the migration of the royal house further south to Prome or Śrī Kshētra. It is from this Prome or Śrī Kshētra dynasty, the founder of which, Mahā Thambava, is assigned by the Chronicles to B.C. 483, that the later kings of Burma claimed descent. It has been already shown how, according to Gerini's arguments, the new capital was called Mareura in consequence of the probable dynastic connection with Māyūra or Maurya.

Thus, according to the Burmese chronicles the region of Burma proper was colonised and governed by Indian dynasties continuously from the 9th century B.C. It is difficult to say whether

6. From the Gandhāra-raṭṭha (Yünnan) in the land of Sein or Sin. See Gerini, p. 62. But Tagaung or Hastināpura seems to have continued to exist. For an inscription at Pagān in A.D. 610 mentions it though the former was the seat of government. *U. Burma Gazr.*, pt. I, vol. 2, p. 186.

7. Pagān has also been connected with Vugama or Bugamati in Nepāl.

8. A Pagān inscription dated in 1242 calls it the most beautiful and pleasant of the kingdoms of the earth.

the expansion of the Āryan power beyond the north-east mountains of India into Burma took place so early as the later Vēdic period. The chronicles are defective in certain respects. They seem to be chronologically unreliable. Sir A. Phayre "believed that the general trend of historical events was probably correct, but that they were ante-dated by several centuries. He suggests that the two Kshatriya States of Upper Burma must have been overthrown by the Shān or Thai race when they were driven westward towards the basin of the Irāvati by the Chinese incursions into Yūnnan in B.C. 122—109 and A.D. 9, and that it was as the result of this that the capital was shifted to a place much further south. Col. Gerini on the other hand believes that the traditions of the Thai race indicate that the Shāns must have begun their advance towards the west by the middle of the 6th century B.C. He is, in other words, not for going to so late a period as the first century B.C. or A.D., but for an intermediate date.

The other defect in the chronicles is, they ignore ethnology altogether. We know that ethnologically Burma is occupied by three races: the Mon-khmers in the south, of whom a branch called the Talaings played a most important part in history till the 18th century; the Chinese Shāns in the east; and the Tibeto-Burmans in the north, from whom the modern Burmese proper and the Arakanese are generally derived.

"The original home of all these people" says Sir George Grierson, "seems to have been North-western China, between the Upper courses of the Yang-tse-kiang and the Ho-ang-ho, and from here they spread out in all directions. So far as British India is concerned, they followed river-valleys in their migrations down the Chindwin, the Irrawaddy, and the Salween into Burma, down the Brahmaputra into Assam, and up the Brahmaputra into Tibet. From Tibet they occupied the Himalayas and are now found in Nepāl and in other mountainous tracts lying south of the main watershed. Three successive waves of completed migration can be traced. First, there was in pre-historic times, a Mon-Khmer invasion into Further India and Assam. Secondly, there was the first Tibeto-Chinese invasion, that of the Tibeto-Burmans, into the same localities and into Tibet, the period of which is also unknown. Thirdly, there was the second Tibeto-Chinese invasion, that of the Tai branch of the Siamese-Chiese into Eastern Burma, which took place in force about the sixth century A.D. Finally, another Tibeto-Burman invasion, that of the Kachirs, was actually in progress when it was stopped by the British conquest of Upper Burma. The later invaders drove the first to the sea-board or into the hills overlooking the river-valleys; and thus we find the earliest immigrants to India, the Mon-Khmers, confined at the present day to the coast country of Pegu and a few mountain tracts in Assam and Burma, while the Tais, who found most room for expansion in the direction of Siam, have driven the Mon-Khmers of that country to the seacoast also." (*Imperial Gazetter,* chap. VII, pp. 384—5). The languages of Further India, accordingly, fall into the two groups of the Mon-Khmer and Tibeto-Chinese.

During the early colonisations and settlements of Indians in Burma there must have been the Tibeto-Burmans in Middle and Upper Burma and the Mon-Khmers in Lower Burma, Pegu, Cambodia and Tenasserim. The Shān Tais were to come later on. The Chronicle ignores these ethnological factors. It indeed refers to occasional racial irruptions but it does so vaguely. The racial convulsions were between the Tibeto-Burmans of the comparative north and the Mon-Khmer Talaings of the south. The chief Tibeto-Burman tribes were the Pyus, the Kanrans and the Thets. The latter two are believed to have been the ancestors of the Arakanese and the Chins, and it is the first that are believed to be the chief ingredient in the Burmese race. It was the Pyus that had to meet the Shan, Tai and other Chinese tribes. As has been already said, Sir A. Phayre attributes the overthrow of the two Kshatriya kingdoms of Tagaung and Old Pagan in Upper Burma to the Shan-Tai race in the first century B.C. and the beginning of the Christian era, but Col. Gerini places it about the middle of the 6th century B.C.

While in Middle and Upper Burma there were Kshatriya colonisations and settlements from North India many centuries before the Christian era, there were similar movements into the Mon-Khmer land of Lower Burma from South India. As Gerini observes, "a double stream of emigrants from India flowed into Indo-China at a very early period. One, proceeding from the north, advanced overland through Manipur and Burma, and influenced the northern part of Indo-China as far as the Tonkin Gulf and the Chinese borders; the other, coming from the south, reached Indo-China by sea, and its influence extended mainly over the Malay Peninsula, Siām, Kamboja and Southern Assam. Thus it will be seen that Northern Indo-China owes its early civilisation to settlers from Northern India; while its southern portion, including the Malay Peninsula and Archipelago, is indebted for its ancient development to adventurers and colonists from the Coromandel and Malabar coasts. Once this point, never hitherto cleared up, is well understood, much that is yet incomprehensible and obscure of the early history of Indo-Chinese nations will appear more distinct." (p. 122).

The North Indian colonists of the first three or four centuries before the Christian era left royal dynasties not only in Upper Burma, but Siām, Laos, Yünnan, Tonkin, and South-east Indo-China. This string of petty States from Manipur to Tonkin used Sanskrit or Pāli in their court records or epigraphs, built monuments in the Hindu style, and employed Brāhmān priests and advisers for the guidance of the State. Tagaung and Pagan were only States typical of similar state of things throughout the northern parts of the Peninsula. It was from them that the Chinese derived much of their knowledge in different fields. Out of the tangle of racial convulsions and dislocations of the Peninsula the one thing that emerges as a unifying, civilising, assimilative and preservative force in unifying mankind in this part of the world is the Indian culture brought by the organised immigrant Kshatriya aristocracy in the north and the more commercialised culture of the Talaings in the south. To use the expressive language of G. E. Harvey, " The Burmese are a Mongolian race, yet their traditions, instead of harking back to China, refer to India. Their chronicles read as if they were descended from Buddha's clansmen and lived in Upper India. Even their folklore is largely Hindu. Most of their towns have two names, one vernacular and the other classical Indian, just as the Latin Church made it the fashion for every city in Europe to have a Roman name whether the Romans had been there or not. A few of these classical names are due to actual immigration from the original namesake in India ; thus Ussa, the old name for Pegu, is the same word as Orissa, and Pegu was colonised from Orissa. The surviving traditions of the Burmese are Indian because their Mongolian traditions died out. The only classes who could read and write and keep traditions alive were their ruling class, the Indian immigrants " (*Hist. of Burma*, p. 6). Mr. Harvey continues : " In Upper Burma these immigrants came overland through Assam ; in Lower Burma they came by sea from Madras. In some localities such as Thaton, Prome, Pegu, Rangoon and in many a town in Arakan, Indian immigrants doubtless formed a large proportion of the population ; indeed the name *Talaing* is probably derived from Telingana, a region on the Madras coast whence so many of them came. Like good Hindus they built little shrines ; and it is probably these shrines that form the original strata of such pagodas as the

Shwemawdaw at Pegu, the Shwedagon at Rangoon, and the Shwezayan at Thaton, all of which may well date back, in some shape or another, to before the Christian era. They brought their clergy with them, just as Chetties and European merchants do now in Rangoon, and with as little result on the people at large. As a rule their religion was a domestic matter, but in the course of centuries they became so numerous as to effect peaceful penetration. Moreover their Hinduism began to[9] include Buddhist elements after 261 B.C. when Aśōka conquered Kalinga and introduced Buddhism into South India." (*Ibid*, pp. 6—7). Writing, law, industries, and trade were introduced into Burma as much as in Sumatra, Java, Borneo and Tonkin. Prome, Rangoon and Thaton were typical "trading principalities." We know from Burmese chronicles that the dynasty of Prome or Śrī Kshētra ended in A.D. 84 and a new capital was established at new or Lower Pagan in Middle Burma. The date is somewhat different in different authorities, the fall of Prome being placed in 95 A.D. and the foundation of new Pagān in A.D. 108. In any case the new dynasty was very much under the control of the Talaing culture; and it was during this period that a synthesis of North and South Indian cultures took place; though very often there was a rivalry between the two.

(*To be Continued.*)

9. There are traditions connecting Burma with the Buddha and with Aśōka directly, but the historicity of these is doubtful.

News and Notes

The Association and its Journal have just completed ten years of useful work ; and the present issue opens the eleventh volume. We take this opportunity of thanking the Director of Public Instruction, Madras, and the heads of educational institutions, who have continuously supported the *Journal* and made the recent improvements in it possible. With increased financial support, we intend to carry out further improvements in the coming years.

* * * * * *

It is our great joy to welcome the Marquess of Linlithgow as our new Viceroy. With his antecedents and his great qualities of head and heart, we feel sure that no better choice could have been made at this juncture. It is gratifying to recall to our readers that the noble Marquess when he came to India as Chairman of the Royal Commission on Agriculture presided over one of the early meetings of the Associations in the very first year of its existence (22-11-1926), when Mr. R. D. Anstead, the then Director of Agriculture in Madras delivered a lecture on *The Planting Industries of South India*. M.R.Ry. Rao Bahadur H. Narayana Rao, Avl., M.A., the President of the Association then, in requesting the Marquess to take the chair, spoke prophetically as follows : —" The Marquess of Linlithgow felt the charm of India, her infinite fascination, so far as to decline an important office in his party. He would, it is hoped, give India of his best in still more exalted spheres in the years to come."

And the Marquess himself in the course of his concluding speech said —" In such matters it is the achievement and not the promise that counted. I would, therefore, not take up your time by making any prognostication of the direction in which my recommendations would point or by giving you an undertaking that the Commission would do their best, because, as you are aware, men did not undertake those grave and arduous tasks unless they were fully determined to give all their best. It is true, no doubt, that India's future for many a long day must be based on industry and agriculture. * * * I do not desire that all the industrial conditions prevailing in the West should be introduced in Oriental countries. Nevertheless, we hope that the measurable future will see in this country a more flourishing agriculture, calling upon the industrial enterprise of India to provide it with the machinery and the agricultural implements which it required." It is now eft to His Excellency to take his share in working for that consummation.

* * * * * *

Three meetings of the Association were held during the quarter nding 31-3-'36. In the first of them, Mr. P. Sridhara Rao read a aper on "*The Geological Formations of South India*" on 25-1-'36, nder the presidency of Mr. T. N. Muthuswami Iyer, which was ublished in the last number of the Journal. On 21-2-36, Mr. M. 'ivekananda read a paper on "*Earthquakes and Seismic Activity ı India,*" under the presidency of Mr. T. Sankara Singh. On 1-3-36 Mr. B. M. Thirunarayanan delivered a lecture on "*The 'oils of India*" with Mr. N. Subrahmanyam in the Chair. These wo papers are included in this number.

* * * * * *

The Coimbatore Branch of the Association held a meeting on -2-36 when Mr. C. S. Subburatnam of Peelamedu High School ead a paper on the *Human Geography of the Amaravathi Basin* ith Mr. Rao Saheb C. M. Ramachandra Chettiar in the Chair. nother meeting was held on 8-4-36 when Mr. M. Narayanaswamy yer of St. Michael's High School delivered a lantern lecture ntitled "*Round the Cape Comorin in Three Weeks.*" The first aper has been published in this issue; and the second one will e included in the next number.

* * * * * *

Under the auspices of the Association, twenty-five members ent on a week-end excursion to Kambakkam Durgam (2,540 et), about 50 miles from Madras. The party left Madras by one us and two cars on the afternoon of Saturday the 29th February 936, visiting *en route* Red Hills tank and the ruins of Sathiavedu rt and its environs. The whole of the next day was spent in the scent and descent of the Hill, which is an outlier of ıe Cuddappah formations. The Hills enclose a long valley-trough, irly well wooded, which appears to have been in former times region of some strategic importance, as can be seen from the ined walls and gateways in some places. One of the streams in ıe Valley, it is said, was a retreat of holy men, and its name *ıpala Madugu* (the stream of austerities) is reminiscent of that adition. Its strategic importance arises from the fact that the ıstern coastal route is very much constricted here between these ills and the Pulicat Lake. The region appears to be quite an ıteresting one from various points of view; and it is proposed to e-visit the place next year, making a longer stay and fuller study.

* * * * * *

The Tenth Annual Meeting of the Association was held at 5 P.M., on the 30th April 1936 at the Teachers' College, Saidapet, under the Chairmanship of Mr. K. Srinivasaraghavan, M.A. After the reading of the Annual Report the following persons were elected as members of the Working Council for the year 1936-37 :— Miss E. D. Birdseye (*President*), Miss J. M. Gerrard and Mr. Rao Bahadur R. Krishna Rao Bhonsle (*Vice-Presidents*), Mr. N. Subrahmanyam (*Secretary*), Mr. K. Sundaresan (*Treasurer*), and Mr. George Kuriyan, Mr. B. M. Thirunarayanan, Mr. V. K. Sundaram and Mr. Rao Saheb C. M. Ramachandra Chettiar (*other members of the Council*).

* * * * * *

After the business meeting was over, Prof. R. Gopalan, M.A., delivered a lecture on "*Some Aspects of Animal Geography,*" which was illustrated with the help of the Epidiascope. Mr. N. Subrahmanyam then gave a short talk on "*The Use of Pictures in the Teaching of Geography,*" which was also similarly illustrated.

* * * * * *

The Sixth Summer School of Geography was opened at the Teachers' College, Saidapet, by Mr. R. M. Statham, M.A., C.I.E., Director of Public Instruction, Madras, on 15-4-36 ; and Mrs. P. S. Sundara Raj, F.R.G.S., delivered the Inaugural Address in connection with it, which is published in this number of the Journal. 36 teachers joined the course ; and it is interesting to note that several of them have come from such distant places as Jamkhandi and Rajkot in the Bombay Presidency, Secunderabad, Bangalore, Berhampore, Mangalore, Cannanore, Nazareth, etc. Another interesting feature of the school this year was that half the number of teachers attending the course were ladies.

* * * * * *

Before declaring the Summer School open, Mr. R. M. Statham said in the course of his speech :—" I appreciate very much the work which the Association has been doing ; and particularly I may make special mention of the real and valuable propaganda work which the Association has been doing in the Presidency and in all parts of India in favour of Geography. The Association Journal is a very good production. I am happy to note that the work of the Association and its Journal are known even outside India, in Europe and other countries. By taking up the running of the Summer School course, you are serving a very real need indeed. Unfortunately in India there are not many degree courses in Geography ; and seeing how the curriculum of schools has been changed, I consider the work of the Association a very great benefit to the Educational Department. I congratulate the Association for working on its own resources without expecting Government Grant." The Summer School was brought to a close on 5th May 1936 with a *Valedictory Address* by Miss J. M. Gerrard; and a full Report of its working will be published in the July number.

* * * * * *

The Sixth Geographical Conference will be held at Salem on the 7th, 8th and 9th May, as per programme already published (Vide last page of the Tenth Annual Report for 1935-36). 16 papers have so far been presented on various aspects of the Geography of Salem District; and excursions will be arranged to places of geographic interest in the District such as Hogainakkal Falls, Mettur Dam, Magnesite Works, Yercaud and Kolli Malais. A Report of the Proceedings of the Conference together with all the papers read will be published in the July issue of the Journal.

* * * * * *

The Refresher Course in Geography organised by Mr. D. Samuel, M.A., District Educational Officer, Tinnevelly, for the benefit of teachers in the District, could not be held in December last, as originally intended. It was now conducted by Mr. T. S. Sundaram Ayyar for a fortnight from 15-4-36. 45 teachers, representing almost all schools in the District, attended the course.

* * * * * *

The Director of Public Instruction, Madras, has issued a comprehensive Questionnaire regarding the reorganisation of the S.S.L.C. Scheme to the Heads of High Schools in the Presidency. It is hoped that educationists will give their considered opinion, and the S.I.T.U., whose Conference will be held shortly in Salem in May, will discuss the Questionnaire from all points of view, and express itself and formulate a healthy scheme, giving a right lead in the matter. It is hoped that the Director and the S. S. L. C. Board will settle the question permanently, as the present uncertainty does not tend to efficient and sound education. We hope that in the final solution the importance of Geography will be duly recognised and a proper place assigned to it in the final scheme.

* * * * * *

At its Conference held recently at Bhimavaram, the West Godavery Teachers' Guild passed a resolution, requesting the S.S.L.C., Board to give more prominence to Geography by holding a two-hour examination for the subject in the S.S.L.C. Scheme. We heartily support this request, and hope it will be granted, as it will tend to the best interests of the subject and the examinees.

* * * * * *

The University Geography Department, which was hitherto working in a rented hall in the Wesleyan High School, Royapettah, has been shifted to the University's own buildings, just completed near the Senate House. The Diploma classes in Geography will be held from July 1936 onwards, in the new premises. In view of the growing importance of the subject and the need for prospective teachers of Geography to get first of all a grounding in the subject, it is expected that the Diploma class will become fuller and more popular. With growing strength, the University also will be able to provide for the teaching of the alternative subjects in the course such as Historical Geography and Bio-Geography, instead of forcing all students to take up Economic Geography alone.

Reviews

North America. By Thomas Pickles. (J. M. Dent & Sons, London). 1936. Price 2s.

This book is suited for use by pupils of High Schools, who are preparing for the Secondary School-Leaving Certificate and Matriculation examinations. In the choice and presentation of the material, relationships between natural phenomena and human activities have been generally brought out; and the treatment made rational and realistic. Some of the chief historical factors which have influenced the modern development of the areas studied have also been outlined, thereby infusing living interest in the studies. Tables of Statistics have been appended to each chapter; and these can form the basis of exercises framed by the teacher. The volume includes a treatment of Central America and the West Indies also. It is well illustrated with a dozen pictorial plates and 74 useful maps and charts.

A New Geography: Book I (In Tamil for Form I). By Rajamani J. Johnson and B. Clutterbuck. (Macmillan & Co., Madras). 1935. Price Re. 1.

This is a text-book prepared in Tamil for use in Form I in accordance with the recent departmental syllabus in Geography for middle school classes. The first part treating about India is naturally fuller than the latter part dealing with the Southern continents. The volume has been copiously illustrated with sketch-maps, diagrams and pictures. We feel, however, that several unnecessary details, which go to swell the volume to no purpose, and are not of geographic importance, might well have been omitted. The book has apparently been brought out very hastily; and several mistakes have crept in, many of which have been corrected in the list of errata. One of these, not corrected on page 107 is Walajabad (a town in Chingleput District) for Walajah Road in North Arcot District. Again, there is no doubt a difficulty in getting proper technical terms in the mother-tongue. Still the use of the word படுகை for *basin* (as in the Orinoco *basin*) seems objectionable, for the word would mean *bed* and not *basin*. The book is on the whole better than the ordinary middle school geography book; and we are sure that the few errors and the unnecessary details would be eliminated in the next edition.

Experimental Geography (Books I, II and III). By A. D. Merriman (Thomas Nelson & Sons, Edinburgh). Price 2s.

This is a very useful series of books on Practical Geography, including observational work, covering mathematical and physical geography. As Prof. J. H. Nicholson of Durham University says in his foreword, "The matter is well selected and arranged, the illustrations are distinctly good and to the point, and the exercises are well-designed to maintain interest and to ensure that the principles studied have been understood and can be applied to practical problems." These books may be recommended for use in High Schools where C. Group Geography is taught as well as in Training Schools and Colleges.

The Oxford Advanced Atlas (Fifth Edition). By John Bartholomew. (Oxford University Press). 1936. Price 10sh. 6d.

The fifth edition of this well-known Atlas has been considerably enlarged and improved to such an extent that even those who already possess copies of the earlier editions will find it to their advantage to go in for this edition. Among the improvements may be noted the following:—The size of the page is increased in width, so that the double-page plates now measure approximately $20'' \times 14\frac{3}{4}''$ instead of $18'' \times 14\frac{1}{2}''$ as formerly. An important new projection, termed the *Recentred Sinusoidal,* is used for the World Political and Population maps, so that it has been possible to show all land areas true to scale and with a minimum of distortion, as can clearly be seen by a comparison with Mercator or Mollweide. For Europe a valuable new map of Morphology has been introduced, classifying land forms into their different types, and showing where earlier river systems of the Great Ice Age have played their part. The physical maps of the British Isles show added detail; and a new population map is given along with a general Political and Railway Map. Seismology is an improved plate, while 'Storm Tracks' is an addition to Climatology. Entirely new maps (generally double-page) have been introduced for several important 'regions', notably the Soviet Union, S. W. Asia, the Malay Archipelago and the Atlantic and Pacific Oceans. Altogether a very useful atlas to students of Geography as well as to general readers.

Books and Journals Received

Experimental Geography, Books I, II and III: By Dr. A. D. Merriman.

A New Geography (Book 1) for Form I: By R. J. Johnson and B. Clutterbuck.

North America: By Thomas Pickles.

Oxford Advanced Atlas (Fifth Edition): By John Bartholomew.

Studies of the Morphological Activities of Rivers, as illustrated by the river Fyris: By Hjulstrom.

Kalaimagal: February, March and April 1936.

The Geographical Magazine: February, March and April 1936.

The Educational Review: February, March and April 1936.

The South Indian Teacher: February and March 1936

The Indian Educator: February and March 1936.

The Geographical Journal: February, March and April 1936.

Our Home Magazine: February 1936.

Journal of the Andhra Historical Research Society: April 1936.

Geography: March 1936.

Mitteilungen der Geographischen Gesellschaft in Hamburg, Bd. XLIV.

Educational India: March and April 1936.

Academy Hayk: *Geography* (Russia): Bk. 15.

Indian Journal of Economics: January 1936.

Journal of Indian History: December 1935.

Journal of Annamalai University: March, 1936.

The Scottish Geographical Magazine: March, 1936.

Geographical Review (New York): April, 1936.

SOME IMPORTANT PAPERS PUBLISHED IN PREVIOUS NUMBERS OF THE JOURNAL

1. *Some Aspects of the Geography of Madras*: By Miss E. D. Birdseye.
2. *The Geographical Evolution of Madras and its Environs*: By Rao Bahadur H. Narayana Rao.
3. *The Flora of Madras and its Environs*: By Mr. M. S. Sabhesan.
4. *The Planting Industries of Southern India*: By Mr. R. D. Anstead.
5. *Rural Geography* (With special reference to South India : By Mr. N. Subrahmanyam.
6. *The Birds of South India*: *their Distribution and Habits*: By Mr. C. Lakshminarayana.
7. *South Indian Cattle*: *their Breeds and Distribution*: By Mr. A. Swaminatha Ayyar.
8. *Stages in the Growth of the City of Madras*: By Professor Srinivasa Chari.
9. *Sewage and City Geography*: By Mr. A. Swaminathan.
10. *Rural Life on the West Coast*: *A Study in Environment*: By A. Appadorai.
11. *The Geographical Data of the Sangam Works*: By Professor V. Rangacharya.
12. *Notes on the Maps of Old Madras preserved in the Madras Record Office*: By Professor C. S. Srinivasa Chari.
13. *The Buckingham Canal*: *A Survey—Historical, Geographical and Economic*: By Mr. V. K. Sourirajan.
14. *The Geographical Basis of Ancient South Indian Culture*: By Professor P. T. Srinivasa Ayyangar.
15. *Some Results of Recent Upper Air Investigations*: By Dr. K. R. Ramanathan.
16. *Studies in the History of Some Common Commodities*: By Professor V. Rangacharya.
17. *The Comorin Continent*: By Mr. C. P. Gnanamuthu.
18. *The Geographical Distribution of Disease* (With special reference to South India) : By Major A. M. V. Hesterlow.
19. *Environments and Economic Activities in the Madras Presidency*: By Mr. K. C. Ramakrishnan.
20. *South Indian Pearl Fisheries*: By Dr. B. Sundara Raj.
21. *Migration of Labour* (With special reference to South India) : By Dr. P. S. Loganathan.
22. *Statistical Sources for the Study of the Economic Geography of India*: By Mr. K. C. Ramakrishnan.
23. *The Geography of Kalidasa*: By Mr. C. Sivaramamurthy.
24. *Localisation of Industry in India*: By Dr. P. S. Loganathan.
25. *South India of Venkatanatha's Days*: By Mr. C. Sivaramamurthy.
26. *Economic Geography of the Vizagapatam District*: By Mr. T. Appalanarasayya.
27. *The Geographical Evolution of India*: By Mr. T. N. Muthuswami.
28. *Sugar Industry in India*: By Mr. K. C. Ramakrishnan.

A limited number of back issues of the Journal are available at specially reduced prices. The Conference numbers contain papers on various aspects of the Geography of the following Districts:—Coimbatore, Malabar, Madura, Trichinopoly, Anantapur and Salem. They are of permanent value as reference books; and no school or college library in South India can afford to remain without them.

THE TENTH ANNUAL REPORT OF THE MADRAS GEOGRAPHICAL ASSOCIATION, 1935-36

THE WORKING COUNCIL

For 1935-36.

EX-OFFICIO MEMBERS.

President.

Miss Irene H. Lowe, M.SC., F.R.G.S.,
Inspectress of Schools, Coimbatore.

Vice-Presidents.

1. Miss E. D. Birdseye, B.SC.,
   Principal, Wesleyan Mission Girls' High School, Royapettah, Madras.
2. M.R.Ry. Rao Bahadur R. Krishna Rao Bhonsle, B.A.,
3. Miss J. M. Gerrard, M.A.,
   Principal, Lady Willingdon Training College, Madras.

Secretary.

Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.,
Lecturer in Geography, Teachers' College, Saidapet.

Treasurer.

Mr. G. Narayanaswami M.A., L.T., DIP. IN GEO.,
Geography Master, Teachers' College, Saidapet.

OTHER MEMBERS.

1. Mr. George Kuriyan, B.SC. (LOND.),
   Lecturer in Geography, University of Madras.
2. Mr. B. M. Thirunarayanan, B.A., (HONS.),
3. Miss A. Devadasen, M.A., L.T., DIP. IN GEO.,
   Geography Mistress, Lady Willingdon Training College, Madras.
4. Mr. Rao Saheb C. M. Ramachandra Chettiar, B.A., B.L.,
   President, District Educational Council, Coimbatore.

THE TENTH ANNUAL REPORT OF THE MADRAS GEOGRAPHICAL ASSOCIATION, 1935-36.

The Working Council of the Madras Geographical Association has the honour to present the following Report for the year 1935-36:—

Strength.—The strength of the Association at the commencement of the year was 234 as against 290 at the commencement of the previous year. During the year 9 members resigned and 57 members were removed from the list for non-payment of arrears of subscription. 20 new members were enrolled during the year. The strength of the Association on 31-3-36, therefore, stood at 188, including four life members.

The Journal had 160 subscribers during the year as against 172 in the previous year. Of these 82 are official subscribers as against 72 in the previous year; and 78 are member-subscribers as against 100 in the previous year.

Financial position.—The financial position can be seen from Appendix A, which shows that the total subscriptions for the year (including the Journal) amounted to Rs. 1305 as against Rs. 1,600 for the previous year. The Association Fund stood at Rs. 462-13-6 at the beginning of the year and there has been a surplus of Rs. 14-5-5 added during the year, as shown by the Income and Expenditure Account, which brings up the balance of the Fund to Rs. 477-2-11. The total of the Association, Research and Capital Funds at the end of the year amounted to Rs. 783-2-11.

The Working Council.—The Working Council met thrice during the year; and urgent business was transacted by circulation.

A list of the *ordinary meetings* of the Association is given in Appendix B.

The Standing Committee of the Association met five times during the year. In the second meeting, a Questionnaire was prepared regarding the teaching of Geography in the High Schools and Training Schools of the Presidency; and it has been sent to those schools with the permission of the Director of Public Instruction who has ordered the results of the investigation to be communicated to him. In the last three meetings, the scheme of work in Geography for the lower school was discussed; but the work has not been completed.

The Vizagapatam and Coimbatore branches of the Association continued to work satisfactorily during the year. The former organised a successful excursion to Chattikona Falls on the Eastern Ghats; and the latter had some interesting papers read. Of these, *the Noyyal Basin* by Mr. Rao Saheb C. M. Ramachandra Chettiar has been published in Volume X, No. 3 of the Journal of the Association. The paper on the Amaravathi Basin by Mr. C. S. Subburatnam will be published in the issue of April 1936.

The Fifth Summer School of Geography was conducted in the Teachers' College, Saidapet during April 1935, which was attended by 37 teachers (including 3 ladies). A Report of it was published in the issue of the Journal for July 1935. The Working Council feels specially indebted to the following lecturers, who did honorary work in the Summer School:—Messrs. George Kuriyan, B. M. Thirunarayanan, S. Balakrishna Iyer, S. Muthukrishna Iyer, T. Sankara Singh, G. Narayanaswami Iyer and N. Subrahmanyam.

Excursions.—Though there was no major excursion of the Association during the Michaelmas holidays as in the two previous years, there was an interesting excursion in February last to Kambakkam Durgam (2,540 feet) about 50 miles from Madras, in which 25 members (including 3 ladies) participated. A detailed account of it will be published in the Journal for April 1936. The excursion to Chattikona Falls by the members of the Vizagapatam branch has already been noted above.

The proposed *Decennial Celebration* of the Association was decided to be put off to next term, as a result of His Majesty's demise.

In conclusion, the Working Council has to note with regret that there has been no improvement in the set-back noted last year in the strength and financial position of the Association. This was traced partly to the altered position of Geography in the proposed 1934 S. S. L. C. Scheme and partly to the widely prevalent salary cut. It is hoped that with the passing off of these temporary conditions during the coming year, the strength and financial position of the Association will improve.

(By order)

Gopalapuram Cathedral P.O.
Madras, 14th April 1936.

N. SUBRAHMANYAM,
Secretary.

APPENDIX A.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS

Balance Sheet as at 31st March 1936.

Liabilities.			Rs. a. p.
Advance Subscriptions:	Rs. a. p.		
Ordinary Membership	27 7 0		
The Journal	14 0 0		
			41 7 0
Liabilities for expenses:			
Press bill due		..	222 4 9
Capital Fund:		..	300 0 0
Research Fund		..	6 0 0
Association Fund:	Rs. a. p.		
Balance as per last Balance sheet	462 13 6		
Add surplus since	14 5 5		
			477 2 11
	Total	..	1,046 14 8

Assets			Rs. a. p.
Furniture (at cost)		..	120 13 0
Cycle (at cost)		..	45 0 0
Books, Maps & Equipment (at cost)		..	232 8 6
Subscriptions Outstanding:			
Ordinary Membership:			
for 34-35	Rs. 2.		
35-36	„ 141.		
			143 0 0
The Journal:—			
for 33-34	Rs. 10.		
34-35	„ 13.		
35-36	„ 155.		
			178 0 0
Cash & Other Balances:			
Cash to be remitted		..	2 0 0
Balance of Imprest A/c.		..	72 0 1
Balance on S. B. A/c. with Indian Bank Ltd.		..	253 9 1
	Total	..	1,046 14 8

Note:—Articles not included in the above statement and received by the Society in kind will be recorded in a separate inventory.

N. SUBRAHMANYAM,	G. NARAYANASWAMI,	J. M. GERRARD
Secretary.	**Treasurer.**	**Vice-President,**

AUDIT REPORT.

Verified the above Balance Sheet as at 31st March 1936 of the Madras Geographical Association, Madras, with the books of account relating thereto. The statement shows a true and correct state of affairs of the Association as on that date according to the books maintained and in the information and explanations furnished.

G. L. NARASIMHAM, R. A., G. D. A.,

Madras, 6th April 1936.

Registered Accountant,
Auditor.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS

Income and Expenditure Account for the Year Ending 31st March 1936.

Expenditure.

	Rs.	a.	p.
Journal Expenses ..	684	6	9
Stationery ..	8	14	6
Expenses of meetings ..	4	8	0
Conveyance charges ..	51	9	0
Travelling Allowance ..	53	14	0
Cycle License & Repairs ..	8	1	0
Office rent ..	180	0	0
Summer School Expenses: Paid Rs. 10 12 0, Less Opening dues Rs. 8 14 0	1	14	0
Postage ..	165	0	0
Excursions ..	2	0	0
Telephone & sundries ..	2	10	6
Fee to auditor ..	20	0	0
Clerk & Peon ..	87	8	0
Branch Expenses ..	3	0	0
Cost of views, etc. ..	1	9	6
Balance c/d. ..	441	5	5
Total ..	1,716	4	8
Irrecoverable subscriptions written off—			
Ordinary Membership ..	211	0	0
The Journal ..	216	0	0
Surplus (to B. sheet) ..	14	5	5
Total ..	441	5	5

Income.

	Rs.	a.	p.
By Subscription received and Outstanding:—			
Ordinary Membership ..	392	0	0
The Journal ..	913	0	0
„ Advertisement ..	32	0	0
„ Sale of copies of Journal ..	1	3	0
„ V. P. Charges recovered and sundries ..	2	11	0
„ Interest from Bank ..	2	6	8
„ Summer School:			
Fees ..	370	0	0
Hostel rent ..	3	0	0
Total ..	1,716	4	8
By Balance b/d. ..	441	5	5
Total ..	441	5	5

G. L. NARASIMHAM,
Auditor.

G. NARAYANASWAMI,
Treasurer.

N. SUBRAHMANYAM,
Secretary.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS

Statement of Receipts & Disbursements for the Year Ending 31st March 1936.

Receipts.	Rs.	a.	p.	Disbursements.	Rs.	a.	p.
Opening Balances:				**Expenses:**			
Cash to be remitted ..	8	8	0	Journal Expenses ..	562	2	0
Balance of Imprest A|c. ..	2	12	7	Return of "Advance by Secretary for Potage." ..	140	0	0
Balance Indian Bank S. B. A|c. ..	177	3	5	Stationery ..	8	14	6
Receipts:				Expense of meetings ..	4	8	0
Interest from Bank ..	2	6	8	Conveyance ..	51	9	0
Subscriptions:				Travelling allowance ..	53	14	0
Life Membership ..	80	0	0	Cycle License & repair ..	8	1	0
Ordinary Membership ..	332	7	0	Office rent ..	285	0	0
The Journal ..	827	0	0	Summer School:			
Summer School:				Hostel rent ..	3	0	0
Fees ..	370	0	0	Photos, etc. ..	7	12	0
Hostel rent ..	3	0	0	Postage ..	165	0	0
Advertisement ..	32	0	0	Excursions ..	2	0	0
V. P. Charges recovered and sundries ..	2	11	0	Telephone & sundries ..	2	10	6
Sale of copies of Journal ..	1	3	0	Fee to auditor ..	20	0	0
				Clerk & Peon ..	122	8	0
				Cost of Cycle ..	45	0	0
				Branch Expenses ..	3	0	0
				Cost of views, maps, etc ..	26	11	6
				Closing Balances:			
				Cash to be remitted ..	2	0	0
				Balance of Imprest A|c. ..	72	0	1
				Balance with Indian Bank S. B. A|c. ..	253	9	1
Total ..	1,839	3	8	Total ..	1,839	3	8

N. SUBRAHMANYAM,
Secretary.

G. NARAYANASWAMI
Treasurer.

Accounts passed at meeting held on 14-4-36.

J. M. GERRARD
Chairman of E. Committee.

Checked and found correct in accordance with the books.

G. L. NARASIMHAM,
Auditor.

Madras, 6th April 1936.

APPENDIX B.

List of Meetings held in 1935-36.

DATE.	SUBJECT.	LECTURER.	CHAIRMAN.
10- 8-1935	Indian Geography as Key to the Ramayana and the Ramayana as Key to Indian Geography.	Mr. Diwan Bahadur K. S. Ramaswami Sastri.	Prof. V. Ranga charya.
24- 8-1935	Anthropo-Geography of the Dekhan.	Mr. V. R. Ramachandra Dikshitar.	Mr. George Kuriyar
6-11-1935	The Political Geography of the Italo-Abyssinian Conflict.	Mr. V. Venkataraman.	Mr. Joseph Franco.
14-12-1935	The Tourist Industry in the West.	Mr. N. Subrahmanyam.	Miss E. D. Birdseye
25- 1-1936	The Geological Formations of South India.	Mr. P. Sridhara Rao.	Mr. T. N. Muthu sawmi Ayyar.
21- 2-1936	Earthquake and Seismic Activity in India.	Mr. M. Vivekananda.	Mr. T. Sankar Singh
21- 3-1936	The Soils of India.	Mr. B. M. Thirunarayanan.	Mr. N. Subrahmanyam.

The Journal of
The Madras Geographical Association

Vol. 11 | July, 1936 | No. 2.

Proceedings of the Sixth Conference of the Madras Geographical Association, Salem Session May 1936.

The Sixth Conference of the Madras Geographical Association was held in the Salem College on the 7th, 8th and 9th May 1936 under the presidency of *Mr. B. Rama Rao,* M.A., D.I.C., F.G.S., Director of Geology in Mysore.

The opening session of the Conference commenced at 4 P.M. on Thursday the 7th May 1936 at the spacious assembly hall, before a large gathering of members and visitors. *Mr. C. R. Viraraghavacharya, Chairman of the Reception Committee* welcomed the delegates and visitors to the Conference with an address (printed below). *Mr. B. Rama Rao the President-Elect* was then formally proposed as President by Prof. V. Rangacharya (Madras) ; and the proposition was seconded by Mr. Rao Saheb C. M. Ramachandra Chettiar (Coimbatore) and supported by Mr. T. S. Sundaram Iyer (Ambasamudram). After he was installed in the chair, the President delivered his address (printed separately below). After the Presidential Address was over, Mr. N. Subrahmanyam, the Secretary of the Association made a statement regarding its working during the past ten years of its existence, referring to the Summer Schools and Refresher Courses held, excursions conducted, original studies and researches made, the Journal published as its organ, etc. He then appealed for the co-operation of all concerned for the success of the Conference and of the Association. *Prof. V. Rangacharya* then read a paper on " *Salem as the Home of Early Man,*" after which the Conference rose for the day.

The Second Session began at 4 P.M., on Friday the 8th May, when the following papers were read and discussed :—

(i) *The Salem Magnesite Industry* by Mr. H. R. Robinson ;

(ii) *Public Health of Salem District in relation to Environment* by Mr. A. J. George ; and

(iii) *Place-Names of Salem District* by Mr. Rao Saheb C. M. Ramachandra Chettiar.

The Third Session of the Conference met at 8 A.M., on Saturday, the 9th May, when the following papers were read and discussed :—

(i) *Forests of Salem District* by Mr. S. Raghunadha Rao, and

(ii) *Population of Salem District* by Mr. K. Srinivasaraghavan.

The Concluding Session of the Conference commenced at 2 P.M. on the same day, when Mr. N. Subrahmanyam read a paper on *the Communication-lines and Town-sites of Salem District.* After it was discussed, the following papers were taken as read for want of time :—

(i) *The Physiography of Salem District* by Mr. K. S. Chandrasekharan ;

(ii) *The Geology of Salem District* by Mr. P. Sridhara Rao ;

(iii) *The Meteorology of Salem District* by Mr. C. K. Anantasubrahmanyam ;

(iv) *The Agricultural Geography of Salem District* by Mr. N. R. Sundaram Ayyar ;

(v) *The Cattle of Salem District* by Mr. R. W. Littlewood ;

(vi) *The Urban Geography of Salem* by Mr. R. Dann ;

(vii) *Salem and Other Towns of the Tamil Region* by Mr. B. M. Thirunarayanan ; and

(viii) *The Shevaroys Region* by Mr. V. Natarajan.

The President then delivered his concluding address, in the course of which he said :—" Several interesting papers of varied interest have been read at this Conference during the last three days ; and many experts have dealt with several important aspects of the Geography of the Salem District. I was personally much interested in the paper on the Magnesite Industry as well as in some others ; and all the papers were very interesting even to me, an outsider. I thank the authors of them all for having contributed in no small measure to the success of this Geographical Conference. I am also thankful to the Reception Committee and the S.I.T.U., for enabling this session to be held here."

Mr. C. R. Viraraghavacharya, the Chairman of the Reception Committee, in proposing vote of thanks, spoke as follows :—" We are under a deep debt of gratitude to Mr. B. Rama Rao for having graced this occasion by readily consenting to preside over this Conference in such a successful manner. It is really very kind of him to have chosen to exchange the pleasant weather of Bangalore for the last three days for the scorching heat of Salem. It is his great academic interest and goodness of heart that have made him do so. I have great pleasure in proposing a hearty vote of thanks to Mr. Rama Rao for so ably conducting the Sixth Geographical Conference to success.

" In this connection let me also couple the name of Mr. N. Subrahmanyam, the very heart and soul of the Madras Geographical Association, to whose dynamic energy the success of this Conference is in no small measure due. In spite of his selfless work for the last ten years, Geography has not yet been given the place that it deserves in the educational systems of South India. I fear that people in this country have not yet realised the importance of the subject. Still, even the present position of it in the S.S.L.C. Scheme and the University is the result of his persistent activities. The thanks of all lovers of Geography are due to him for all this work as well as for the successful organisation of this Conference."

In proposing a vote of thanks on behalf of the Association, *Mr. N. Subrahmanyam,* the Secretary spoke at some length on the nature and scope of Modern Geography and its position abroad ; and then appealed to all the teachers of Geography to join the Association in large numbers and help to strengthen it, so that they might themselves reap the fruit thereof. He then said :—" Let me thank the ever-vigilant Chairman of the Reception Committee, Mr. C. R. Viraraghavacharya, and its energetic Secretary Mr. D. J. E. Collins as well as the whole Committee for making excellent arrangements for the comfort and convenience of the President and delegates during the past three days. We are also thankful to the General Secretary of the S.I.T.U. Conference Mr. A. V. Sundaresan, who co-operated with the Reception Committee in the general arrangements of the Conference.

On behalf of the delegates, *Mr. K. N. Pasupathi Iyer* (Kurnool), thanked the Reception Committee for all the arrangements made by them for the convenience of the delegates, and suggested that in organising future Conferences steps may be taken to avoid overlapping of meetings so that it may be possible for delegates to attend all the important functions and meetings connected with the several Conferences, that were conducted side by side.

The President then declared the Conference dissolved

Welcome Address.

By

MR. C. R. VIRARAGHAVACHARYA,
Chairman of the Reception Committee

LADIES AND GENTLEMEN,

By the grace of the Almighty, we, the citizens of this historic place, have this day the rare opportunity of extending our sincere and most cordial welcome to you all, who have come from different and distant educational centres of this Presidency at the heavy sacrifice of your time and energy, especially at this time of the year, when you hope to enjoy rest and recoup your health by resorting to some comfortable sanatorium of your own choice. We take special pride and pleasure in according our whole-hearted reception to so many gentlemen earnestly and actively interested in the advancement of the cause of education.

Indeed, we are fully aware of our defects and drawbacks on account of our meagre means and poor arrangements to meet adequately even the ordinary and essential needs for your comfortable stay here. But you will be immensely pleased to learn that we are second to none in our earnestness and enthusiasm and in our utmost endeavour to give you our very respected friends all the amenities that will serve to make your stay here a happy and cherished memory.

You have—I am conscious of it—very responsible work before you demanding your careful attention and profound study. It is not an ordinary meeting of a routine nature, but it is one of paramount importance in that it has drawn together men of high culture, varied experience, and great influence. And it is an assemblage of gentlemen who are so proficient and so authoritative that their expert knowledge will serve well in arriving at solid resolutions commanding the fullest respect from all quarters. Are we not therefore entitled to lay claim to a special pride, and say it is our good fortune to meet so many eminent scholars in this city of ours ?

We are truly grateful to you, and we know it well that you do not mind our short-comings. On the other hand you are reverently looking up to that high and noble cause. I mean the just purpose of proper education and the right programme for its dissemination among the masses.

It is needless to point out that scientific education is the pride of modern days. The pinnacle of its glory is visible all round. I do not now propose to discuss it. No doubt it is for us all to make the best use of it; and each one of us should eagerly look forward to the times when it will be the only order of the day. But alas! I for one weep over the misuse of the products of scientific inventions for all the miserable havoc perpetrated nowadays under the masquerade of civilization. Still our respect for scientific education is very great, and our admiration for the many-sided activities in the exploration of the virtues imbedded in and inborn of Nature is ever more increasing.

From day to day are we not progressing in our researches in Physics, Chemistry, Astronomy, and in one and all the departments of human knowledge? It is my belief that we are getting nearer and nearer to Divinity through the medium of science.

You will not be surprised when I proceed to assert that History and Geography have enabled men to learn a great deal about this world of ours. The one is the handmaid of the other. I say emphatically that more importance has to be attached by one and all of us to the Study of Geography in our Schools than at present and that, without it, the study of History or for that matter, of any other subject becomes next to useless. The other day our Director of Public Instruction, Mr. R. M. Statham, in his address at the opening of the Summer School of Geography in the Teachers' College, said that he was sorry to find that even graduates lacked in their powers of observation and general knowledge, because they did not learn Geography in the real sense, and to the full extent they ought to.

It is really deplorable that I have noted in my experience as the Manager of a High School in intimate touch with the progress of the pupils that some of them, even in the higher forms, blundered when they were asked to state where London is, and where Calcutta is; and so on and so forth; and I am aware of quite a large number of such illustrations. Well, last year I went through the Examiners' Report on the S. S. L. C. Examination, and I found therein very amusing specimen howlers. Every one of you connected with the High Schools should have shuddered to go through those answers. The managements, therefore, are bound to make special arrangements for the teaching of geography. General in and around Yercaud, can well compare with that afforded by the finest landscape of the English country-side.

About 25 miles from here you have got the famous seat of Agastya Maharishi—I mean the Kolli Hills, and on the way you have several other spots worth seeing. The water you drink now comes from the lake near Panamarathupatti village nearly 7 miles from here. The lake is surrounded by hills on three sides and on the fourth an artificial embankment has been raised. The rain water flooding down the hill-slope is perennially stored up in the lakes. The purified water is made available at Salem on the simple hydrostatic principle of water flowing from a higher to a lower level. This water supply scheme is maintained by our Municipality at a very heavy cost, and you will be glad to know that we have also been assured of drinking-water from the Cauvery at Mettur where a huge Dam has recently been built up. It is this Dam which to-day stands as the proudest demonstration of Engineering skill, and which attracts the curiosity of innumerable travellers from all parts of India. This wonderful feat of human skill has been achieved at a cost of nearly five crores of rupees. The place can be reached both by bus and by train on a payment of a few annas. I can assure you that your stay there will be very pleasant. Mr. H. F. Saunders when he came there a few months back to preside on the occasion of the Silver Jubilee of the Government Training School, exclaimed expressing his great wonder at the sight of the colossal dam and appreciated the marvellous performance of its engineers. He went on to say that the pupils and teachers, and as for the matter of that every one who visits the place, have much to learn from the dam about regularity, discipline, systematic methods, prudence and caution. The Dam is there to show how man's hand can regulate and discipline Nature to make her yield her full benefits, and how a huge wastage can be turned into a great boon by the proper use of our skill and intelligence. I have given at the end a comparative statement of figures relating to the various celebrated dams in the world, and you find that of all the dams in the world that at Mettur is the biggest; and it has been given to us, Salemites to be proud of it.

I would also draw your attention to a very beautiful waterfall in our district called the Hogainakal Falls which is a little more than 50 miles from here. It is near Pennagaram in the Dharmapuri Taluk, and is to be reached through a long forest range. There you find that a huge piece of stone has been split up into two, and through a very narrow crevice the entire bulk of the Cauvery water gushes and falls down a considerable depth in a slender, silvery column upon the rocks below, and produces a cloud of spray which, rising to the top, gives the impression of smoke. Hence the name of "Hogainakal" meaning "smoking rock." Legend has it that precisely at this spot Brahma performed his wonderful "Homa," and there is a beautiful shrine near the spot as well as a choultry.

Our district consists of 9 taluks, namely, Salem, Namakkal, Trichengode, Dharmapuri, Krishnagiri, Harur, Attur, Omalur and Hosur. Of these the last named deserves special mention in that, lying as it does on the extreme north-west near the Mysore border, it was once a Capital. It has got the remnants of a fort and possesses a genial climate. At Sankari and Attur we have the relics of ancient fortresses which go to show the unusual prosperity and wealth of those who built them, and ruled over this part of our country in those olden days. You will certainly wonder to see the skilful workmanship of our ancient sculptors in the temples both at Taramangalam and at Ayodyapatnam, the one 12 miles away from this place and the other nearer still, being only 5 miles away.

Of places of pilgrimage we have not many to boast, but a couple of them I can name have been, from time immemorial, regarded with great deal of sanctity. The two notable places are Trichengode and Namakkal. At Trichengode the deity is curious and remarkable. It is that of Ardhanareeswara who is represented as half-male and half-female. Though apparently it may signify nothing, you will be surprised to note, if you reflect upon it, that the deity symbolizes a profound philosophical notion. The female-part stands for custom, and tradition, and the male-part for originality and the creative tendency. The one mechanically adheres to the beaten track, while the other wanders in quest of new grounds and explores new regions. A co-operation of both these two diametrically opposed principles is essential for carrying on our existence. Indeed we have to stick up to tradition, but we should also proceed on a constructive programme for the improvement of human civilization. This idea was very beautifully explained by Mr. S. V. Ramamoorthi, I.C.S., our District Collector, in his own inimitable language, in his address to the students on the occasion of the anniversary of the Literary and Debating Society of the Gokulanatha Hindu Mahajana High School, Salem.

In conclusion, it is my desire to welcome you all for deliberation over the several aspects of the study of Geography in general and, in these sessions I am confidently looking forward to great success, as we are this time specially fortunate in having the able guidance of so great a scholar as Mr. B. Rama Rau. It is needless for me to say that Mr. N. Subrahmanyam, the life-spring of this Geographical Association has not only sacrificed a great deal for the cause of this movement but also has been wholly responsible for the wonderful work of the Geographical Association. I am proud in no small measure to say that we have to-day these two stalwarts amidst us, and I congratulate myself in having had this unique honour to welcome them and to welcome you all on behalf of the Reception Committee of this Geographical conference.

	Name of Dam.	Cost in Lakhs.	Masonry contents. Millions. c. ft.	Water storage capacity. (Millions. c. ft.)	Period of constr.
1.	Aswan (Egypt)	367	18·8	37,600	4
2.	New Croton (America)	212	23·1	5,120	14
3.	Sennar Dam (Africa)	847	14·8	22,560	7
4.	Krishnaraja Sagara (Mysore)	250	29·9	43,934	16
5.	Nizam's Sagar (Hyderabad)	366	30·1	25,556	7
6.	Lloyd Dam (India)	172	21·5	24,198	6
7.	Mettur Dam (S. India)	478	54·6	93,500	6

Presidential Address.

Geological History of the Indian Peninsula.

By

MR. B. RAMA RAO, M.A., D.I.C., F.G.S.

LADIES AND GENTLEMEN,

When I received in February last, the Secretary's kind invitation to preside over this function, the Sixth Geographical Conference, I very much hesitated to accept it since being almost an alien to academic activities, I could not presume to have any claim to guide the deliberations of a gathering like yours. But on further reflection I agreed to accept the offer not in the belief that I could, in any way, be a worthy successor to the eminent educationists who have preceded me in this office, but with an idea that occasions like these are the best means of furnishing opportunities to bring together, on a common platform votaries of allied subjects of study, to discuss and understand each other's aims and aspirations in the common pursuit of knowledge. So while thankfully accepting the proffered seat of honour, I request your hearty co-operation in leading this Conference to its successful ending.

STATUS OF GEOGRAPHY AMONG OTHER SCIENCES.

Geography, as its name implies, is the systematic description of this earth in all its various aspects and consequently the task which it (geography) sets to itself is of a very great magnitude. The geographer has to ascertain, record, and compare, the arrangement of things on or in relation to the surface of the earth and interpret values. This cannot be done without an adequate knowledge of other borderland branches of learning and without borrowing material therefrom. How much of this heteregeneous storehouse of information should form the nucleus for imparting instruction to students and how best to do it in their scholastic and collegiate courses of studies are certainly matters for discussion and in some of your previous conferences this aspect of the question seems to have been already ably dealt with. I have no intention of going into these details nor do I like to discuss here the precise position which the teaching of geography should occupy among other sciences as an avenue for mental equipment. To elevate geography to the dignity of a science would have been repugnant to the straitened code of understanding of the older school of educationists. In fact, for a long time geography had to rest content with a secondary position among other sciences and was tolerated only as an adjunct to some other favoured branches of learning. This, in a large measure, was due to the belief that geography has no independent existence as a definite science ; that it is mainly synthetic deriving its data largely from other bordering sciences like geology, meteorology, anthropology, oceanography etc., which it co-ordinates and moulds to serve its own purpose.

I should say that this is an underserved accusation. The mere fact of borrowing material from borderland branches of studies need not deter any science from claiming its own independent status so long as it fulfils a definite function. As Lord Meston has argued elsewhere, " the material which geography indents on is already there for the service of human knowledge generally, just as mathematics is at the service of astronomy, or physics and chemistry at the service of geology. Morever, there is none of the bordering sciences which is prepared to undertake the tasks which Geography has set for itself. The positive claim of geography is that, while always indenting freely on existing sources of knowledge it is building up for itself, sifting and classifying, a body of knowledge which is found nowhere else and which has a unity of its own and a purpose of its own. This purpose is claimed to raise geography to the dignity of a definite science."

With the present day rapid advancement of sciences, the barriers which separated one branch of learning from another are fast breaking down and disappearing. The results of scientific investigation cannot be shoved into pigeon-holed compartments and a seeker after truth cannot rest content with isolated values. A coordination and correlation of results of allied sections of study are necessary to get a true perspective of the sum total of human knowledge. When geography sets to do this necessary task, within its own sphere, there is no justification in cavilling at its efforts or in trying to exclude it from the common fold of natural sciences.

In the British Association for the advancement of science, Geography had to share with Geology a single section at the beginning for some 16 years, from 1835-1851, but in the latter year, Sir Roderic Murchison, one of the great geologists of his time, strongly put forth a plea for an independent section for geography and became himself its first president when it was newly constituted. The Indian Science Congress which is modelled after the British Association, had till very recently no place for geography, but from the last session, I am glad to say it has admitted geography as an adjunct to the geology section. It was rather disappointing to me, as the President of the newly constituted section, to see that there was no representation of your Association therein. Perhaps it was due to the absence of your enthusiastic Secretary from India, and also in no small measure due to the short notice the members of your Association had regarding the reconstitution of the geology section of the Congress.

From next year onwards, I hope your Association will be well represented in the combined section of Geology and Geography of the Science Congress and I dare say that within the course of a few years your activities therein will so multiply as to claim a separate section for geography alone.

TOPIC OF ADDRESS

In spite of the unrestricted privilege of the President of a Science association to choose his own topic of discourse, I have not been without some dilemma to select a subject suitable to this occasion. Philosophers like Kant have classified the geographic studies into Mathematical, Physical, Political, Commercial, Moral and Theological divisions. Amongst these geology's kinship with geography comes very close only on the physical side which again could be broadly divided into (1) General: dealing with the earth and its constituents, land, water, and air: (2) Special, which deals with particular products of the earth—animals, plants and minerals. To address an audience of geographers, a geologist has naturally to choose some topic either from the one or the other of the two broad divisions of physical geography.

For the last 20 years I have been specially interested in the genetic study of a particular section of the earth's oldest series of rocks, the Archæans. The results of these investigations have already formed the topic of my address to the geology section of the last Science Congress and I did not like to inflict on you an address dealing with highly specialised phases which at the best would interest even among geologists only a limited section.

The best thing which I could do under the circumstances was either to give you in broad outlines the history of the vicissitudes which this land of ours has undergone during past ages before it assumed its present form, or to give you an account of the geographical distribution of our mineral wealth as contained in the several rock formations of the Peninsular India.

The first one perhaps has the smack of a bit of staleness about it in having become a sort of common ground for geologists to exploit for their popular lectures, and the latter labours under the disadvantage of bordering on too many dry and technical details. Between the two, I should think that the subject of the ancient geography of the Indian Peninsula as inferred from a study of its geological formations is likely to be more interesting and despite the fact that the edge of novelty of this subject might have been somewhat blunted by too many handlings, still I think it is a story worth listening to.

As a compromise, I will supplement it while passing over the several geological epochs, by mentioning the various economic minerals which the several rock formations contain. The subject no doubt would have a geological flavour, but I will try to avoid as far as possible superfluous technical details.

SOME GENERAL PRINCIPLES OF GEOLOGY

For the benefit of those who might not be familiar with the general principles of geology, I should like to say a few words regarding the geologists' conception about the age and origin of the earth, and the way in which they reconstruct the past history of the globe.

There are two diametrically-opposed views on the question of the probable mode of origin of the earth. One school of thought have held to the hypothesis that the earth was formed as a result of gradual cooling of a large gaseous globe, a nebula ; the other, a more recent one led by Chamberlain and other American geologists, postulate that it was formed from the continued accretion of colder solid particles or planetisimals. The nebular or Laplacian hypothesis regards that the earth was intensely hot at first and by gradual radiation of heat into space condensed later into liquid with the formation of a peripheral solid crust, and further continual loss of heat resulting in the volume shrinkage of the globe. It is clear that according to this view the earth had from its earliest age an enormous envelope of atmosphere. The planetisimal hypothesis on the other hand, regards that the earth started as a nucleus of meteoric matter without any atmospheric envelope, the occluded gases expelled from the interior escaping into space. But when the planet grew in size, the expelled gases formed later into oceans and atmosphere when the gravitational attraction of the growing planet became sufficiently strong to retain them. The interior heat of the globe is regarded to have been developed as a result of central compression, molecular re-arrangement, bombardment of meteoric matter and such other causes.

In whichever of these ways the earth might have originated there is no doubt about its enormous antiquity. Recent investigations by radio-active methods involving the estimation of uranium-lead ratios, and the uranium-helium ratios, have been disclosing that some of the archæan granitic rocks are as much as 1,500 to 3,000 million years old, and as these are found intruding into a series of pre-existing rock formations evidently the age of the earth must date back still considerably further.

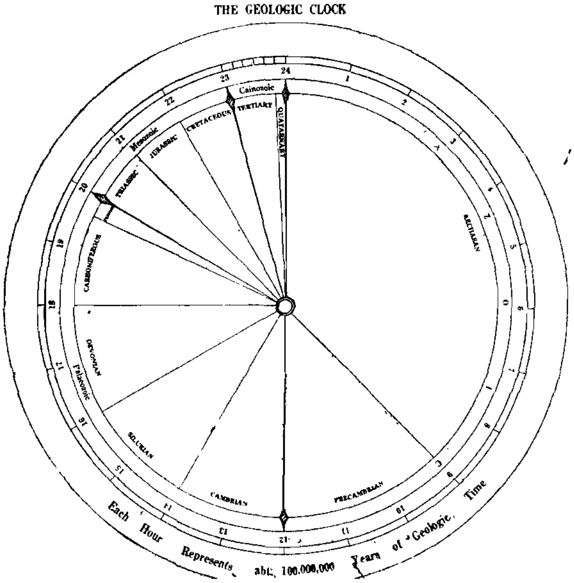
Without troubling ourselves regarding the precise order of evolution of conditions which led to the present formation of the globe with its lithosphere, hydrosphere and atmosphere, we can safely infer that since the time that the constituents of the planet differentiated into solid rocks with fluidal environments, destruction of land masses has set in and the broken debris has been transported and laid down in the adjacent basins of water, layer after layer, like the leaves of a book. It requires but little thought to perceive that in the normal order of superposition of such layers of strata, the lowest formed should naturally be the oldest. But the earth has not been a finished product; and the story of the stone does not end with this single chapter. In every 150 million years or so, it passes through a period of convulsion. Various causes bring about constant changes in the relative levels of land and sea. Portions of land get submerged beneath the sea, and the sea bottom will often be lifted high and dry to form land masses, which again will be worn down to furnish material for a fresh series of sedimentation elsewhere. Such alternate elevations and depressions of land areas beneath the sea will thus be responsible for the formation of sedimentary beds of different periods or ages.

For nearly half the period of its existence the conditions on earth seem to have been unsuited for the support of life. Then we see the gradual incoming of different types of fauna and flora, each playing its part for several generations and disappearing in its time from the stage of this earth's history. Fortunately these ancient denizens of the earth have left their relics in the rocky strata. The geologist has found that a certain order of appearance characterises these organic remains, that each group of rocks is marked by its own special type of life, and that these types can be recognised and recorded and the rocks in which they occur can be correlated as of the same period of formation even though they may be far distant from one another. At one moment he may have to deal with the bones of some large mammal scattered through a deposit of superficial gravel, at another with minute shell or skeletons of foraminifers of an upraised sea-bottom. Corals and crinoids crowded into a massive limestone, ferns and cycads matted together into a bed of coal where they originally grew, the trails of worms, the footprints of birds and quadrupeds and such other innumerable pieces of evidence enable the geologist to visualise in some measure what the fauna and flora of successive periods have been and the physical conditions under which they flourished. A careful study of this self-written record, though often incomplete and effaced, affords still the clue to the stratigrapher to reconstruct the earth's history during the several stages of its formation. By a comparative study of the arrangement of strata over wide areas, and on the recognition of major breaks in deposition and in the stages of organic evolution, the geologists have classified, for purposes of description, the entire strata of the earth into four major epochs or eras, based on the evolution of life, as noted below : —

Cainozoic or Cenozoic	..	Meaning of the life of Recent period.
Mesozoic	..	Life of the Intermediate period.
Palaeozoic	..	Life of the Old period.
Azoic or Archæozoic	..	Lifeless period or Ancient Life period.

If we conceive of the time taken for the evolution of this globe from the commencement to the present, as a day of 24 hours, it is

THE GEOLOGIC CLOCK

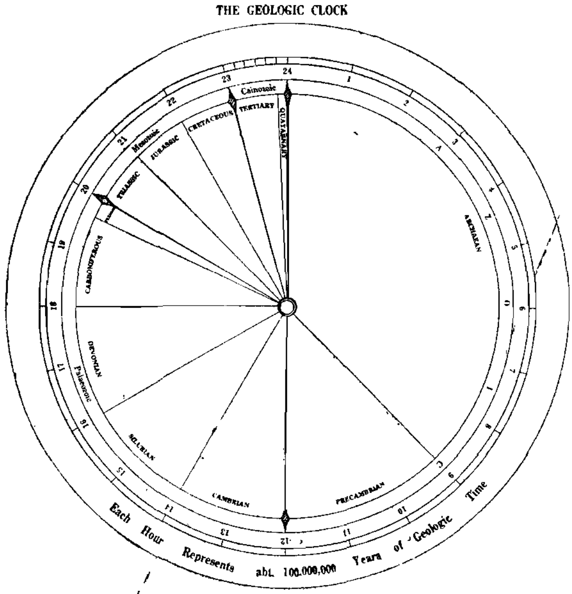


an upraised sea-bottom. Corals and crinoids crowded into a massive limestone, ferns and cycads matted together into a bed of coal where they originally grew, the trails of worms, the footprints of birds and quadrupeds and such other innumerable pieces of evidence enable the geologist to visualise in some measure what the fauna and flora of successive periods have been and the physical conditions under which they flourished. A careful study of this self-written record, though often incomplete and effaced, affords still the clue to the stratigrapher to reconstruct the earth's history during the several stages of its formation. By a comparative study of the arrangement of strata over wide areas, and on the recognition of major breaks in deposition and in the stages of organic evolution, the geologists have classified, for purposes of description, the entire strata of the earth into four major epochs or eras, based on the evolution of life, as noted below :—

Cainozoic or Cenozoic	..	Meaning of the life of Recent period.
Mesozoic	..	Life of the Intermediate period.
Palaeozoic	..	Life of the Old period.
Azoic or Archæozoic	..	Lifeless period or Ancient Life period.

If we conceive of the time taken for the evolution of this globe from the commencement to the present, as a day of 24 hours, it is

THE GEOLOGIC CLOCK



believed, that the history of Archæozoic or Azoic period alone has taken away more than 12 hours of the conventional clock, the palæozoic period about 8 hours, the mesozoic period about 3 hours, and the tertiary of about an hour. In the tertiary the recent period from the advent of man forms only the last 10 to 15 minutes of the hour (Pl. 1). The major eras have been divided into a number of systems ; and each of these systems has been further sub-divided into formations, stages and so on. The geologists in India following the classification proposed by Sir Thomas Holland, one of the former Directors of the Indian Geological Survey, adopt the following four major groups for their descriptive purposes :

(1) The Aryan Group ;
(2) The Dravidian Group ;
(3) The Purana Group ; and
(4) The Archæan Group.

Except the Archæan group, the remaining three do not correspond exactly in time-scale to the major eras mentioned before.

The sub-divisions of the four major groups of India are as far as possible correlated with the several chronological systems of rock

Table of Geological Formations

Eras	Periods or Systems on the Standard Scale of Europe		Equivalent Formations of Peninsular India
Cainozoic	Pleistocene and Recent	ARYAN	Recent Alluvia-Sand dunes Etc., Kurnul Cave Deposits, Older Alluvium.
	Pliocene		Laterite
	Miocene		Cuddalore Sand Stone and Cuddalore Series
	Oligocene		
	Eocene		Deccan Trap
Mesozoic	Cretaceous		Marine Cretaceous of Trichinopoly, Bagh beds Etc
			Upper Gondwanas, Marinebeds of East Coast
	Jurassic		
	Triassic		
Palaeozoic	Permian		Lower Gondwanas
	Carboniferous	Dravidian	Absent
	Devonian		
	Silurian		
	Ordovician		
	Cambrian		
Archeozoic	Algonkian	Purana	Vindhyans—Kurnul Series
			Cuddappahs, Bijawars, Cheyairs Etc
	Archean	Archean	Dharwars, Champaners, Aravalis Etc.
			Intrusive Granitic Gneisses

formations of the standard scale of Europe, as shown in the annex ed statement (Table 1).

THE ARCHÆAN PERIOD

The geological record of the oldest period of Southern India in common with that of similar rock formations of the rest of th world, is highly mutilated and its first few pages are hopelessl singed and scorched. Our book of ancient geography of this lan opens at the chapter when the earth as a whole was in throes c intense vulcanism. The oldest recognisable rock groups of thi period, the Archæan era, constitute a series of highly crumple schists and gneisses massed into a confused jumble rendering th task of their separation into recognisable stratigraphic units almos impossible. The earlier view, that on the solid basement of graniti gneisses, believed to constitute, at least in parts, the original crust c the primitive globe, the oldest series of sediments, the Dharwa schists, were laid down, is discredited at present. The detailed wor of the geological survey of Mysore during the past forty years ha clearly shown that the base on which the schistose sediments firs formed is unrecognisable and that the various granites which ar lying under them are actually of later ages. The available eviden ces indicate that the Dharwar period opened with a tremendou igneous activity with the outpouring of vast masses of lava flow of varying composition, mainly basic followed by thin sheets c acidic flows. Their cooling and contraction gave rise locally t numerous fissures through which have welled up wall-like masse of acidic dykes. As I have stated above, the nature of the base o which these lavas were poured out has not been recognised till nov and it has been found to be the same case in every other land wher the archæan rocks are exposed.

These consolidated volcanic flows with their associated dyke were later subjected to decay and furnished material to the adja cent basins for the deposition of the oldest series of sediments re cognisable. The process of this sedimentation was cut out by th lifting up of the floors of the ancient shallow basins as a result c propulsion of a series of granitic rocks from the interior of the pr mitive earth. The earlier geologists of the Mysore Survey, postu lated four different epochs of such intrusions, but recent wor indicates only 2 clearly distinguishable periods. Some of the gra nites of the older epoch of intrusions are found to be the progenitor of the valuable auriferous lodes of the Dharwar schists, amongst which those of the Kolar Gold Field have already yielded the noble metal to the tune of 18 million ozs. valued at about 79.5 millions of £. As a digression I might tell you that the magnitude of underground work which has been done till now to wrest this metal from the bowels of the earth amounts to some 435 miles in the shape of horizontal levels or galleries. The shafts and winzes sunk at different spots aggregate to about 30½ miles and the deepest part reached is now some 7,700 ft. or nearly a mile-and-a-half below the field datum.

The various granitic intrusions have eaten away the base of the older rocks and resting beneath them give the appearance of a false basement. But evidences are clearly seen at numerous places to indicate that they have disrupted and torn asunder the overlying schists producing such complex changes in their constitution and appearance that it is now no easy task to recognise the several shattered members torn apart from the same band.

The earlier geologists in Mysore believed that after two of such epochs of intrusion of the granitic rocks into the older schists, there was again another series of intrusion of a peculiar type forming a complex series of rocks, which I daresay, many of you are familiar with. These are the well-known charnockites. Recent investigations disclose that instead of being subsequent in age to the main masses of the granitic rocks of Southern India, they are considerably older than such granites and that they might even represent a highly altered phase of the older section of a mixed assemblage of rocks of the Dharwar period.

The older school of Geologists in Mysore doubted the sedimentary origin of the Dharwar schists, but recent investigations have given us sufficient proofs to believe that though the Dharwar Age represents mainly an era of vulcanism, there were certainly intermittent periods of sedimentation; but it is still not definite how many times the land of this ancient Age had been actually submerged beneath the water.

The exact configuration of land and water of this ancient epoch is difficult to ascertain. Probably during this oldest period of the earth's history, deep seas and oceans had not been developed, and land and water formed a sort of network of shallow disconnected basins and gently sloping mounds throughout. At the end of the period, that is to say, with the formation of the huge masses of formations of the standard scale of Europe, as shown in the annexed statement (Table 1).

THE ARCHÆAN PERIOD

The geological record of the oldest period of Southern India, in common with that of similar rock formations of the rest of the world, is highly mutilated and its first few pages are hopelessly singed and scorched. Our book of ancient geography of this land opens at the chapter when the earth as a whole was in throes of intense vulcanism. The oldest recognisable rock groups of this period, the Archæan era, constitute a series of highly crumpled schists and gneisses massed into a confused jumble rendering the task of their separation into recognisable stratigraphic units almost impossible. The earlier view, that on the solid basement of granitic gneisses, believed to constitute, at least in parts, the original crust of the primitive globe, the oldest series of sediments, the Dharwar schists, were laid down, is discredited at present. The detailed work of the geological survey of Mysore during the past forty years has clearly shown that the base on which the schistose sediments first formed is unrecognisable and that the various granites which are lying under them are actually of later ages. The available evidences indicate that the Dharwar period opened with a tremendous igneous activity with the outpouring of vast masses of lava flows of varying composition, mainly basic followed by thin sheets of acidic flows. Their cooling and contraction gave rise locally to numerous fissures through which have welled up wall-like masses of acidic dykes. As I have stated above, the nature of the base on which these lavas were poured out has not been recognised till now, and it has been found to be the same case in every other land where the archæan rocks are exposed.

These consolidated volcanic flows with their associated dykes were later subjected to decay and furnished material to the adjacent basins for the deposition of the oldest series of sediments recognisable. The process of this sedimentation was cut out by the lifting up of the floors of the ancient shallow basins as a result of propulsion of a series of granitic rocks from the interior of the primitive earth. The earlier geologists of the Mysore Survey, postulated four different epochs of such intrusions, but recent work indicates only 2 clearly distinguishable periods. Some of the granites of the older epoch of intrusions are found to be the progenitors of the valuable auriferous lodes of the Dharwar schists, amongst which those of the Kolar Gold Field have already yielded the noble metal to the tune of 18 million ozs. valued at about 79.5 millions of £. As a digression I might tell you that the magnitude of underground work which has been done till now to wrest this metal from the bowels of the earth amounts to some 435 miles in the shape of horizontal levels or galleries. The shafts and winzes sunk at different spots aggregate to about 30½ miles and the deepest part reached is now some 7,700 ft. or nearly a mile-and-a-half below the field datum.

The various granitic intrusions have eaten away the base of the older rocks and resting beneath them give the appearance of a false basement. But evidences are clearly seen at numerous places to indicate that they have disrupted and torn asunder the overlying schists producing such complex changes in their constitution and appearance that it is now no easy task to recognise the several shattered members torn apart from the same band.

The earlier geologists in Mysore believed that after two of such epochs of intrusion of the granitic rocks into the older schists, there was again another series of intrusion of a peculiar type forming a complex series of rocks, which I daresay, many of you are familiar with. These are the well-known charnockites. Recent investigations disclose that instead of being subsequent in age to the main masses of the granitic rocks of Southern India, they are considerably older than such granites and that they might even represent a highly altered phase of the older section of a mixed assemblage of rocks of the Dharwar period.

The older school of Geologists in Mysore doubted the sedimentary origin of the Dharwar schists, but recent investigations have given us sufficient proofs to believe that though the Dharwar Age represents mainly an era of vulcanism, there were certainly intermittent periods of sedimentation; but it is still not definite how many times the land of this ancient Age had been actually submerged beneath the water.

The exact configuration of land and water of this ancient epoch is difficult to ascertain. Probably during this oldest period of the earth's history, deep seas and oceans had not been developed, and land and water formed a sort of network of shallow disconnected basins and gently sloping mounds throughout. At the end of the period, that is to say, with the formation of the huge masses of granitic rocks of the two separate epochs of intrusion, the whole of Southern India had become one solid land mass.

The relics of these ancient formations are now found preserved as disconnected patches in several parts of India, for instance, in the Dharwar district and the north-western parts of Mysore, and also in the Aravalli region, in the neighbourhood of Champaner in Gujerat, in the Central Provinces and in the neighbourhood of Darjeeling, in the Himalayan region.

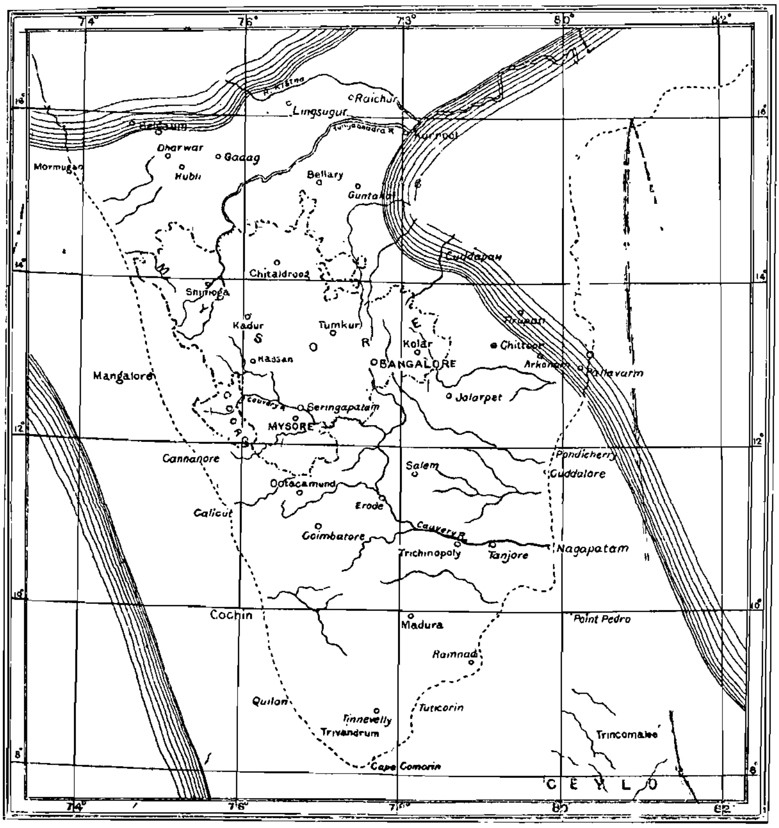
In spite of all the recent advances of geological studies, the task of arranging in logical sequence the detached bits of evidences, skilfully extracted from the highly-defaced pages of the history of these ancient rocks, is still left incomplete and uncertain. Therefore a piece of evidence here and a bit of clue there which might occur as the connecting links in the severed chain of events of this ancient era, when freshly discovered give the students of Archæan geology, a greater thrill than what Sherlock Holmes could ever have experienced in hitting on the right trail of the most elusive of his criminal characters.

It is not merely in furnishing ample scope for the abstruse disquisitions of the learned few that the interest of this ancient period lies. The various igneous intrusions of this hoary past have been responsible in some way or other for the collection within these ancient rocks of almost all the mineral wealth of India. To mention a few, the gold of Kolar in Mysore ; the manganese ores of Central Provinces, Madras, Bombay, Mysore and other parts ; the iron ores of Singbhum and Southern India ; the chromite deposits of Mysore ; the copper ores of Singbhum and the Carnatic ; the magnesite deposits of Salem and of Mysore ; the graphitic deposits of Travancore ; the mica deposits of Bihar and Nellore and the monazite, ilmenite, garnet and zircon sands of Travancore all owe their source to the archæan rocks.

At the closing of the Archæan era there were extensive earth movements which crumpled the Dharwar schists with their associated igneous intrusives into complicated wrinkles resulting in a number of mountain ranges. No such powerful crustal deformation of an equal degree of magnitude has ever occurred since then in the peninsula and from the close of the Dharwar period, the Mysore plateau and all but the marginal fringes of Southern India have remained as a solid mass of land subjected only to sub-aerial decay. The various denuding agencies since then have been gradually carving the central portion of Southern India into its present physiographic features.

THE CUDDAPAH PERIOD

After a vast interval, extending perhaps over a thousand million years, during which time the mountains and plateaux of the ancient Dharwar land had been cut down to the base level of erosion, a part of the land area was submerged beneath the sea to receive the next succeeding series of sediments of the Cuddapah system. In the ancient Cuddapah sea, the deposition went on undisturbed for



a long time giving rise to an accumulation of sediments of very great thickness, amounting to some 20,000 ft. This huge accumulation of sediments forming a series of parallel strata, is capable of being split up into two stratigraphic groups—a lower and an upper. During the formation of the lower group, the Papaghni series, there were still intermittent stages of igneous activity giving rise to a number of volcanic flows, and intrusive dykes and sills. The large number of dolerite and dioritic dykes which cut across the Archæan tracts in Mysore and in Southern India are believed to be of this period of vulcanism.

In Southern India, the rock formations of this period are exposed in the Cuddapah and Kurnool districts forming an irregular crescent. The concave part of the crescent faces the coast and the convex part abuts against the granitic gneisses on the west.

The remnants of the upper division of the Cuddapah formations are found scattered widely further north, in other parts of Peninsular India : in the Bijawar, Cheyair and Gwalior areas. There has been considerable indications of volcanic activity in all these series of rocks, and the dykes associated with the basic flows in the Bijawars are believed to have been responsible for the formation of the Indian diamonds.

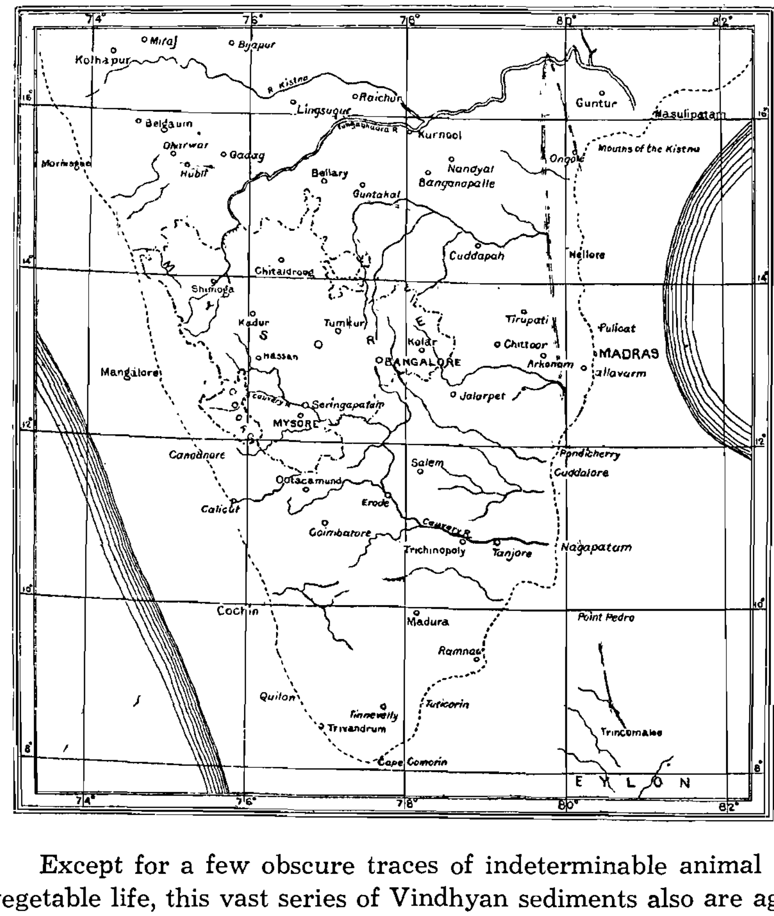
The conditions of the Cuddapah times seem to have been quite suitable for supporting organic life, but still the whole system of this thick pile of marine sediments has failed to disclose any reliable relics of recognisable organisms.

THE KURNUL PERIOD

The Cuddapah sea, retreating from its basin exposed the series of rock formations to atmospheric denudation for a fairly long time after which the partly-denuded land got submerged again, to receive another series of sediments, remnants of which are now exposed in the Kurnul District. Along with the Kurnul rocks, were forming further north in the basin, near Chattisgarh and the Bhima valley, some shales and limestones. These different deposits have been classed as the lower division of the next important rock formations, viz., the Vindhyans. The rock exposures of both the lower and the upper divisions of the Vindhyan system, form the conspicuous series of escarpments of the Vindhyan range in Central India.

The depositions in the Vindhyan basins took place under different conditions. During the early period the Vindhyan sea was fairly deep and got gradually shallower later. After the deposition of the lower Vindhyan sediments, the zone was disturbed by earth movements which elevated the bottom of the shallow sea high and dry above the water. When after a time the land got submerged again to receive the debris of the upper Vindhyan period, the highlands which had furnished material for the deposition of earlier sediments had changed entirely.

Towards the close of the period of formation of the Vindhyan sediments, there was again a large-scale upheaval which lifted these deposits to form a continental land area. This has been the last of the serious earth movements recorded in the history of the peninsula ; and since then there has been no other disturbance of a similar nature in this part of India, during the long series of subsequent geological ages. The Peninsula has remained as a solid block or buttress of land unassailed by any movements which convulsed the northern part of India during the later geological periods.



Except for a few obscure traces of indeterminable animal and vegetable life, this vast series of Vindhyan sediments also are again totally devoid of recognisable organic remains. These several unfossiliferous formations till now mentioned, are classed under the Azoic or Archæozoic era which in India, as I have already stated, has been divided into two groups, viz., the Archæan comprising the Dharwar schists, granites and gneisses and the Purana consisting of the Cuddapahs and the Vindhyans. During the whole of this period of about two thousand million years, preceding the great fossiliferous system, the Cambrian which forms the dawn of geological history, the earth must have been a very uninviting place, its entire surface being made up of monotonous, serrated and jagged peaks and buttresses unrelieved by the pleasing contrasts of colours of vegetation. The pre-Cambrian land must have been oppressively silent without any animals to make their peculiar noises.

ABSENCE OF PALÆOZOIC SEDIMENTS IN SOUTHERN INDIA

Subsequent to the formation of the Kurnul series, there is an enormous blank in the geological history of Southern India, extending perhaps over many millions of years, during which interval the great fossiliferous sediments, ranging from Cambrian to Carboniferous were being accumulated in the Extra-Peninsular area and also in other parts of the world. Of these great formations in which the history of the earlier evolutionary record of organisms is preserved, there is no trace in Southern India, which as I have already stated remained unsubmerged beneath the sea through all these ages.

GEO-MORPHIC CHANGES AT THE END OF THE CARBONIFEROUS PERIOD

The end of the Carboniferous period was the precursor of profound changes in the relative distribution of land and sea. The *purana* sea which had receded northwards by various previous earth movements was now mingled with the sea which invading from the west overspread North India, Tibet and a great part of China. At this time Southern India formed part of a great Continental area which extended through Madagascar and South Africa to South America on the one side and through Malay Archipelago to Australia on the other. This old continent called by the geologists the Gondwana land, formed a barrier between a southern ocean and the newly-extended great, Central Eurasian sea (The Tethys) of which the modern Mediterranean forms a shrunken relic.

Denudation had been slowly wearing down the Archæan and the Pre-Cambrian rocks of Southern India during the whole of the palaeozoic era ; and the larger rivers had gradually worn their valleys down to their base-level of erosion with the result that their sluggish movements had been developing swamps and marshes.

As a release of tension of the upper-Carboniferous movements a series of parallel fissures or rifts were developed in various parts of the Peninsula. The ground gradually sank along these lines of weakness giving rise to a number of basin-shaped depressions in the older gneissic land. This modified topography determined afresh the drainage areas, and the debris of land decay including the remains of abundant vegetation transported by the larger rivers were discharged into these basins. With the accumulation of sediments, the loaded basins sunk still deeper making room for further deposition. Continued subsidence and sedimentation marched apace resulting in thick deposits of a series of fresh water sediments which now form the Coal measures of India.

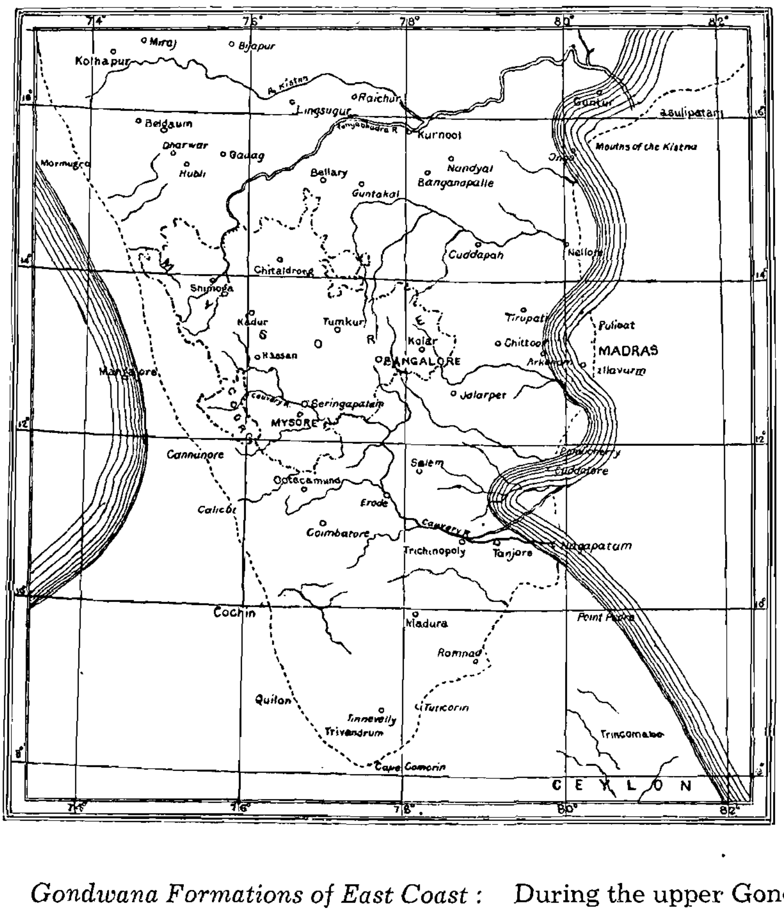
GONDWANA PERIOD

The process of accumulation of these sediments continued for a very long time, possibly for some 150 million years, ranging from the Permo-Carboniferous to the end of Jurassic or to the beginning of the Cretaceous period, and resulted in the formation of a considerable thickness of sediments, known to the Indian Geologists, as Gondwana Formations. They contain nearly all the workable coal seams of India.

Climatic changes : The Gondwana period started with an intense cold, most of the land being covered with a mantle of snow and ice with the formation of glaciers on the tops of the mountain chains. This was succeeded by a much warmer climate which was conducive to an abundant growth of vegetation consisting of not very highly evolved ferns, cycads, conifers and other flowerless plants, the remains of which are found well preserved in the Coal seams of the lower formation. A cold climate seems to have followed again, giving place later to dry and arid climate which was followed subsequently by warm and moist climate when once again the ferns and cycads of an advanced stage of evolution flourished and luxuriously grew on the land.

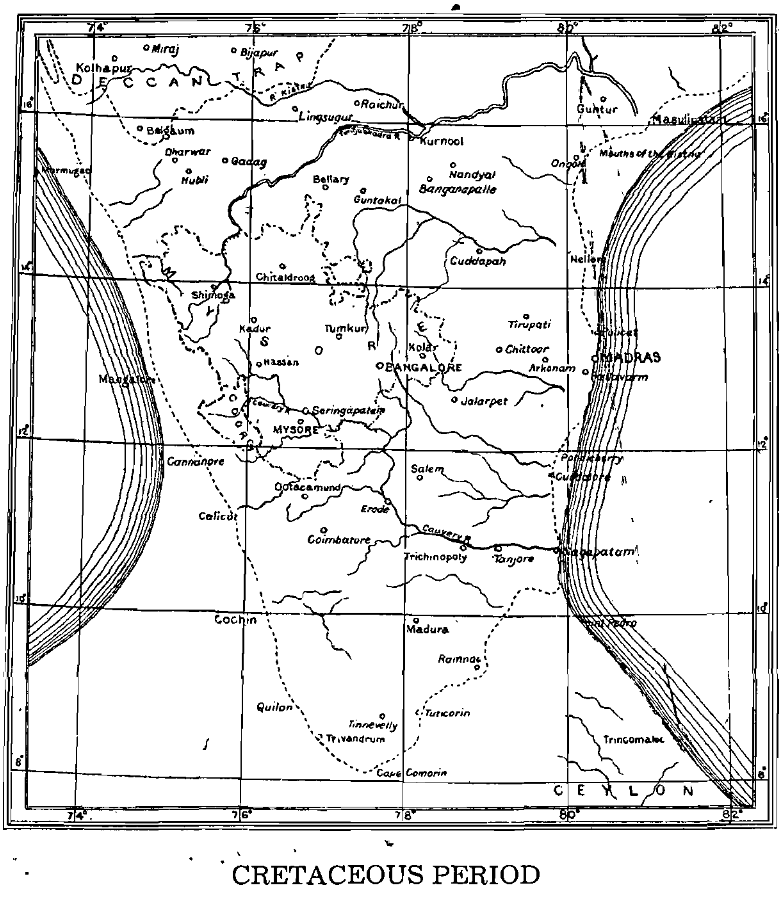
Distribution. The various exposures of the Gondwana formations are found scattered in a number of isolated basins which follow approximately the linear trend of some of the existing rivers of the Peninsula, i.e., along the valleys of the Damodar, Mahanadi and Godavari.

There has been a difference of opinion on the classification of the Gondwana system. Some geologists have classified it into three divisions : Upper, Middle and Lower corresponding in a general way to the Jurassic, Triassic and Permian of Europe. Others recognise only two divisions, an upper and a lower. All the workable and important coal seams are found in the Damuda series of the Lower Gondwanas, while a few are of upper Gondwana age, the Singereni Coalfield of Hyderabad being one such of the latter period.



Gondwana Formations of East Coast : During the upper Gondwana times the southern sea encroached slightly on the Coramandel coast receiving detritus of the adjacent land area including the remains of plants and animals that lived near the shore. The relics of the rock formations of this period are now found as isolated small patches between Vizagapatam and Tanjore, along a narrow strip between the gneissic country and the coast line. The principal exposures are found near Rajahmundry, Ongole and near Madras at Sriperamatur and Sattiavedu, and further south near Utatur in the Trichinopoly district.

Fauna and Flora : During the Gondwana times, uncouth rep-;iles with gigantic bodies and ridiculously small heads were roam-ng on the land amidst forests of huge ferns, cycads and other /arieties of flowerless plants, the stronger preying upon the weaker. They were the giants of crêation, but still on account of their in-:apacity to adapt themselves to the surroundings they, in their turn, ıad to make room for the more agile forms best fitted to survive.



CRETACEOUS PERIOD

During the next succeeding period, the cretaceous or the Chalk ɔrmations of Europe, the physical conditions in India were very iversified. The Peninsular area still formed an integral part of ıe great Gondwana continent. A deep gulf of the Tethys or the mid-Eurasian sea occupied the present area of Salt range and Sind and at one time it even penetrated into the present valley of Narbada by a narrow inlet.

On the southern side the sea encroached again on the Coromandel coast. This marine transgression or encroachment has left its records in the small but extremely interesting patches of sediments in the Coromandel coast. The rock formations of this period occur as a number of small patches, the most southerly of which in the Trichinopoly district, covering an area of about two to three hundred square miles. This contains very well preserved relics of an abundant fauna of the period, forming in fact a little museum of palaeontology.

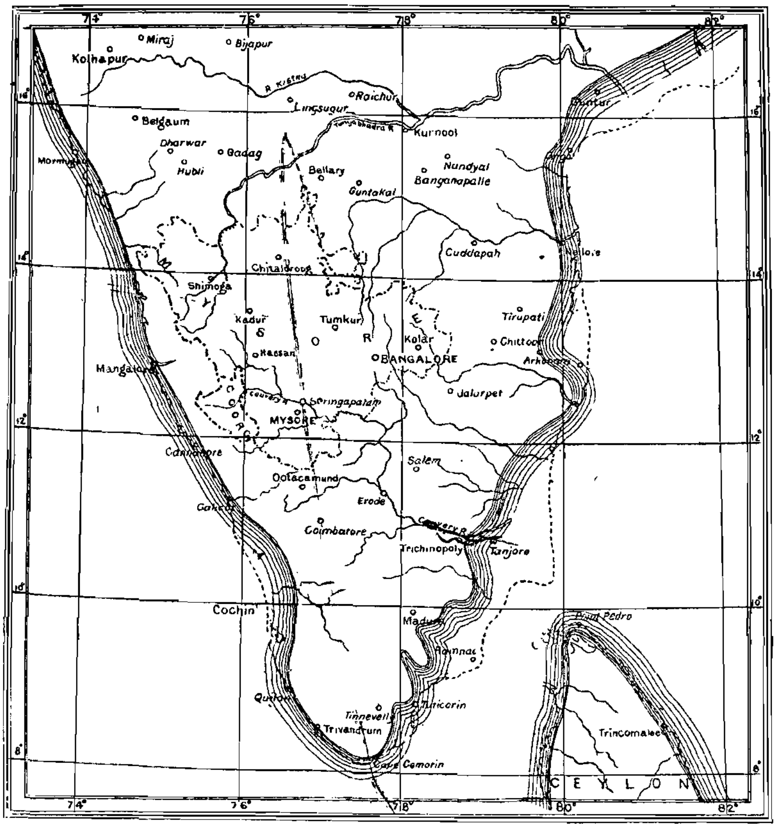
Three or four stages of successive encroachments of the southern sea are noticeable during this cretaceous period. The earliest of such encroachments over the worn-down surface of the archæan gneisses, seems to have given rise to a shallow sea or lagoon the waters of which were clear enough to support colonies of corals whose skeletons have now been turned into the massive limestone found near Utatur. On the top of this limestone were deposited in order, some clays, shales and sandstones, the products of decay of the adjacent land areas.

The periods of these several transgressions correspond in age approximately to the different horizons of the upper cretaceous times, the formation of the Utatur, Trichinopoly and Ariyalur rocks being of Cenomanian period and that of the Niniyur rocks being slightly later corresponding to the Danian period, which represent the different stages in the upper cretaceous of Europe.

In Central India, along the Narbada valley are found a few detached outcrops from Bagh in Gwalior, to Baroda and further west. These also represent the relics of the marine transgression, not of the southern sea, but of the northern Tethys. The fossils contained in these beds bear a closer affinity to the cretaceous fossils of eastern Europe which is far distant, than to those of the cretaceous of Trichinopoly, indicating thereby that these two seas, the Trichinopoly sea and the Bagh sea were separated from each other by a barrier of land, the Gondwana land, which prevented the migration of marine organisms from one sea to the other.

Lametas: Overlying at some places the Bagh beds, and at others resting directly on the crystalline rocks are found in Central

India, Central Provinces, and in many parts of the Deccan, a series of sediments, the Lametas which were formed along the mouths of rivers and estuaries, subsequent to the period of the Bagh formations. Their interest lies in the doubtful mode of origin of some of its constituent members, especially the limestones, to which a sedimentary origin has been denied. However, definite fossils have been found in some beds indicating that there are true sediments in the series.



DECCAN TRAP PERIOD

As a contrast to this peaceful history, the end of the cretaceous witnessed a stupendous outburst of volcanic energy. Towards the very end of the era, the Gondwana land began to break up. Numerous fissures and cracks were formed in the north-western part of the Peninsula through which welled out enormous quantities of liquid lava, intermittently till a thickness of some thousands of feet of horizontally bedded flows accumulated. These immense masses covered everything beneath them, obliterating all the pre-existed topography of the country. This great volcanic formation covering at present an area of about 200,000 sq. miles is known in Indian Geology, as the Deccan Trap. When originally poured out it must have covered an area of 4 to 5 millions of square miles. It consists of a number of flows, the thickness of each varying from 15 to 50 feet. The aggregate thickness of the Trap formations reaches to about 10,000 feet along the coast of Bombay; but further inland and eastwards at places it dwindles to about 100 to 300 feet. The successive flows are separated by thin partings of ash, scoriæ and other material characteristic of cone eruptions, and also in very many cases by true sedimentary beds.

There has been some doubt regarding the precise age of eruption of the Deccan Traps. A late cretaceous has been generally assigned. Palaeo-botanical and other evidences indicate however an early Tertiary age.

THE CAINOZOIC OR TERTIARY ERA

With the close of the Cretaceous we enter into the next, the Tertiary period. Though there has been a pronounced break between the upper limits of the cretaceous and the lower limit of the Eocene in Europe, in India there is not any sharply marked stratigraphic break. With the beginning of the Tertiary, an era of earth movement set in which broke up in the south the Gondwana land, blocks of which sunk beneath the present Arabian sea in the west and also eastwards in the arms of the Indian Ocean. North and south faults developed on the west, along the line of the present Western Ghats, which determined the subsequent western outline of the Indian Peninsula. In the north, these powerful crustal movements started to crumple and lift up the enormous accumulation of sediments formed in the Tethys, to give rise to the magnificient mountain chains which constitute the present Himalayas. The warping of the sea bottom broke up the Tethys into a number of isolated lakes and lagoons. One after another there were three such successive uplifts which raised the Himalayan range to stupendous heights, many times more than what they are at present. As a result of these uplifts the mid-Eurasian sea was entirely driven back from this area to the present boundaries of the Mediterranean. Thus, what was once a sea bottom is now represented by one of the youngest and highest mountain ranges of the world.

In southern India the Tertiary era has not been in any way of striking events. The Tertiary seas have left their mark in the occurrence of a few insignificant thin outcrops of rock formations amongst which the small outcrop forming the Quilon limestone in Travancore, and the Ratnagiri rocks on the Malabar Coast may be mentioned as those of the middle Tertiary period. On the east coast are found a series of outcrops extending from Vizagapatam to Tinnevelly whose principal component is a mottled and variously coloured loose textured sandstone. The rocks of this formation are grouped under the general name the Cuddalore sandstone series and are believed to be of Pliocene or Pleistocene age.

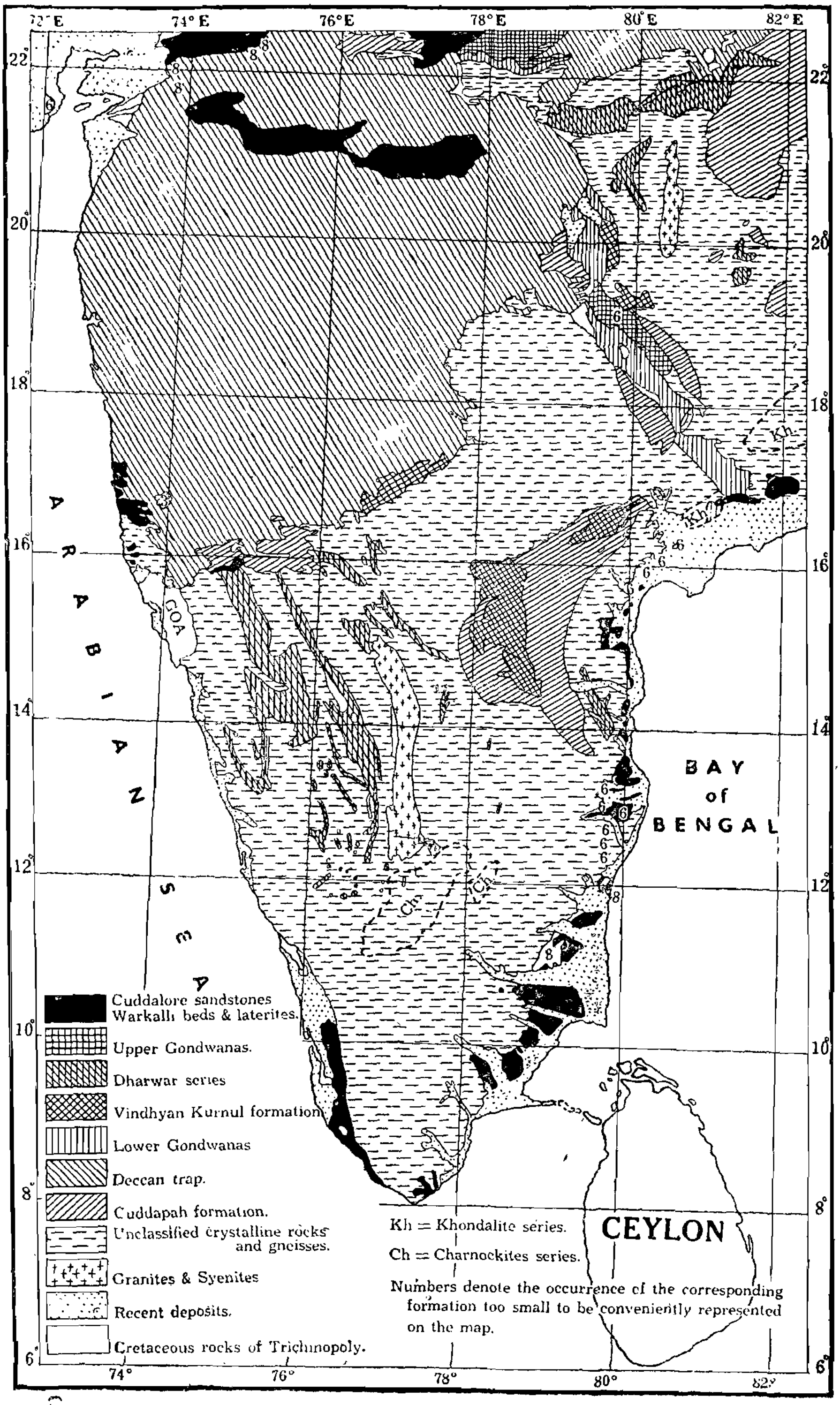
Laterite.—The only other extensive formation which needs a mention here is the laterite which is found all along the west coast and in many other parts of the Peninsula. This is a kind of vescicular clayey rock which is soft enough to be cut easily, but hardens considerably on exposure. It occurs capping the basaltic hills and plateaus of the Deccan, Central India and Central Provinces. It is resting in other places, on the Archaean gneisses, the Dharwar schists and even on the Gondwana clays. The mode of origin of the laterite is still controversial. It was for sometime believed to be an ordinary sedimentary formation deposited either in running water, or lakes; and later views regard it as the sub-aerial decomposition of the rocks *in situ*. Bacterial action has also been evoked in certain stages of the formation of Laterite. It is doubtful if any single theory will actually answer the mode of its formation at different places.

The age of its formation also is uncertain. Its formation may range from early Tertiary (Eocene) to post-Tertiary or Pleistocene.

Few changes of geography have occurred in India since the Pleistocene. The present period seems to be an era of geological repose. The only changes which are perceptible during recent times, are the accumulation of blown sands forming sand dunes on the Malabar coast, in the valleys of the Kristna and the Godavari and other parts; formation of alluvium and soil along the banks of large rivers and coastal strips; the slight subsidences of land beneath the sea as in the eastern part of the Bombay Island; the modification of shore-lines as witnessed by the encroachment of sea at certain places for instance, at San Thome near Madras and at Tranquebar, and its recession at others as at Karkoi in Tinnevelly coast; some changes in the course of rivers; the silting up of the Rann of Cutch, a few catastrophic earthquakes producing minor changes in the topography of the regions where they occurred such as those of Cutch in 1819, and the recent ones of Bihar and Quetta, etc. These are all that the geologist has to notice since the advent of man.

GEOLOGICAL MAP OF SOUTH INDIA

Scale 1″ = 66 miles (approximately).



SUMMARY

Recapitulating the main geographical changes which have occurred in the past in the Indian peninsula, you will notice that the records of the earliest stages of the geological history do not clearly indicate the exact delimitations of land and water. With the commencement of the Cuddappah epoch definite indications of the distribution of land and sea are discernible. At that time the main portion of Southern India was dry land, whereas the present Cuddappah and Kurnul districts, the Kaladgi region of the Southern Mahratta country, the Nizam's Dominions and parts of Central Provinces and Chota Nagpur were all beneath water. The exact limits of this sea cannot be defined with any great accuracy. After the final uplift of these non-fossiliferous ancient sediments (Purana formations) the peninsular portion of India was never again submerged beneath the sea except at the coastal fringes, and as such presents an enormous blank extending over many millions of years, in its Geological history. At about the close of the Palaeozoic period, earth movements caused a series of parallel rifts in the Peninsula, along the courses of the major rivers, the Damodar, the Mahanadi, and the Godavari through which the land sank forming deep basins. In these depressions were deposited the debris of land decay and vegetation of the period to form later the coal measures of India. During this period, extending over some 150 million years, there were slight encroachments of the southern sea on the Coromandel Coast which in the main assumed its present outline at the end of the Jurassic times.

But throughout the mesozoic period the western side of the Peninsula formed part of a land mass continuous with South Africa on the south-west, and stretching north-east through the present Gangetic delta and the southern side of the Assam hills with Australia on the south-east. This barrier or bridge of land mass, separated the southern sea from the northern one which extended over the north-western part of India, and the Himalayas. The end of the Cretaceous period witnessed the breaking up of this ancient continental land mass, the Gondwana land, parts of which sank beneath the present Arabian Sea in the west and parts beneath the Bay of Bengal in the east. Simultaneously with this or very early in the next Tertiary period gigantic fissures were formed in the north-west part of the peninsula through which welled out the enormous masses of liquid lava, the remnants of which form the Deccan Traps. In the Extra-peninsular area, the floor of the successive stages to form the magnificent mountain chains of the Himalayas, driving back the northern sea to the limits of the present Mediterranean. Concurrent with these earth movements a series of north-and-south parallel faults might have developed along the present Western Ghats, determining the main western outline of the Peninsula which has been modified to its present form by subsequent denuding agencies.

The present easterly trend of the drainage of the Peninsula is believed to be an ancient one probably dating back to the period of these crustal disturbances. It is probable that a big river flowed westwards through the present Palghat gap, but the earth movements which raised the Western Ghats reversed this drainage, diverting it to the east.

Glancing back, we see that while the East Coast of India was mainly formed during the end of the Jurassic period, the West Coast did not take its present shape for a very long time after, till the early part of the Tertiary period.

Ladies and Gentlemen, in an address like this aiming mainly to suit the needs of a lay audience, it is difficult to treat it with a technical precision. But still, I hope that this brief and rapid survey of the ancient geological history of our Peninsula will be sufficient to create in you a desire to go more deeply into the study of the interesting subject from the proper sources.

The Physiography of the Salem District

By

Mr. K. S. Chandrasekharan, B.A. (Hons.) L.T.

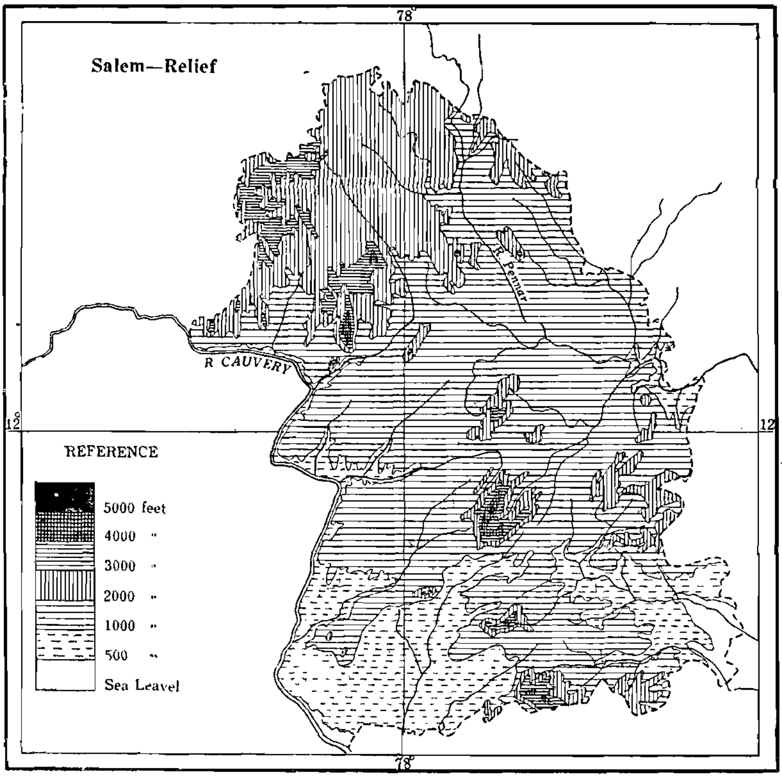
The district of Salem is now one of the most important districts in the Presidency of Madras. In recent years it has come into great prominence as it holds the key to the irrigation system of the Cauvery delta. The conception of a dam across the Cauvery at Mettur by Col. Ellis in 1910, and the successful execution of the project quite recently has assured Salem district a permanent and justifiable position of importance.

The district has had a very chequered history. It was never an independent political entity. It came under the influence of several kingdoms until about 1652 it came under the sway of the Mysore Kings. With the downfall of Haidar the British annexed portions of it; and during Tippu's reign all parts of the district except Hosur came under the British government. With the fall of Seringapatam and death of Tippu in 1799, Hosur too was absorbed by the English.

In shape the district of Salem is irregular, very roughly resembling a rectangle. On the west the district is bounded by longitude 77° 28′ 40″ E. and on the east by 78° 50′ 40″ E. On the south it is limited by latitude 11° 0′ 38″ N. and on the North by 12° 53′ 14″ N. The district is bounded on the north by portions of the Mysore State and North Arcot district, on the east by North and South Arcot districts, on the South by Coimbatore and Trichinopoly districts and on the west by the Coimbatore district and Mysore State.

The district comprises the taluks of Salem, Omalur, Rasipuram, Tiruchengode, Attur and Namakkal, in the south, and Dharmapuri, Harur, Krishnagiri and Hosur in the north. In area it is about 7,500 square miles.

The district may be considered to be a continuation of the Mysore plateau (the highest part of the Deccan) gradually sloping down to the Carnatic plains. The general slope of the country is towards the south and the east. The larger rivers of the district therefore flow south, or east. Hosur in the north-western part of the district attains a height of over 3000 ft. Krishnagiri in the north central portion slopes from 2000 ft to 1000 ft. Salem descends from a maximum height of about 1200 ft to the plains. Attur is somewhat lower than Salem, while Tiruchengode is still lower. Namakkal on the borderland of Trichinopoly is about 250 ft.



The district falls into three distinct terraces. (1) The Bālāghāt, (2) The Bāramahāl and (3) The Tālāghāt. The Bālāghāt is over 3000 ft. in height above the sea-level and comprises the Hosur taluk. The taluks of Krishnagiri, Dharmapuri, Tirupattur (of the North Arcot district) and Harur are included in the tract of Bāramahāl. Its height varies from 2000 ft. to 1000 ft. The Bāramahāl is separated from the next tract of Tālāghāt by an almost unbroken chain of hills running East-South-East to West-North-West. The taluks of Salem, Attur, Namakkal and Tiruchengode below the Eastern Ghats are included in this tract which descends down to the Carnatic plains to the east and the south. The southern Tālaghāt is characterised by three masses of rock—Namakkal, Tiruchengode, and Sankaridrug. The northern Tālaghāt is studded with numerous hills of varying elevations.

The River Systems. As has been mentioned in a previous paragraph, the main drainage of the district is towards the south and the east due to the natural slope of the ground. The main rivers that drain the district are (1) the Cauvery, (2) the Vellar and (3) the Ponnaiyar (Pennar). These have numerous tributaries that dissect the interior of the district and carry off their drainage.

The Cauvery which rises in the Western Ghats near Mercara in Coorg at an elevation of 4400 ft. flows through the Mysore State and enters the Salem district at the South-western corner of the Hosur taluk. It runs along a deep and rocky bed and is joined by several mountain streams. To the left of the Cauvery here are the Melagiris which are drained by five big basins, the biggest being called the Doddahalla. A few miles downstream, the Cauvery is narrowed down to a few yards by the hills on either side.

This point is called the Mēka datu (=Goat's leap). Twenty miles further down is the waterfall of Hogainakal. A little onwards the Cauvery takes a southerly bend and at this point is joined by the Sanad Kumaranadi draining the South Hosur and Dharmapuri. The Cauvery then changes its course a little and flows due south and south-east until it leaves the district to enter Trichinopoly. The river forms a natural boundary between Salem district and the neighbouring districts of Coimbatore and Trichinopoly. At Mettur where it enters the plains through a gorge, has been built the most gigantic dam in the world, a detailed account of which has been given in the Journal of the Madras Geographical Association, Vol. 9 No. 2, pp. 78—118.

The other noteworthy tributaries of the Cauvery are the Sarabanganadi, Tirumanimuthar, Karuvettar, Thoppur river or Veppadiar and Palai. These drain the taluks of Tiruchengode, Namakkal and Salem. Tirumanimuthar is of particular interest as it rises in the Shevaroys and flows through Salem. The tributaries have in general a southern or south-westerly course. Besides these, there is a number of minor tributaries to the Cauvery which are in floods only during the monsoon : on the banks of the Cauvery lie several villages particularly in the latter half of its course.

The Vellar proper flows mainly in the taluk of Attur and then enters the adjoining eastern district of South Arcot. Between Attur and Salem taluks there is a water-shed, clearly noticeable near Godumalai. Here, two rivers, the Vasishtanadi and the Swetanadi originate and drain two parallel valleys lying almost due east-to-west between the Kalrayans and the Pachimalai and Kollimalai. They unite outside the Salem district proper to form the true Vellar which is of importance in the irrigation of S. Arcot district. Another river that has its water-shed in the elevated region of the eastern slopes of the Shevaroys unites with them later on and swells their flow. This is the Mani-Mukthanadi.

The third main river system is situated in the northern half of the district. This is the *Pennaiyar* (Pennar) and its tributaries. The Pennaiyar rises outside the district in the Mysore plateau and enters the district at the north-western corner of the Hosur taluk. It takes a very sinuous course and flows through the taluks of Hosur, Krishnagiri and Harur. It has a general south-eastern trend and receives several tributaries. The most important of them are the Chinnar in Hosur. Markandanadi in Krishnagiri and Vaniyar in Harur ; Sandūr, Mattūr and Bargūr rivers as well as the Pambar from the Tirupattur taluk of the North Arcot district also join it. The Vaniyar rises in the north-eastern slopes of the Shevaroys, and is joined by several mountain streams. It has a general north-easterly course and flows through open country.

It is noteworthy that the various rivers and streams feed a number of tanks some of which are considered to be holy. There are a number of tanks and wells scattered throughout the district and intended for irrigation purposes by storing rainwater.

Orography. There are a number of hills in the district. As mentioned previously, an almost unbroken chain of hills extends from E. S. E. to W. N. W. The spurs extend from N. E. to S. W. The general level of the country in this direction is high especially at the centre. The hills have been given several local names. Bruce-Foote is of opinion that the district has suffered double crushing, once in the E. W. direction and a second time in the N. S. direction approximately ; and he recognises seven ranges arising therefrom. A brief account of the important hills in the district is enough for our purpose.

The Shevaroys are the most important of them. They are situated almost in the centre of the district (between 11° 43′N & 11° 53′N latitude approximately and between 78° 13′ & 78° 25′E longitude). They occupy a total base area of about 150 square miles with the high plateau of Yercaud on the southern portion of the eastern block (about 10 square miles). On the north-west it is continued as the Thoppur hills. The average elevation is 4,500 ft.

the highest point being about 5,410 ft. Owing to its elevation, the Shevaroys enjoy a mild climate and form a summer resort. Plantations are carried on to a great extent on its slopes.

The Kollimalais are in the south-eastern corner of the district. They cover the south-east and north-east corners of the Rasipuram and Namakkal taluks. They are separated from the Pachai Malais of the Attur taluk by the Turaiyur valley and the pass leading from thence to Thammanpatti and from the Bodamalais by the Ayilpatti Ghat. They measure about 18 miles in a north-to-south direction and 12 miles east-to-west. They rise abruptly from the plains in the south and east, reaching a height of about 4,000 ft. There are several ravines on the northern slopes cut *en echelon* in a N.E. by West direction. The descent to the plains is made by a number of long and gently-sloping spurs. The portion on the Namakkal side appears flat-topped, when viewed from the plains; and hence is called the Saduragiri. As a matter of fact, this is made up of five basin-shaped depressions covered with terraced cultivation. A splendid view of the plains and the hills could be had from the path which leads to the heads of these ravines. The Shevaroys, the Tennandemalais, and the Kalrayans are seen towering in the north. The highest peak in this area is the Vèttakaramalai (4,663 ft.). In the Namakkal portion the highest point is 4,200 ft. (in Selurnad). There is a famous Siva temple (Arappaleeswaran Koil) at the head of the ravine leading to the Turaiyur valley; and two miles below it is a pretty waterfall called the Akasa Gangai.

The Bōdamalais are in the Rasipuram taluk. They measure about five miles in the north-south direction and eleven miles east to west. The Alwais in the Rasipuram taluk belong to this group; it is also called Siddhamalai.

The Kalroyans are in the eastern border of the district adjoining the boundary of the South Arcot district. They are continued from the south-eastern end of the Shevaroys in a north-east direction. At their extreme north-eastern end is the holy hill of Thirthamalai, attaining a height of about 3,500 ft. Several peaks are situated on this hill range.

In the north-west of the district is the broad, irregular and lofty range of the Melagiris in southern Hosur. They are in the Bālāghāt tract and attain a height of 4,500 feet at their southern extremity. They are covered with thick jungle producing sandalwood and valuable timber, as at Denkanikota jungle. Numerous streams that are torrential in the rainy season flow along several gorges carved out between the hills. The Sanad Kumaranadi has cut its way at the south-eastern extremity of the range and flows over a rocky bed, and joins the Cauvery.

Among the several isolated hills in the district may be mentioned the following:—

((1) The Tallamalais, 14 miles south-east of Namakkal. This is a small range of hills, one of the peaks of which rises to 2,785 feet. There is a survey station here.

(2) In the same taluk is the Nainarmalai; it is an isolated rock attaining a height of 2,460 feet.

(3) Kapilamalai 15 miles S.W. of Namakkal and 6 miles west of Paramatti. It is said to be so named on account of the Sage Kapila having lived there according to legend.

(4) Sankaridrug: in the main road from Salem to Bhavani near the town of the same name is a great, white, square mass of rock. The prospect from the plateau of the top of the hill is most pleasing. Its height is about 2,350 ft.

(5) Kanjamalai lies south-west of Salem. Its height is nearly 3,300 ft. It is important on account of the iron ore bands found there. The iron ores of Salem are famous, and are found in several parts of the district. The Kanjamalais have striking serrated ridges which are outlined sharply against the south-western sky. To the east of this can be seen the peaks of the Godumalai rising boldly towards the Attur valley.

(6) The crescent-topped hill of Tiruchengode.

There are four passes leading through the great mountain screen giving access from the Tālāghāt to the Bārāmāhāl plateau. They are the Kottapatti Pass (easternmost) leading to the historic and lovely valley of Chengam and thence to the ancient holy and market centre of Tiruvannamalai; this pass separates the Tennandemalai from the Kalrayans. On either side of the Shevaroys is a ghat leading to the two great land marks of the Bārāmāhāl country. The trunk road over the eastern or Manjavadi Pass runs to the left of the Chitteri hills and winds round Harur towards the sacred Thirthmalais (3,500 ft.) in the north-east; on the west the railway toiling up the Morŭ-patti ghat keeps the Vattala-malai to the left and runs past the sharp peak of Mukkanūr (4,000 ft.). The westernmost is the Toppūr Pass. This leads to the rolling downs of Dharmapuri.

The Kottapatti, the Manjavadi, and the Mallapuram Passes are excellent examples of strike valleys in the district.

No attempt has been made to describe the rocks of the district as that topic is dealt with in detail in the paper on the geology of the district. It may be said in passing, however, that the rocks in this district all belong to the ancient Archæan system of gneisses and schists and their associated rock types.

A list of the higher peaks in the district is herewith appended.

List of a few Peaks over 3,000 feet: Kannapadi 3,020′; Nāgulūr 4,144′; Sholaikaradu 5,410′; Shevaroys 5,314′; Prospect Point 4,759′; Bear's Hill 4,828′; Pagoda Point 4,507′; Twins Peak 4,858′; Alwaymalai 3,121′; Kanjamalai 3,236′; Bodamalai 3,774′; Cauvery Peak 5,049′; Sammudrakad 4,457′; Vellaikalmalai 3,625′; Jandakattimedi 4,015′; Periyamalai 3,216′; Keddamalai 4,018′; Kollimalai 4,240′; Guttirayan Hill 4,575′; Mariyalam 3,446′; Thirthamalai 3,500′.

The Geology of Salem District

By

Mr. P. Sridhara Rao, M.A., L.T.,

The geological structure of Salem district is a very simple one. A very large part is made up of rocks of the Archæan system of South India mostly metamorphic gneisses and a part eruptive rocks, and the remaining part of the district is covered by the alluvia of the different rivers. The Archæan rocks can be divided into four groups: (1) older gneisses, (2) thinly foliated schists, (3) the Charnockites and (4) eruptives and dykes cutting through the older rocks.

The older gneisses constitute the bottom rocks of the country, no older formation having been discovered. It consists of various members differing in the degree of contortion and in mineral composition. They are prominent in the hills of the eastern part of the district, while they underlie and are cut into by igneous rocks which form the hill masses in the western and northern parts of the District. The old biotite gneisses have the composition of granite rocks, but no direct evidence as to the nature of their origin can be had. They are regarded as the members of the older division of the Archæan gneisses. As they underlie all other rocks of the Presidency, they are also known as the fundamental complex. In the complexity of their structure, these rocks resemble the Archæan rocks of other regions of the world. The gneiss shows well-developed foliation in the Nagaramalai north-west of Salem, and in many places near and west of the Namakkal Road. The general direction of foliation is east-north-east to west-south-west; but it varies in some places to east-west, always dipping northwards at very high angles. These rocks are not quite fresh, the evident crushing being accompanied by the formation of epidote in distinct crystals and the development of other secondary minerals such as *sphene,* and *muscovite.* Quantitatively the quartz, felspar and ferromagnesian constituents are generally in the same proportion as in granites. Inter-growth of different kinds of felspar is common. The relationship which these gneisses bear to the Charnockites clearly show that the former are older in age. One of the more important rock varieties of these gneisses are beds of magnetic iron ore which are dispersed over almost the whole district. Many of the iron ore beds fall into five major groups, and a few single beds are not referable to any of the groups. The five groups are :—

1. The Kanjamalai group,
2. The Godumalai group,
3. The Singipatti group,
4. The Thalaimalai-Kollimalai group ; and
5. The Tirtamalai group.

1. *The Kanjamalai group* is named after the hill of that name 6 miles to the west-south-west of Salem. Latitude 11°36′ N and longitude 78°7′E. The hill is about a thousand feet above the plain, and about 4 miles long in an east-west direction. The thick jungle and the debris make it difficult to count the number of beds of magnetic iron ore. The beds form ellipses in plan, with the major axis in an east-west direction. The number of beds are five, two of them being visible only on the western extremity of the ridge. The two lowest beds are very conspicuous even when seen from a distance of a few miles. Where not too much weathered, the beds stand out prominently coloured dark purplish grey. The thickness of these beds is very difficult to estimate. The beds are so broken near the surface that debris rolled down from the upper beds are not distinguishable from the blocks separated from the broken beds in situ. But, their thickness may not be below 50 feet on the average. Two more beds are estimated at 20 feet thick each, but the amount of ore contained in the first two beds only is almost inexhaustible. On the southern side of the hill the talus mainly consists of the ore. For a distance of a mile or two from the foot of the hill the fields are thickly strewn with the ore. Thousands of tons of the ore can be gathered up without any mining. In the beds the ores are not in the same quantity in the rock. The mineral magnetite occurs in grains of various sizes, making up from half the rock to about seven-eighths. The rest of the rock is always made up of quartz. Till about the middle of the last century smelting operations were being carried on by the natives of the surrounding villages. The non-availability of fuel put a stop to this industry. A company which was doing this business finally closed down about 1860. If fuel could be got cheap at that place, it is quite certain that the ore of Kanjamalai can be exploited for an indefinite time ; flux in the form of limestone can be got from Sankaridrug, which is on the railway line.

2. *The Godumalai Group.* 9 miles east of salem. The Godumalai is a very fine bold mass about 1,500 feet or more above the

Salem and Attur Valley. It is about 4 miles long west to east, the maximum breadth is about 3 miles. When seen from the south the chief beds of magnetic iron which runs up the ridge from west to east reaches the summit at the eastern extreme end. On the northern side of the summit it is precipitous, and the fall from the cliff is several hundred feet. At the western end of this ridge the quantity of the magnetic iron is good; and small native furnaces used to work in the villages in the neighbourhood. The rock here has iron ore making up from ¾ to⅚ of the mass. The iron ore beds get poorer and poorer in quality as we proceed to the east but when ascending the *Valoor* hill it again becomes richer. The course of the beds, the width of the outcrops and the thickness of the beds are all difficult to estimate as the hills are covered by a thick jungle and the compass becomes practically useless in determining the directions.

3. *The Singipatti Group.* The beds forming this group occupy a position about 4 miles south of the Godumalai peak. They appear to form a synclinal fold, having, if followed from west to east along the strike from Vullala Cardam, a course ranging from west and east to north-east by east and then trending to east-north-east and east by north. In length they extend for about 10 miles.

There are three principal beds, separated from each other by intervening beds of hornblendic and quartzo-felspathic gneiss of very considerable thickness. By far the greatest visible development of the beds is along the northern side of the synclinal fold, the greatest length of which is stated above. On the south side the three beds can be traced only for much shorter distances to the village of Singipooram. At that village five beds of iron ore appear on the western slope of the small hill, bearing the same name as the village; only three of these appear to the west on the slope of Ponnárampatty hill, and here two are apparently cut off by a fault, the line of which is occupied by a small dyke, having a north-north-east course. To the east of the village the iron beds are almost immediately lost sight of under thick soil, and do not reappear again, while the beds on the northern out-crop die away gradually both in size and richness, and disappear on crossing the Vellaur river a mile-and-a-half to the south-west of Yaetapur pagoda. Indication of magnetic iron beds are met with in the great spur of the Kalrayanmalai, north of Yaetapur, and are in all probability representatives of this Singipatti series. In point of richness the beds of this series are not very remarkable the richest being part of the northern or lowest bed lying south-south-east of Walapandy bungalow. The thickness of the bed cannot be less than 50 ft. which may probably represent the general thickness of the three beds cropping out on the north side of the synclinal fold. To this series belongs in all probability a small bed of magnetic iron occurring on the flank of Kalrayanmalai, rather more than a mile south of Toombul.

4. *Tallamalai-Kollimallai group.* This group is included in a vast curve formed by a large number of strata constituting the gneissic system, and present in the southern part of Salem district. The curving of the overlying iron beds is remarkably perfect especially some of the numerous hornblendic beds east of Namakkal. The heart of the curve appears to be at Kollimallais. The beds dip at a very high angle of 60° to the north. The number of iron beds belonging to this series are mainly three; there are a number of other beds which are not continuous but die out very soon after they become observed by the overlying soil. The principal beds occur about half way up through the series, and have been traced from a little north of Mathensenapetta (Thathangarpettai) westward to the most northerly ridge, outlying from the Tallamalai and all along that ridge. They get covered by the alluvium till they appear again to the south of Keerambur, 6 miles west-south-west from Namakkal, at Ramagiripetta and other villages in the Rasipur Taluk.

5. *The Teertamalai group.* This group consists of only two great beds running parallel and close together along the crest of the Teertamalai ridge. They form also the peak of the Teertamalai, which is a very fine and almost isolated mountain mass, about 8 miles north-east by east of Haroor. To the east the side of the magnetic iron bed forms a tremendous and apparently perpendicular precipice of many hundred feet in height, which gives the peak a very fine bold outline when seen from any position except from the east or west. The beds show a large dip about 82° to west at the foot of the mountain on the north-western side, close to the temple at Teertamalai. To the south of the Teertamalai the beds are lost in the jungle under thick soil at about a mile-and-a-half south-south-west of the peak. No estimate is possible of the thickness, etc. being covered by the talus, etc. There are more than twenty other beds here. but they are not very important in thickness or extent.

Crystalline limestone. Near Shattambur 7 miles south-west of Namakkal are a number of beds of crystalline limestone whose total thickness is several hundred feet. They are mainly greyish white in colour, while a few are greenish and pink. They outcrop on the surface for 2 miles east of the village while further east they are covered by thick soil. Another occurrence of limestone in this district is near Sankagiridrug. The quantity of limestone available here is far less compared to the other place. But the several beds cross the railway line, and, if there is much demand, they can be quarried and transported with greater ease. If smelting of ore is done at Kanjamalai on a large scale these limestones can be used for flux.

Steatite. There are talcose and chloritic schists widely distributed in the district. The schists are in some places very hard bluish-green rocks. The greatest development of the schists is seen along the north banks of the Ponnaiyar river. They continue to form the Javadi hills just outside the district. Associated with the schists in some places are small beds of steatite or potstone, an impure variety of talc. This mineral is very widely distributed throughout India. Steatite is used for manufacture of refractory furnaces and is exported for that purpose. Locally they are used for the manufacture of pots, dishes and other cooking utensils. They are much in demand by Brahmins. The vessels are cut by means of various well-shaped tools, when resting either on a pad of straw or rags ; the stone easily breaks during chiselling due to numerous impurities like pyrite, etc. Though potstone is available in numerous places the three principal localities where they occur in large quantity and are worked are Tandagoundanpalaiyam 17 miles east-south-east of Salem, Kampur 6 miles north-west of Salem ; and Yerumaipatti near Namakkal. Salem is one of those three areas in India from which steatite is exported in large quantities.

Corundum. Certain beds belonging to the old gneisses have been worked for corundum from time to time in this district. Corundum is used by the lapidary as an abrasive. But competition is very keen. Cheaper forms of garnet, artificial forms of corundum manufactured from bauxite, and artificial abrasives like carborundum and crushed steel prevent not only the export of this mineral but are also imported into India. Still now and then mining leases are obtained in Salem especially in Palakod and Paparapatti. Corundum is being now produced from about 1926 and a fresh lease for a period of 30 years has been obtained in the year 1934.

Igneous rocks. The rest of the district not covered by the gneisses so far described are made up of rocks belonging to the 'charnockite' series. The charnockite series of igneous rocks vary from acid rocks like hypersthene granites to ultrabasic pyroxenites and amphibolites, through augite, norites, hypersthene norites, etc. (These rocks whenever they meet the biotite gneisses show a younger age). Though it is possible all types of this series can be met with in the district the most abundant is a rock of 'intermediate' composition. In the neighbourhood of the intermediate rock it is possible to meet with small pieces of acid or basic rock. The charnockite hills stand out prominently as lenticular hills from the plains of the gneisses. By far the largest exposure is the Shevaroy hills which cover an area of about 100 square miles and form a mass 16 miles long north-east to south-west and 10 miles wide from south-east to north-west. The rocks are even grained, blue-grey or greenish grey in colour. It is difficult in fresh hand specimens to distinguish the quartz from the felspar both of them being of the same blue colour. The colour is due to minute hair-like inclusions in both the minerals. The minerals present in the charnockites, are pale blue green augite, highly pleochroic hypersthene, hornblende a strongly pleochroic brown-green variety, and the accessory minerals are opaque iron ores, zircon, apatite and biotite. The smaller hillocks in the Salem-Attur valley are all related to the Shevaroys but are a little basic. The rocks of Nagaramalai are garnetiferous varieties of the charnockite.

In the neighbourhood of basic varieties it is possible to find lenses, bands and small dyke-like formations of the charnockites devoid of felspar. In the majority of these ultra-basic rocks pyroxene is in excess and the rock can be named pyroxenite. Such pyroxenites have been described as occurring in the Nagaramalai. About half-way up the south-western slopes of the Shevaroys there are large masses of these rocks in which hornblende exceeds the pyroxene in quantity. They resemble closely the pyroxenites of Pallavaram near Madras.

Younger intrusions. Younger to the charnockite series there are igneous rocks which are quite independent of foliation and are intruded into the gneisses and the charnockites. There are distinguishable three such independent groups which do not come into contact with one another so that their relative ages cannot be determined. The three groups are:—

1. *Augite-diorite* dykes with micropegmatite;
2. Magnesian series of the Chalk hills; and
3. The "White Elephant Rocks."

1. *Augite-diorite dykes.* Running in a north-west-south-east direction across the Shevaroy mass is the most prominent dyke about 50 yards in width. It marks the direction of a depression instead of standing up above the rocks. While the dyke can be traced from one edge of the Shevaroys to the other, it is not known beyond the limits of the hills. A second dyke is seen near Kavipatti running south-eastwards. The third dyke is found much further to the westward. The direction and extent is difficult to determine as the edges are covered with talus material. The rocks of all these dykes are augite-diorites with micropegmatite. They are generally regarded as the dyke representatives of the Cuddapah lava flows and are met with in numerous places in Chingleput and South Arcot districts also cutting through the charnockites or the gneisses. Apart from the three main dykes there are found numerous narrow dykes running parallel to the large ones, but they show the usual differences in structure due to more rapid cooling. They show rapid transition from the black opaque, probably glossy matrix to a porphyritic rock with crystals of pyroxene and basic felspar imbedded in a pilotaxitic ground-mass.

2. *Magnesian rocks.* There occur magnesite veins in a few places in the district. The most important of these are seen in the so-called 'Chalk hills,' a few miles north-west of Salem. The area over which these veins cut through is about 10 square miles of ground. The veins continue in an east-north-east direction to within half-a-mile of the western base of the Nagaramalai, a conspicuous hill lying due north of Salem town at a distance of about 3 miles. The magnetite veins occur in innumerable quantities, running in every possible direction ; the more important veins, however, follow certain definite directions. Associated with the magnesite are minute veins of fibrous serpentine of pale green colour. Compact serpentine in the form of pebbles are found very rare. Chalcedony or jasper occurs as thin crust over the surface of the magnesite. *Chromite* or chromate of iron is found in very thin veinlets lyir ; either among the magnesite or between the magnesite and the wall of the magnesite vein. A vein 4 inches thick occurs in the Kan- malai hill.

Of the quantity of magnesite present in the Chalk hills no estimate has been given. Practically we can regard the reserves as unlimited, especially as the formation is not due to any superficial phenomena but due to the alteration of magnesium silicate of the ultra-basic rocks by carbonic acid to form carbonate of magnesia and free silica. The small quantities of serpentine have been formed by hydration of portions of the olivine which escaped the action of the carbonic acid. Salem produced in 1934, 11,859 tons of magnesite valued at Rs. 71,208. Further details about the ore, its uses, etc. is separately dealt in another paper.

3. *'The White Elephant Rocks.'* There are two masses of white quartz, on either side of the southern spur of the Shevaroy hills. On the east the huge mass of pure white quartz rises to a height of 100 or 120 feet from an irregular base the diameter of which is estimated at 200 feet. The whole mass is much cut up by large vertical joints. This rock is very conspicuous, visible on clear days even from a distance of about 35 miles. A corresponding but rather smaller mass of white quartz stands on the west side of the spur overlooking the magnesite veins of the Chalk hills. The quartz here is much different from the blue quartz of the charnockites; there are not found any minute needles in quartz crystals. The liquid inclusions present in the quartz crystals and the absence of any signs of elastic structure such as are found in a quartzite are evidences of the igneous origin of this quartz. "There is no direct evidence for connecting these masses of quartz with any particular eruption in the neighbourhood. But the nearest eruptives are the peridotites of the Chalk hills, and as every peridotite intrusion in South India seems to be accompanied by masses of pure white quartz, it is not unlikely that those masses belonging to the Chalk hills province represent the end product of that eruption."

Soils. Next to the Archæan gneisses and the rocks of plutonic origin and a few dykes described above the rest of the geological formations are all recent in origin. Of these are the laterites which cap a few hills on the western boundary of the district, the greyish white kankar occurring commonly all over the plains of the district, and the black cotton soil. A discussion about the age of the laterite or the kankar is not entered into here.

The black cotton soil is found to the south of the Pachamalais, west of Namakkal, east and north of the Tallamalai, and in the eastern part of the Attur valley. The soil is of a very dark brownish-black colour with occasionally greyish or bluish shades. The composition varies with the region, some regions even containing a considerable portion of sand. In dry weather the cracks in the soil extend to a depth of 3 to 4 feet. The black soil is used for the cultivation of cotton and other dry crops.

The decomposition of metamorphic gneisses gives rise to a red arenaceous soil. This soil is found around each of the mountain ranges. It is generally 4 or 5 feet deep but sometimes goes to a depth of even 15 feet *in situ*. Accumulations of red soil are found in the great valley running into the Tennandemalai range, especially on the north side of the hills, and also on the east side of the Kalrayan-malai. The river alluvia of the Cauvery, the Vellaur and the streams flowing into it form a class by themselves.

The Salem Magnesite Deposit

A DESCRIPTION OF THE WORKING PROCESSES AND SOME OF THE USES OF THE MAGNESIA PRODUCTS.

By

Mr. H. R. Robinson, B.Sc.

The Salem Magnesite area consists of masses of olivine-chromite rock, which belong to the peridotite or ultra-basic group such as Dunite etc. In process of time, the rock has undergone enormous mineral change, whereby the Dunite became serpentinised. After this further changes took place, resulting in the formation of Chalcedony, Silica and Magnesite.

The Magnesite is visible in the form of out-crop, on the surface of the low-lying hills in which the deposit is contained, thus indicating Magnesite-bearing land below the surface.

Excavations have been proceeding for many years in the form of open quarry work and owing to the abundance of the mineral, it has so far been unnecessary to work below water level.

The Crude material is excavated by manual labour and because of its natural high chemical purity, being over 95% $MgCO_3$, it merely requires superficial cleaning on the surface, which is carried out by small chipping hammers. The Crude Magnesite is then conveyed to the Kilns, where it is calcined to the oxide of Magnesia (MgO).

The Kilns which operate continuously, are of the vertical shaft-type and fired by producer gas, generated from coal in an external producer. The Crude material is fed in at the top of the Kiln and gradually falls down through the combustion zone, as calcined material is withdrawn from the bottom. The producer gas is admitted through gas ports into the combustion zone, where a temperature of the order of 1250/1300° Centigrade is obtained. The products of combustion are drawn off at the top of the kiln by natural draught, along with the gases expelled from the crude material, which consist largely of carbon dioxide. This process occupies an over-all time of about 70 hours, from crude material entering the Kiln to leaving as Calcined Magnesia.

The calcined material is allowed to cool and is subsequently sorted into various grades and size specifications according to requirements, and is finally packed in gunnies for export. The lightly-calcined oxide of Magnesia is also marketed in the finely-ground form, and when required, can be ground to pass 200-mesh.

A further grade of Magnesia is obtained by carrying the calcination process to a higher temperature, when refractory Magnesia is obtained. This Grade is of great value as a refractory material in many industrial processes.

One of the highest forms of refractory material known is fused Magnesia. This is obtained by the electrical fusion of Magnesia at a temperature of the order of 2,600° Centigrade. During fusion, the Magnesia undergoes a complete physical change and becomes a clear crystalline substance, capable of withstanding the highest temperatures used in industry at the present time.

THE USES OF MAGNESIA PRODUCTS.

Crude Magnesite:—This material on the addition of sulphuric Acid forms Magnesium Sulphate, commonly known as Epsom Salts.

Lightly-Calcined Magnesia:—This material possesses cementitious properties of a high order and its principal use therefore is in building construction, where it is incorporated in many flooring compositions, plaster and stucco work and in a variety of asbestos and other similar compositions for various uses in interior work in buildings, where lightness is required to be combined with strength.

When mixed with Magnesium Chloride solution or water, it forms an oxychloride cement, which will accommodate up to 20 times its weight of sand or their aggregate.

Magnesia Cement possesses a tensile strength of 800 lbs. per square inch after 10 days, thus being much stronger in this respect than Portland Cement.

Magnesia composition flooring as well as being strong and permanent, is light and resilient and may be laid over either concrete or wood foundation equally well. Any colouring matter may be incorporated in the mix, thus facilitating the introduction of coloured designs in a perfectly jointless flooring.

Lightly-calcined Magnesia and light Carbonate of Magnesia are also incorporated with asbestos in boiler lagging compositions, producing a permanent and efficient covering which greatly improves the thermal efficiency of any steam-raising plant to which it is applied.

Lightly-calcined Magnesia is used in the manufacture of paper pulp from wood and bamboo in the sulphite process. The Magnesia assists in the digestion of the pulp and improves the strength of the paper obtained, thus forming an important constituent in the manufacture of high quality paper.

Lightly-calcined Magnesia is rapidly coming into prominence in the manufacture of glass. By virtue of its chemical purity, and particularly its extremely low iron content, Indian Magnesia is specially suitable for the manufacture of colourless and scientific glassware. The introduction of Magnesia facilitates easier working of the glass in the molten state and enables annealing to be carried out at a lower temperature than otherwise. It also improves the chemical resistance of the finished product.

Another industrial use for Magnesia is in the manufacture of rubber, where it proves a powerful accelerator in the vulcanisation process, particularly in the case of resinous or tacky rubbers and those which would otherwise vulcanise extremely slowly. Light Carbonate of Magnesia is also used as a filler in the manufacture of rubber products.

The value of Magnesium alloys in preference to Aluminium for lightness and strength, has recently been demonstrated and calcined Magnesia is being reduced to the metal, by an electro-chemical process and the Magnesium alloys subsequently produced, are being increasingly used in the manufacture of aeroplane parts.

In India and Burma and other rice-producing countries, Magnesia Cement is supplied to Rice Mills, where it is used in conjunction with emery powder for hulling and polishing the rice.

Magnesia is also widely used in a number of medical preparations, such as Magnesia Ponderosa (Heavy) and Magnesia Levis (Light) and Milk of Magnesia. It is also used in the preparation of certain cosmetics.

A recent specification describes the use of Magnesia as an ingredient of cigarette paper. The benefit is twofold in that Magnesia readily gives up Oxygen thus promoting combustion and also leaves a white ash, such as one finds in Egyptian cigarettes.

Refractory Magnesia:—The properties of this Grade of Magnesia are quite different from the lightly-calcined variety, in that it is no longer a cement, but the chief characteristic is its extreme refractoriness. Magnesia is a basic refractory and is therefore most suited for use in industrial processes where an acidic reaction is undesirable.

Dead-burnt Magnesia is very widely used in the hearths and linings of basic open-hearth steel furnaces, copper reverberatories and converters, bullion and other metallurgical furnaces, where it resists the action of the high temperatures employed in such operations, successfully.

In this form, refractory Magnesia is also made up into magnesia bricks, which are well-known as high-class refractories in industrial furnaces. Magnesia bricks of good quality are being made from Indian Magnesite and have proved most successful when incorporated in steel manufacturing processes, in India and elsewhere.

Another variety of Refractory Magnesia which is manufactured at Salem, is Assay material and Magnesia Cupels for Gold and Silver Assay work. Large quantities of Assay material and Cupels are sold to various Government Mints, Gold Assayers and Gold Mining Companies, for Assaying Gold metal and ores.

In conclusion, it will be realised that an abundant supply of such an important mineral constitutes a valuable national asset in India, especially in view of the fact that Magnesite deposits in other parts of the Empire are relatively rare and small in character.

The Chemistry of Magnesia is advancing rapidly as research work is being carried out in various countries and more uses are being found for Magnesia products.

It is also certain that as India proceeds further with internal industrialisation as she undoubtedly will, the Magnesite industry will take its place in the country's industrial sphere as a key industry.

Meteorology of the Salem District.

By

Mr. C. K. Anantasubrahmanyam, B.A.,
Kodaikanal Observatory.

The district of Salem is divided into three tracts which differ very much physically. Balaghat is a part of the Mysore table-land; to the north and east an uneven plateau with poor vegetation; to the south and west with dense forests. The average elevation is about 3000 feet above sea-level. Baramahal is a wide basin, between the Mysore tableland and the plains, with a general elevation of 1300 feet above sea-level. It is bounded on the north and west by the Mysore plateau and on the south and east by a second line of ghats. Talaghat is the country below the ghats and resembles in general aspect the adojoining districts of Trichinopoly and Coimbatore. The town of Salem is 900 feet above sea-level.

The hot weather in Salem begins early in March. April and May are the hottest months. From June onwards the temperature steadily comes down. The highest recorded temperature was 108° on May 9, 1900 and the lowest 55°2′ on January 30, 1902. The average maximum in January is higher than in December; but the nights are much cooler. The difference between maximum and minimum in March is nearly 27° and in October and November 18°. Owing to the calm atmosphere in September and October, the weather is more trying than in February or March, though the maximum is higher in the latter months.

AVERAGE MAXIMUM AND MINIMUM TEMPERATURES

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Maximum.	88.1	93.4	98.4	100.8	99.6	95.3	93.3	92.3	91.4	89.9	87.1	86.3
Minimum	64.1	66.6	71.3	76.2	76.5	74.5	73.6	72.9	72.5	71.7	69.1	65.7

The average humidity varies from 70 to 80, being 72 in April and 81 in October. The dryness of the atmosphere, the comparatively cool nights and the drop in temperature from June onwards when the southwest monsoon sets in, render the climate of Salem pleasanter than that of the eastern and the southern districts.

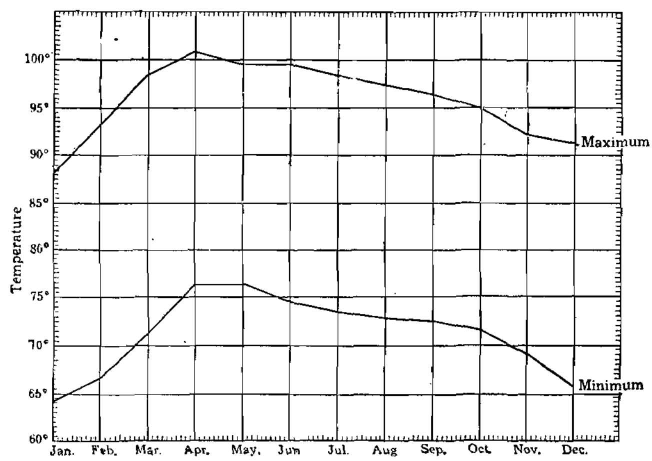
AVERAGE HUMIDITY

Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
76	76	73	72	72	76	78	80	80	81	79	77

During the hot weather, occasionally hailstorms occur in the town of Salem.

There seems to be no official record of the meteorology of the Shevaroys. The temperature there is very equable. The records kept at the Grange showns a maximum of 82° on May 23, 1906 and a minimum of 65°. In any one year the difference between the highest and the lowest recorded temperatures has never exceeded 17°. It is very rare that the maximum rises above 80°. The maximum during the hot weather does not often exceed 77° and in December the usual maximum is 67°. It frequently happens that the four readings on a single day show no variation at all. During winter, occasionally there is frost on the grass in the valleys.

SALEM



The mountainous character of the district causes sharp variations in the rainfall of different localities. The annual average for Salem town is 39·30. This is higher than at any other station in the district except Yercaud. Most of the rain is received in the months August, September and October. February is the driest month.

The connection between wind and rainfall is noteworthy. The heaviest falls of rain occur when the wind is weakest. The rain stops as soon as the wind freshens. From October to March a northeast wind prevails. In April the wind is towards the south and from May to September the general direction is southeast or southwest. February and March have high winds.

AVERAGE WIND VELOCITY AND MONTHLY RAINFALL

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Wind velocity in miles.	115	127	127	110	98	120	113	96	82	60	74	94
Rainfall in inches.	0.31	0.27	0.48	1.79	4.72	3.02	3.82	6.84	6.59	6.74	3.74	0.98

At Yercaud the annual rainfall exceeds that of Salem city by an amount varying from 20 inches in a dry year to nearly 40 inches in a year of heavy rainfall. The annual rainfall in the north of the Shevaroys is about 10 or 12 inches less than at Yercaud and naturally the southwest monsoon is more active on the southern slopes.

Tiruchengode is the driest taluk with an annual fall of only 27·33 inches.

AVERAGE YEARLY RAINFALL IN DIFFERENT TALUKS.

Hosur : 31·27 Krishnagiri: 31·58 Salem: 39·30 Tiruchengode: 27·33 Omalur : 32·35 Attur : 36·16 Dharmapuri : 31·83 Uttangarai : 31·98 Yercaud : 63·14.

AVERAGE MONTHLY PRESSURE

Jan.	Feb.	Mar.	Apl.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
29.125	.096	.051	28.986	.931	.898	.908	.933	.965	29.006	.050	.105

Alambady Cattle.

By

Mr. R. W. Littlewood, N.D.A.,

Deputy Director of Agriculture, Livestock, Hosur Farm.

This is the chief breed of cattle in the North Salem District. The type is " Malai-Madu " or hill cattle, though certain variations are recognised, which are largely due to environment and different conditions of breeding and rearing. Formerly, the cattle of these hills wandered throughout the tract, at the will of the graziers, wherever most suitable pasture was found and there was frequent interchange of breeding bulls. It is a mixture of Mysore blood. The cattle north of Denkanikota in the Hosur Taluk are also known as an allied breed.

It derives its name from the village of Alambady on the banks of the Cauvery ; this village no longer exists and Alambady is just the penning place for cattle.

The reason for the North Salem regions teeming with great herds of cattle is the wild expanse of forest land which is scarcely fit, or has not yet been taken up, for cultivation and with only patches of tillage in favoured places and affording herds of cattle, abundant pasture and wide and unrestricted roaming ground. The tracts are stony in elevation with humus in the valleys. The forest growth is deciduous ; and the pasture lands are thoroughly baked in the hot weather by the heat of the sun so peculiarly intense in the valleys, in the low hilly regions. Another reason, though of a secondary importance, is the noble river Cauvery whose waters are utilised for irrigation higher up in Mysore and fertilize some of the richest tracts in Southern India lower down and which runs in these regions through scenery of wild grandeur on a bed too deep for irrigation purposes and affords cattle a perennial supply of water in seasons when the country becomes parched up and thirsty.

In the forests of Dharmapuri and Hosur in the North Salem district, which together with Kollegal and North Bhavani of the Coimbatore District, represent the most important area of forest breeding, the cattle which graze in the forests are cows with their calves ; except for the breeding bulls which run with the herds, no other male stock are seen. The male stock are annually sold as yearlings at big fairs such as Mahadeswaramalai, Gettisamudram and Mecheri and find their way into the hands of ryots who rear cattle. Throughout this area, the rearing of bullocks from these forest-bred cattle is a most important industry. It not only forms a profitable method for ryots to realise the value of their available straw, fodder and grass, but it also forms a main supply of heavy draught cattle for Malabar, West and North Coimbatore, Chittoor, North and South Arcot, while the pick of such animals are taken further south to Tanjore, Trichinopoly, Madura and Tinnevelly to be used either as coach bullocks or for heavy draught. This breeding is one of the finest object lessons one can see in the Presidency to show the value of not mixing the cattle when grazing. The cows lose condition in the hot weather, but they are all large framed animals; while the bullocks, reared from calves produced from these herds, show still more clearly how valuable it is, even when grazing is limited to select and keep good breeding bulls.

These Alambady cattle are very different from the animals, which come from the Bhadrachalam forests of the Godavari district, which are small, ill-bred animals. In the cattle which come from the latter district, one sees all the evils attending mixed grazing; the surplus male stock are never sold until full grown and fetch very low prices.

The Forest Department make a nominal charge of 8 annas per animal per year and the cattle are permitted to graze over the whole area of about 600 square miles for one yearly payment.

Beyond these forest centres but bordering on them, large herds of this breed are also kept in villages commanding extensive pasture. Cows and bulls of this breed, in small numbers, purchased from the large herds are taken away and reared in these villages. The whole habitat of the breed is favourable to the development of bone.

The cattle north of Denkanikota in the Hosur Taluk are bred by ryots in the villages who often own their private grazing grounds. These are described as "Masti" and "Nundi" dana. The cattle of Pennagaram side are of bigger frame and are mostly black or very dark grey in colour.

In the regular breeding tract, all male calves are sold when young *i.e.*, under one year old and these are taken by dealers to recognised rearing tracts chiefly in North Salem, West Chittoor and the adjoining Mysore territory. Ryots of North Coimbatore visit the breeding villages on the hills and buy large numbers of calves for rearinng. West Coast dealers visit the fairs at Dharmapuri and take away calves to the West Coast for rearing. Thus in the breeding tracts, male stock are seldom seen. Most of the agricultural and draught work is done with cows. It is usually stated that one bull is required for every 50 cows but nowhere were the bulls kept in this proportion, nor are they necessary, since these cows seldom calve more frequently than once in 2 years or so. The breeding herds live on the forests for the greater part of the year, where they are kept in pens at night time. They are brought back to the village at harvest time, when the harvested fields provide grazing for some time, and the cattle supply the necessary manure for the succeeding ragi-crop. After this source of grazing is exhausted, the cattle again return to the forests. Except for this, cows are only brought to the villages, when they are too weak or emaciated to keep with the herd or immediately after calving until the calf is old enough to follow the herd. Occasionally, when the village is located near forest pasturage, animals return to the village every night. The breeders of these cattle, except on the Hosur plateau, cannot be considered as ryots. They certainly grow crops for their own requirements, but by profession, they are breeders of cattle, depending on the sale of their calves for their livelihood.

The number of cows in the breeding villages of the Hosur Taluk have increased, the total number of cows for 16 of the principal breeding villages having risen from 7,809 in Fasli 1314 to 18,875 in Fasli 1319. For the whole of Hosur Taluk it is seen from the 5 year cattle census return that the number of cows has increased from 73,617 in Fasli 1334 to 93,905 in Fasli 1339, an increase of over 20,000.

Almost all the bull calves and a few heifer calves are sold at about a year old; bull calves realise on the average Rs. 15 to Rs. 20 each, heifer Rs. 5 to Rs. 10. The cattle from all the villages around Dharmapuri, Krishnagiri, Palakode, Royakottai, etc., are sent to the forests to graze from July to January each year. The animals chiefly exist on grazing and dry fodder. Bulls 3 years old are given a little concentrated food and are ready for work at 3½ to 4 years. Some breeders state that some of the cows calve every 16 months and others every 2 years; this depends on the season and the monsoon. They are all poor milkers. A good number of breeding bulls are dedicated; the animals live in a semi-wild state and are never tied up and so are uncontrollable.

The breed is not of a fixed type throughout the area. Most of the cows graze in the forests in North Salem and North Coimbatore and a number of animals of Mysore herds graze there also ; and my opinion is that this breed (Alambady) has become mixed with this Mysore blood. Breeders admit this and prefer a grey or fawn coloured breeding bull to the black, also a tight sheath animal.

The cows are compact animals and have not the looseness of build which some of the breeding bulls possess. Some have a fold of skin in the position of the sheath and others have not. The colours are grey, iron grey, fawn, brown and broken colours. Some have flesh coloured skin and others black ; some have light coloured muzzle and others a black one.

Tiruchengode Cattle.—In the Tiruchengode taluk of this District, there was a breed of small cattle, the cows of which were very good milkers for their size. Nothing is known of their origin and no care was taken to maintain the breed with the result that to-day the breed is practically extinct, having become mixed up with other breeds. The breed somewhat resembled the small Mysore cattle. The cows gave 8 to 12 lb. milk per day.

The Cattle of South Salem are akin to the Kangayam breed ; and there are a few large landowners who breed the Kangayam breed of cattle and purchase bulls of this breed from the Pattagar of Palayakottai.

Cattle fairs and weekly shandies are common in the district ; and a lot of petty dealing is carried on. Some of the chief cattle fairs are at Mechcheri, Madakondapalli, Nangavalli, and Nathapatti. The Janappa Chetties of North Arcot and Salem are the biggest traders ; and they purchase cattle from the rearing tracts of North Salem and Mysore, they sometimes purchase their animals on credit, giving small advances and paying the balance when they have sold the animals. A few rich Vellala dealers in South Salem who work with a big capital are able to get the very pick of the trade. Some Muhammadan dealers trade large ; but they deal in an inferior class of animal.

Forests and Forest Products of the Salem District.

By

MR. S. RAGHUNADHA RAO, I.F.S.,
District Forest Officer, South Salem.

1. I am grateful to the Madras Geographical Association for giving me this opportunity of addressing its members on the subject of the Forests of Salem and its forest products. The Forest Officer is very rarely an accomplished public speaker ; and I am afraid I am no exception to this general rule, and I must therefore ask your indulgence for my shortcomings in this respect.

2. As members of the Madras Geographical Association, I am sure you will appreciate the point when I say that Forests are fundamental natural entities in the same sense as mountains and oceans. The face of the globe was formed by various geological upheavals and subsidences of which the geologists tell us. The face of the globe was clothed with vegetation by the play of various natural forces, the study of which forms the fascinating subject of ecology. A forest is Nature's invariable answer to any stretch of exposed soil. It will therefore be well to remember that in dealing with forests we are dealing with one of the first things of the earth and that light-hearted tampering with forests may be fraught with immediately inappreciable but in the long run with far-reaching consequences.

3. What, then, is a forest ? To the urban lay mind, especially if it is steeped in the romantic literary tradition, the word conjures up visions of an impenetrable mass of lofty trees, tangled with lianas and creepers, in the gloomy shade of which lurk mysterious dangerous animals, ready to pounce on the unwary man who ventures within. A tropical forest is commonly supposed to be even more lofty, tangled and gloomy and the vegetation is fecund and fast growing. Judged by these romantic standards, there are few forests in India and none in Salem. To the scientist a forest is not necessarily an association of tall trees, any more than the word rock connotes to the geologist only a substance of granite texture. In the scientific sense, a forest is a natural association of one or more woody species, occupying land in more or less close formation, and

functioning together as a composite organism. The denser a forest is and the more unbroken its canopy, the better does it function as a composite organism. An ideal or, as we forest officers call it, a normal forest maintains its own temperature and humidity and almost makes its own soil and air. A group of scattered trees, however lofty and well-grown may make an excellent park, but will not amount to a forest if they are unable to act together as a composite unit. A forest in its ideal state resists invasion by alien species and maintains itself in a state of perennial youth by natural regeneration. To the professional forester, a forest is not merely a congeries of living things, but is itself almost a live thing responding to every stimulus in a definite and recognisable manner. As is well known a description of the flora does not exhaust the contents of a forest; a forest is never complete, at least in the aesthetic sense, unless it is well stocked with game indigenous to the locality. Only then can it be regarded as a truly fundamental natural entity.

4. A forest is the natural resultant of the various factors of the locality, such as the climate (including temperature and rainfall), the soil, the altitude, the aspect, etc. In India the most important factors which determine the distribution of species and the type of forest formation are rainfall, temperature and altitude. Unlike the temperate zone where conditions favour the formation of gregarious forests (*i.e.,* forests with a very limited number of species) forests south of the coniferous region of the Himalayas contain a great wealth of competing species, not all of which are valuable from the economic point of view. In India, as elsewhere, the advance of agriculture (and civilisation) has always been at the expense of the forest, so that at the present date, forests are confined to hill slopes and soils inhospitable to agriculture. Most of the forests in Salem are hill slopes, with the exception of the Hosur Taluk where a large area of land not unfitted for dry agricultural crops is immersed in forest. The forests of Salem range in elevation from 1,000 to 5,000 feet and the rainfall varies from 30 to 50 inches. These factors practically determine the type of forests met with in Salem. At the lower elevations and in the drier localities, the forest is what is known as thorn forest, composed of a large variety of deciduous species, fit only for fuel, with a thorny undergrowth. The trees are stunted and mis-shapen and rather sparsely scattered.

5. The Forests lying within the Revenue District of Salem may be considered to be in three blocks. On the North-Western

side of the District lie the Forests comprised by the North Division. On the North-Eastern side are the Forests of the Central Division ; and the Forests lying at the South-Eastern corner belong to the South Division ; and these are rather scattered.

6. The importance of Forests, from the point of view of water supply and as sources of rivers and streams and from the point of view of affecting the water level on the plains, is perhaps, not realized by the public to the fullest extent. There are probably people who do not understand the relationship between Forests and the water supply of the country in the plains.

7. The effect of forests on the actual event of water falling as rain is correlated with another and more important one, particularly in tropical countries and that is the mechanical retention and storage of water. The population of India is mainly agricultural and it is of the first importance that one must have all the rainfall, which is often scanty and which occurs in well-marked seasons with intervals of drought.

8. The surface of the land is sloping, and the water falling on it finds its way by a multiplicity of water courses to the main rivers and thus, if not diverted, or held up, ultimately to the sea. I cannot better illustrate this than by referring to the sloping writing desk in a school. Supposing water is poured on a desk of this kind, it will doubtless run off quickly. It is what happens on bare hills and causes flood. Supposing a sheet of blotting paper was put on the sloping desk and then water were poured on it, it will not run off as in the first case, because, the blotting paper would absorb some part of the water and it is only what it cannot hold that will run off. In exactly the same way, if our hills were to be unclothed with trees, water resulting from the precipitation of the clouds will run off the hill slopes. Where there are no forests, or little or no vegetation, the soil exposed to the direct heat of the sun, causes no cooling of the atmosphere and the conditions produced are consequently, as has already been explained averse to conditions of precipitation. Further, the earth is baked to a hard crust which is often covered with a layer of desiccated dust. The rain, when it falls, is thus unable to soak into the soil, and the whole fall runs off rapidly ; and directly the sun again appears, enormous evaporation takes place, since there is no screen intervening between the

side of the District lie the Forests comprised by the North Division. On the North-Eastern side are the Forests of the Central Division ; and the Forests lying at the South-Eastern corner belong to the South Division ; and these are rather scattered.

6. The importance of Forests, from the point of view of water supply and as sources of rivers and streams and from the point of view of affecting the water level on the plains, is perhaps, not realized by the public to the fullest extent. There are probably people who do not understand the relationship between Forests and the water supply of the country in the plains.

7. The effect of forests on the actual event of water falling as rain is correlated with another and more important one, particularly in tropical countries and that is the mechanical retention and storage of water. The population of India is mainly agricultural and it is of the first importance that one must have all the rainfall, which is often scanty and which occurs in well-marked seasons with intervals of drought.

8. The surface of the land is sloping, and the water falling on it finds its way by a multiplicity of water courses to the main rivers and thus, if not diverted, or held up, ultimately to the sea. I cannot better illustrate this than by referring to the sloping writing desk in a school. Supposing water is poured on a desk of this kind, it will doubtless run off quickly. It is what happens on bare hills and causes flood. Supposing a sheet of blotting paper was put on the sloping desk and then water were poured on it, it will not run off as in the first case, because, the blotting paper would absorb some part of the water and it is only what it cannot hold that will run off. In exactly the same way, if our hills were to be unclothed with trees, water resulting from the precipitation of the clouds will run off the hill slopes. Where there are no forests, or little or no vegetation, the soil exposed to the direct heat of the sun, causes no cooling of the atmosphere and the conditions produced are consequently, as has already been explained averse to conditions of precipitation. Further, the earth is baked to a hard crust which is often covered with a layer of desiccated dust. The rain, when it falls, is thus unable to soak into the soil, and the whole fall runs off rapidly ; and directly the sun again appears, enormous evaporation takes place, since there is no screen intervening between the water and the sun. A very different result is seen where the ground is covered with forests. They act like the blotting paper in holding the rain water and in conserving it into the soil. Tree-

clad hills render the conditions favourable for rain-fall. The rain drops fall on the foliage and thence a portion drops on to the undergrowth and soil beneath; another portion falls from leaf, along the twigs and branches and eventually finds its way to the soil by the stems. The portion that reaches the ground will find the loose and permeable surface soil which has not been baked hard by the protection afforded by the trees, and into which the moisture penetrates. Also, the debris of leaves and twigs that are found in the forest floor go to afford a retaining sponge and protection against evaporation.

9. From experiments conducted in Bavaria, it has been learnt that while only two per cent of the fall of rain in the open percolates to a depth of 2 feet into the soil, not less than 60 per cent finds its way to that depth inside a forest.

10. A portion of the rainfall, which has percolated into the soil apparently gets slowly to small springs and streams which are thus regularised in their flow; and water courses issuing from forest-clad slopes are rarely torrential, if not perennial. They at least contain water for the greater part of the year. In the other case, there is a torrent descending down the hills very suddenly instead of percolating into the soil, a furious rush of water for a few hours and then a dry stream bed. In the other, a steady flowing stream, with its flood rising and subsiding slowly, is rarely a danger. Can there be a doubt as to which set of conditions is the more valuable to the community? And is it too much to ask that the people be prevented from irretrievably injuring themselves and their descendants? Everyone who goes about the country knows instances of floods, of mountain torrents bringing with them silt and boulders to destroy the crops and to put fertile fields entirely out of cultivation; of the silting of tanks and irrigation channels; roads and bridges destroyed; of erosions; of the disappearance of springs; of the lowered water level in wells, followed by pathetic efforts to chase the water by digging rather than by tackling the trouble at its source; of rivers becoming of decreasing use for navigation by silting, and in changing their courses for the same reason. By destroying trees, by reducing below the minimum the amount of forest which is essential and by denuding areas, there is a potential danger; man has thus in every climate prepared certain calamity for future generations.

11. The great river of the District, *viz.*, the Cauvery is chiefly fed by the headwaters of the Wynaad forests; but it also gets

its contributions from the headwaters of the forests above Hagainakal of the North Division. The Vasishtanadi of Attur and Swetanadi of Tammampatti side get their contributions from the Forests of the Central and South Divisions respectively.

12. The water-supply of Salem Town is dependent now on a rainfed tank at Panamarathupatti. The hill side on Jarugumalai is rapidly getting denuded. The eventual effect of this would be to reduce the water level of the tank as the rainfall will not be conserved on the hill slopes for the longest period. Boulders of stones brought down by torrential rain will tend to increase the level of the tank bed and thus reduce its volume capacity. According to forestry principles, we would consider the protection of the tree growth of the adjoining hill sides is of paramount importance and do everything in our power to stop the denudation and if possible afforest the banks. We call forests of this kind "Protection Forests" which solely serve the interests of water supply. I can recall to my mind, in this connection a place in Switzerland known as Fribourg which I visited during my probation period. Close to Fribourg are some hills. They were bare at one time. The people living in the plains had to put up with constant destruction by torrential rains which swept their dwellings and all. They had very little choice between living at Fribourg and moving to some safe place away from the hills, until one day a Swiss Forester hit on a brilliant idea. He made up his mind to afforest these bare rocks. There was no soil to put his seed into and make it grow. He literally drilled holes in the rock at different intervals, put in a little soil taken from outside and dibbled seeds of the hazelnut. The hazelnut grew, the roots of the trees spread themselves out and disintegrated the rocks and in due course soil formation set in. Thereafter the Forester introduced other species such as the Silver Fir and the Pines and succeeded in clothing the hill sides. To prevent the downpour of rain water he constructed steps at different intervals in the course of the streams so as to check the velocity of water. This is known as "barraging." Similarly in other places afforestation work has been done in the interests of the plains below; and water supply has been ensured. I must add incidentally that it would be wrong to cut away any tree growth found on the banks of streams as they help to check evaporation and protect them and make them last the longest.

13. The Forests of Salem have a definite place in the economic structure of the District. The hill forests, for example, are the guarantors of water in reservoirs, tanks, etc. Neither the official

world nor the public can afford to look on complacently the disappearance of vegetation on hill sides. Large sums are spent on silt clearance and strengthening of public works. Very little is spent to improve catchment areas (i.e.) on curing the trouble at its source.

14. The first step must be education and persuasion, the spreading of the pertinent knowledge of every possible means among every class of the people.

15. In India, speaking generally, rainfall of the year occurs at two seasons known as the North-East and South-West monsoons. Either a delay in the rainfall or its unseasonal occurrence may, by preventing ploughing or ripening of the harvest, cause widespread disaster amongst the people who have very few resources at their disposal. Therefore the storage of water and of the regulation of its off-flow is of vital importance. Though there are tanks, wells and canals, it is to the forest that we must look for wider results in restraining the surface flow of heavy rain. It is by them that the water level is maintained at such a height that it can be easily reached, that springs are kept supplied and perennial streams are made to flow.

16. The direct benefits from forests are probably more obvious than the indirect. They are divided into major produce including timber and fuel and minor produce including grazing, leaf manure, tanning barks, and various other minor items. In spite of the numerous substitutes for wood in its multifarious uses, the demand for timber per head of population continues to increase. Warning of a timber famine in the near future has been raised.

17. Against an area of 6,912 square miles of Salem District the proportion of the Forests is perhaps 1 to 4. The people living within a radius of five miles from the Reserves are really the ones that are at all affected by Forest problems. To the total population the people that have forest interests apart from water considerations may be about twenty per cent of the whole District population. Their cattle will depend for grazing entirely on the forests and they will depend on the forests for their cultivation in the plains for manure leaf and adequate water supply. Even if the hills do not contribute large volumes of water to any definite rivers or streams, they certainly influence the water level of the springs in the plains, in the proportion in which tree growth on the hill sides are protected or not. Therefore the tendencies on the part of a fraction of the public to cut away trees is fraught with far-

reaching consequences which are not apparent on the surface. I cannot emphasise sufficiently the influence that forests bear to the water supply, and general well-being of the surrounding population.

18. The forests situated in the Revenue District of Salem vary according to the elevation, rainfall and climate which vary somewhat in different parts of the District. For purposes of management, the forests are divided into three divisions known as the Salem North, Salem South and Salem Central Divisions. The headquarters of the North Division is at Hosur, while those of the other two are at Salem. The forests lying in the North Division contain chiefly Sandalwood and grazing ground. The Sandalwood unfortunately has been very much subjected to a disease known as "Spike" which brings about the death of the tree, and thereby does not allow it to put on the maximum amount of scented wood (heartwood). The forests being at the foot hills generally are of a scrub jungle type, containing thorny species such as the Acacias mixed with the Albizzias, etc., which are useful only for fuel. Timber yielding species are few and almost non-existent. Sandalwood is extracted departmentally and sold, while the other kinds of forest products (both major and minor) are worked through the agency of contractors.

19. The products that are made available to the public are the following:—Timber, firewood, bamboos, sandalwood, grazing, minor forest produce and manure leaf, and drift and waifwood.

20. The average Forest Revenue from the District of Salem is five lakhs and twenty thousand Rupees. Of this the biggest item is Sandalwood, worth about two lakhs and thirty thousand Rupees. Of the remaining, ninety seven thousands is grazing, nearly seventeen thousands is timber, forty five thousands is firewood, thirty three thousands is bamboos, fifty thousands is minor produce and leaf manure and forty two thousands is drift and waifwood.

21. The fuel is sold by coupes to contractors who fell and sell the material *in situ* or at the depots located in places where it is in demand.

22. Bamboos. Dendrocalamus strictus variety is the one that is largely met with, while Bamboosa arundanacea is limited. The latter is particularly good on the Pachamalais of the South Division. The bamboo is sold to contractors by coupes, on a three to five year rotation.

23. Sandalwood areas are divided into felling series, each series consisting of six coupes. Each year before March, all the dead trees in a coupe are enumerated, while the living trees are tended. After the first rains, when the ground is soft, the numbered dead trees are extracted in serial order wholesale. Roots up to the size of half a rupee in thickness are taken out intact. In the Shevaroys and the Chitteries Sandalwood is plentiful but somewhat young; fortunately it is not yet attacked by "spike." The Sandalwood of the North Salem Division is badly attacked by "Spike," while that of the South Salem Division is partly attacked.

24. The hills falling in the three Divisions vary in their character, altitude and rainfall. These are the Shevaroys and the Chitteries of the Central Division and the Jowlagiris of the North Division and the Kollimalais and Pachamalais of the South Division. The annual rainfall on these hills varies from 40 to 60 inches.

25. The Shevaroys reach a maximum altitude of 5,231 feet (Sanyasimalai) and contain the hill station known as Yercaud, where coffee-growing is being done on a large scale. The Kolli hills are from 3,000 to 4,600 feet in elevation and produce excellent plantains, a poor strain of jack-fruit, pine-apples and very fine oranges. The inhabitants of these hills are called Malayalees (hill men). They are not really a hill tribe in the ordinary sense of the word, but only low country people that emigrated to the hills at some remote date. The original inhabitants appear to have been Vedans and Irulas whom the settlers appear to have killed and taken their women folk for their wives. One tradition has it that they are Vellalas who emigrated to these hills from Conjeevaram. Another tradition has it that they were soldiers of the Gangas who were defeated by the Cholas and driven to the hills about the 10th Century.

26. A Tamil poem called Arapoleswara Sathakam of 100 stanzas in praise of the Arapoleswaran God on the Kolli Hills, refers to the Malayali king of the Hills as Kangakala.

27. A third tradition has it that they are the natives of Malabar country and soldiers of a king of that country who, when they invaded the Chera country, and were defeated, had to flee to these hills for safety.

28. The Arapoleswaran temple on the Kollis, judged by the Alphabet of one of the long inscriptions, would suggest that it belongs to the Chola period of the thirteenth century.

29. Agriculture is the only source of livelihood of the Malayali done in the flat valley below the head of springs and streams. The hill slopes are cleared of their growth, and burnt and on the hill-side terraces are made into ploughed fields for the cultivation of dry crops.

30. *The Pachamalais.* The Pachamalais vary in height from 2,800 to 3,600. The hill tribes are known as Malayalees and are similar in character to those of the Kollimalais and the Shevaroys Malayalees. They too live mainly by agriculture and the sale of pine apples, plantains, jack fruits, etc., which they take down to the plains on shandy days and sell. Their origin and history is obscure.

31. All these hills are highly malarial so that the people of the plains hardly ever come up except to the Shevaroys which has Yercaud connected with the plains, by a good metalled road. The other hills have no means of getting up except by footpaths.

32. The rainfall on the plains is only up to 39·65 inches in the year. The mountainous character of the District causes sharp variation in the rainfall of different localities. So capricious are the showers round Salem that an inch may fall at the Collector's office and not a drop at the Club. There is generally in the District, considerable difficulty concerning the water supply, and the day when Mettur water comes to Salem Town would be a great day indeed.

33. The Kollimalais which lie in the Salem District are separated from the Pachamalais by the Turaiyur valley, and from the Bodamalais by the Arilpatti ghaut. They form a hill mass measuring 18 miles from North to South and 12 miles from East to West. The Pachamalais lie chiefly in the Trichinopoly District.

34. The average maximum temperature is 93 degrees and the average minimum 70·7 and the average mean 81·7.

35. *Geology.* To a great extent the rocks belong to the great metamorphic or gneissic series of Southern India, known as the Archaean series. The Shevaroys belong to the Charnockite series and are ingneous rocks. Near and about Salem, are the "Chalk Hills" from which magnesite is extracted and exported.

36. As a Forester, I shall be failing in my duty were I to omit a word about the Fauna of the District. It is much to be

deplored that game both big and small has been reduced to the lowest ebb by indiscriminate and continual shooting (poaching) by the hill tribes and others. To-day we are faced with a situation in which the preservation of wild life calls for the utmost consideration. One hardly ever sees an animal in the jungles now-a-days; and the little game that is left is confined to North Salem Division. Public opinion needs to be awakened against destruction of animals. We need to regard our Forests for a long time to come as game sanctuaries and keep our hands off animals. It is sad to have jungles with nothing more than human beings moving in them. I look to the Geographical Association to show their sympathy for spreading the correct ideas.

37. The work of the Forest Department is not probably fully understood by the public. Firstly the Department has to manage the forests in the general interest of the public and not for any individuals or small local communities. Therefore the local villagers are apt to regard the safeguards imposed by the Authorities as an unnecessary restriction on themselves. Secondly, forest areas are situated on difficult country, so that the work that goes on there is not evident to the general public. Thirdly, the practical results of various works are generally evident only after a long time, which may be a generation or more in the life of human beings. Forests exist only as a cause of grievance so long as Government attempts to prevent its destruction and to regulate the utilization of its produce, so that not only the present generation, but the generations to come benefit by it.

38. On 2 main principles underlie the forest practice, namely that of sustained yield and second of harvesting of the produce and its replacement by another as good if not better as that harvested. To secure continuity of working, to regulate the cut, to secure a convenient and orderly arrangement for fellings, to lay down sylvicultural rules to be followed in the regeneration, tending and harvesting of crops, a working plan is made on the basis of assessing, stock-mapping and valuation of the forests.

39. Although I should like to say something about this side of forestry, I feel sure that I have approached the endurance of my listeners and I must not encroach further upon their time.

40. It is in assuring that forests, such as they are, shall be a permanent national asset, that the forester inevitably comes into conflict with the present generation. With people who give no thought to anything but their own immediate needs the forest officer

must for ever be an unpopular person. Small causes operating through long periods of time produce important results and the forest officer who impounds a goat or fines an old woman for collecting twigs from the forest has this in mind. The essence of conservancy is the strictest regulation of the use of the forest for any purpose, the prevention of fire and theft, so that the forest may grow better and denser and confer on our children and our children's children its manifold benefits.

41. I feel grateful to the Secretary of the Association for having given me this opportunity of speaking before this conference.

Public Health of Salem District in Relation to Environment

By

Mr. A. J. George, L.M.S., D.T.M., (Cal.).
District Health Officer, Salem.

Mr. President, Ladies and Gentlemen,

Salem District is an inland District with the sea 150 miles to the east and 300 miles to the west. The area is 7057·98 Sq. Miles, population 2,433,972. The physical characteristics vary to such an extent that we may roughly divide the district into 3 natural groups. There are 10 taluks with 1,806 villages.

(1) Hosur Taluk and northern portion of Krishnagiri taluks are situated at 3,000 feet above sea level and comprise one group. Here the climatic conditions, etc., closely approximate to those of Mysore plateau—*Balaghat.*

(2) The south-west portion of Hosur taluk, the southern portion of Krishnagiri Taluk, Dharmapuri and Harur taluks are roughly 1,300 feet above sea-level and constitute another natural grouping—*Baramahal.*

(3) Omalur, Salem, Attur, Tiruchengode and Namakkal taluks comprise the 3rd group and are situated at 1,000 feet above sea level—*Talaghat.*

Mountains. The whole District is scattered with small hillocks and hills all over and is rightly called a District of hills, dales and valleys. The chief mountains are Shevaroys 4,500 feet above sea level in Salem and Harur taluks, Kolli hills and Pachai hills 4,000 feet high in Namakkal taluk, Kalroyan hills 2,700 feet high in Attur taluk. Other hills of minor importance exist in Tiruchengode taluk. They vary from 1,500 to 2,000 feet high.

Rivers. The main rivers of the District are the Cauvery and the Pennar. All the others are tributaries of the above two rivers. The tributaries to the Cauvery are Doddanahalli, Chinnar, Thoppiar, Sarabhanga Muki and Tirumanimuthar. For the Pennar the chief tributaries are Markandeyanadi, Swarnamukhi and Vaniar. In Attur taluk the Vasishtanadi and Swetanadi are the chief rivers.

Besides these there are many rivulets flowing in the District. All these are dried up in summer except the Cauvery and the Pennar.

Forest. The forests are in plenty and forest produce fairly large.

Rain. A greater portion of the district depends for water supply for cultivation purposes as well as for the use of human beings on wells only, on account of the perversity of the rainfall (which is of frequent occurrence). Water scarcity is common more especially in summer months. The average annual rainfall is 30″ while the rainfall in Shevaroys is 60″ on an average.

Crops. Dry cultivation prevails chiefly and there is a small amount of wet cultivation. The chief dry crops are cholam, ragi, and cotton, and the wet crops paddy, sugar-cane, plantains and a little of tobacco.

In the *Shevaroys,* coffee, berikkai and custard apples are grown.

In the *Kolli hills,* dry crops are cultivated in plenty, besides jack fruits, plantains and oranges.

In the *Krishnagiri Taluk,* grapes flourish and are exported.

In the *Salem Taluk,* mangoes are of special importance, these being of graft variety.

Occupation. The main occupation is agriculture. Weaving of dhoties is carried on in Rasipuram, Salem and Tiruchengode taluks ; woollen carpets of a coarse kind are made in Dharmapuri, Tiruchengode and Hosur Taluks. Sugarcane is largely cultivated in Rasipuram and Dharmapuri taluks, and jaggery is manufactured.

Having pointed out briefly the geographical peculiarities of the District, I shall now proceed to give an account of the epidemic and endemic diseases commonly prevalent in the District and which can directly be correlated to the geographical peculiarities pointed out above.

1. *Plague.* This disease is now practically confined to Hosur taluk. The climate of the taluk is cool and the starting of the epidemic could be definitely traced to importation of cases from the adjoining Mysore province. Usually it starts in the cold months i.e., November and December when the rat flea-population is distinctly on the increase. If the infection starts rather early i.e., in July or August towards just the close of the hot months, the epi-

demic is likely to become severe ; and in the infected villages the nuisance created by the rat fleas is very great. If you just step into a village you will see rat fleas crawling up your legs.

The habits of the people are dirty, and they are economically in bad condition ; and the overcrowded habitations favour infestation by rats. But even here, due to the close watch and anti-plague measures adopted by the Public Health staff specially employed, the virulence and extent of the disease is coming down. The following is the quarterly attacks and deaths for the last 5 years : —

Year.	1st.		2nd.		3rd.		4th.		Total.	
	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.
1931	35	13	0	0	1	0	43	22	79	35
1932	148	55	58	25	125	54	105	42	436	176
1933	133	65	56	13	443	178	222	108	854	364
1934	136	48	31	10	61	29	38	21	267	108
1935	22	8	5	2	8	3	0	0	35	13

It is a recognised fact and also well known that rats are the means of communicating the disease from one person to another and the particular agency in the transmission is the rat flea, which lives on the rat, sucking its blood.

So one of the anti-plague measures is that of catching rats and destroying them. The method till now used which is also now being continued in Hosur taluk is by means of rat traps.

Recently a newer and a more efficient method of destroying rats is put in force in Hosur taluk and that is cyanogas fumigation of rat burrows in houses ; cyanogas is a deadly poison to all living and it speedily kills the rats, bandicoots, mice, etc., in burrows and what is more important is that it kills at the same time, the rat flea, the chief agent in transmitting Plague. It will be realised that by the destruction of rats caught in rat traps, the rat fleas generally escape destruction and they again infect other rats and transmit the disease. The great advantage of cyanogas fumigation of rat burrows is that rats as well as rat fleas are quickly and efficiently done away with. Further this method of cyanogas fumigation is going to be introduced shortly to disinfect clothing of infected persons and grains. Formerly sun-disinfection was being done for the infected clothing, grains, etc.; and it was very unsatisfactory as the conditions requisite for efficient disinfection were not always available. Anti-Plague inoculation is also being pushed on in infected places where the people do not evacuate the infected houses;

people, especially the agriculturists and cooly folk, are yet to realise the full value of the procedure adopted.

Permanent Anti-plague Measures are not attempted to be done yet in Hosur taluk such as rat proof godowns, removal of overcrowded buildings and opening up new extensions, etc., because it involves financial outlay. But it has been done in Salem Municipality. The number of extensions which we see in Salem city is the result of the sanitary conscience roused up in the minds of the well-to-do citizens after repeated attacks of plague to which the city was subjected in the early part of the century, i.e., between 1910 to 1925.

Malaria. Every year there are on an average about 15,000 deaths due to fever, and a third of this is due to Malaria. Hills and forests being in plenty Malaria is endemic. The worst infected area is the Kolli hills, Pachai hills and a portion of Harur taluk. In Shevaroys the disease is prevalent and at times assumes epidemic proportions. Government after investigation are pleased to extend the distribution of quinine to the villages in Kolli hills and in Uttankarai villages. The quinine is in the tablet form and the number of tablets required for a treatment is given to each patient freely with instructions. Each patient is to take 20 pills of 5 grain tabloids for a full course, each packet contains 20 such pills ; and though the quinine is given, patients are generally found to stop the treatment when the fever temporarily subsides. It has been found very difficult in uncontrolled population to efficiently see that the full quantity of the treatment packets are taken by each individual. The chief agents for the distribution of quinine are the Village officers of the Revenue Department, Missionary bodies and teachers.

Besides the free distribution of quinine by Government the District Board purchases quinine every year for free distribution to villages in the rest of the district wherever the disease assumes epidemic proportions. Mention must be made here of Mettur where the disease is brought under complete control. Mettur was stricken with Malaria in former years. The place was carefully surveyed, the breeding places of anopheline mosquitoes were noted, and each one of these water places for a radius of one mile from the town is given antilarval treatment suited to each. Either Paris greening or oiling regularly and systematically and thoroughly was being done by trained staff under efficient supervision. The vegetation in Varis or small channels were systematically removed and oiled by a special method so that a thin layer of oil was kept up in the surface. Surface drainage and sub-soil drainage were attended to. In fact the measures were so perfect in every particular and the supervision so efficient that we see to-day the complete eradication of Malaria from Mettur, and it is now no longer the scare that it used to be in old days.

Cholera. This district is not endemic for Cholera prevalence, but being introduced from adjoining infected places it assumes epidemic proportions when conditions are favourable for the spread. The disease usually starts with the onset of rains in September or October and assumes very great epidemic proportions especially along the villages situated by the side of the rivers. And in two taluks, Krishnagiri and Attur and more especially in the latter, the disease spreads very rapidly along the rivers, and villages on the banks very soon begin to get infected. Consequently, the eradication of the disease, once it gets a hold in the two taluks noted above is a difficult and laborious task.

Burial of dead bodies on the banks of the river, washing of infected materials in the rivers and indiscriminate defecation on the banks and river-beds are the dangerous causes for the spread of the disease in this area.

Last year (1935) we had 1669 attacks and 849 deaths due to Cholera, and the major portion of these were in Krishnagiri and Attur taluks.

Guinea-worm. This disease is prevalent in the southern taluks especially Rasipuram, Tiruchengode and Namakkal where step wells are numerous and water scarcity is prevalent. Though the remedy from a preventive aspect is to remove the steps of the step wells and conversion of the same into draw wells fitted with pulley and rope, yet from a practical point of view the adoption of the proposal is very slow and progress in this direction is not satisfactory. The enormous cost of conversion of the step wells into draw wells and the habits of the people are the chief stumbling blocks in the way of improving such dangerous sources of water supply. A new remedy is now going to be adopted, and that is the introduction into these wells of a particular kind of fish (Barbus Puckelli) which eats away the larva of guinea-worm as well as its host " cyclops quadricarnis " ; and the results of the new remedy would be watched with interest. Even then it is not desirable to have step wells, since the chances of other contamination occurring is great.

Small pox. This disease is endemic. It usually assumes epidemic proportions especially in the hot months of the year due chiefly to the infected materials such as scabs from the small-pox ulcer being blown about by the wind. The infection subsides gradually with the onset of rains. It is of late prevalent in almost all the taluks of the district. The immunity conferred by primary vaccination in infancy gradually wears away in course of time and it is noted that the incidence of the disease is chiefly among the adult population and also among those who had for some reason or other escaped primary vaccination in infancy. As a remedial measure, primary vaccination and mass revaccination are being pushed on ; revaccination among adults once in 7 years is now compulsory as per rules.

Diseases of the hot months. Conjunctivitis (sore eyes) is common. Among the others may be included Dysentery, Diarrhoea and skin affections like boils, etc. As these are not peculiar to this district alone but are also common in other districts, no special remarks are necessary.

Leprosy. A passing note may be made to the prevalence of Leprosy in this district and measures adopted to bring relief to the affected and to prevent the spread. The disease is noticed to prevail particularly among the weaver population. At present there are estimated to be 20,381 leper cases in the district not to speak of the early cases still undiagnosed. Perhaps a host of causes bring about the disease, though it is difficult to point to a particular cause. Bad economic conditions, overcrowding, intemperance, eating of stale fish and a poor state of general health are found to prevail among this class of people. It is also found to be prevalent in the villages situated on the banks of the river where the river beds offer wide expanse of sandy areas.

We have forty part-time clinics attached to hospitals and dispensaries where leper patients receive treatment twice a week and one full time clinic at Peddunaickampalayam where the Medical Officer in charge treats cases, does leprsoy survey, i.e. collecting statistics by inspecting house to house in the villages allotted to him. We are also doing intensive work in demonstration centres.

Such in brief is the survey of a great part of the Public Health activities of this district. Much remains to be done yet, e.g., provision of good drinking water wells for villages and improvement of village sanitation. The progress is necessarily slow as funds are required in sufficient amounts ; but at the same time, a steady though slow progress is being made on the onward march towards the desired goal.

Conclusion. In conclusion I thank the Secretary, Mr. Subramania Ayyar for having given me the chance of talking to you regarding the Public Health aspect of this district to such a learned audience and I hope that it has been of some use for the deliberations of the Conference. I also thank the Chairman and the learned audience for having patiently heard all that I had to say.

Population of Salem District

By

Mr. K. Srinivasaraghavan, M.A., Dip. in Geo.

Salem district, though a political unit, can be divided into four distinct Geographical regions. 1. The Balaghat forming part of Hosur taluk and Krishnagiri taluk, belongs strictly to the Mysore plateau and is above 3000′ in elevation. It is peopled mainly by Kanarese people and the population is distributed more along the four river valleys in the area.

2. The Baramahal (the twelve forts) forms part of the taluks of Hosur, Krishnagiri, Dharmapuri, and Harur and lies at an average elevation of 1300′. It forms the main step leading from the Mysore plateau to the Carnatic plains, and has been historically of very great military importance.

3. The Talaghat forms the rest of the district and has an average elevation of less than 1000′. This is the densely peopled area and is the most important region of the district.

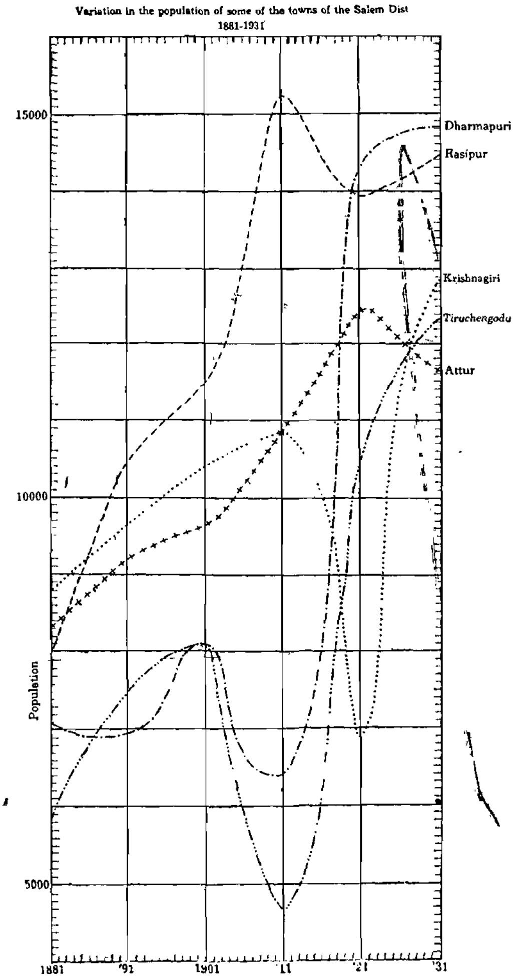
4. The scattered and isolated hills of which the most important are the Shevaroys, Kalroyans and Kollimalais are distributed over the Talaghat region. These are peopled by the hill tribes known as Malayalees and the human settlements and activities are distinctly peculiar to this region.

The Northern half of the district has for ages been the cockpit of contending forces from the plateau and the plains, and thus this area has never permitted the growth of a settled population or culture. This is seen from the lack of Siva and Vaishnava temples of importance. But a few towns have begun to grow during the last century and the rail and road have to a certain extent brought more human settlements to this area.

Geographically the district has extremes of relief condition, an excessive range in temperatures and very differing rainfall and soil conditions. Again there are flat plateaus, deep valleys, basins among hills and isolated hills of varying heights. Thus the region has been an uninviting one for human settlements and has to a great extent contributed to the uneven distribution of population, the southern portion in general being more densely peopled than the northern portion.

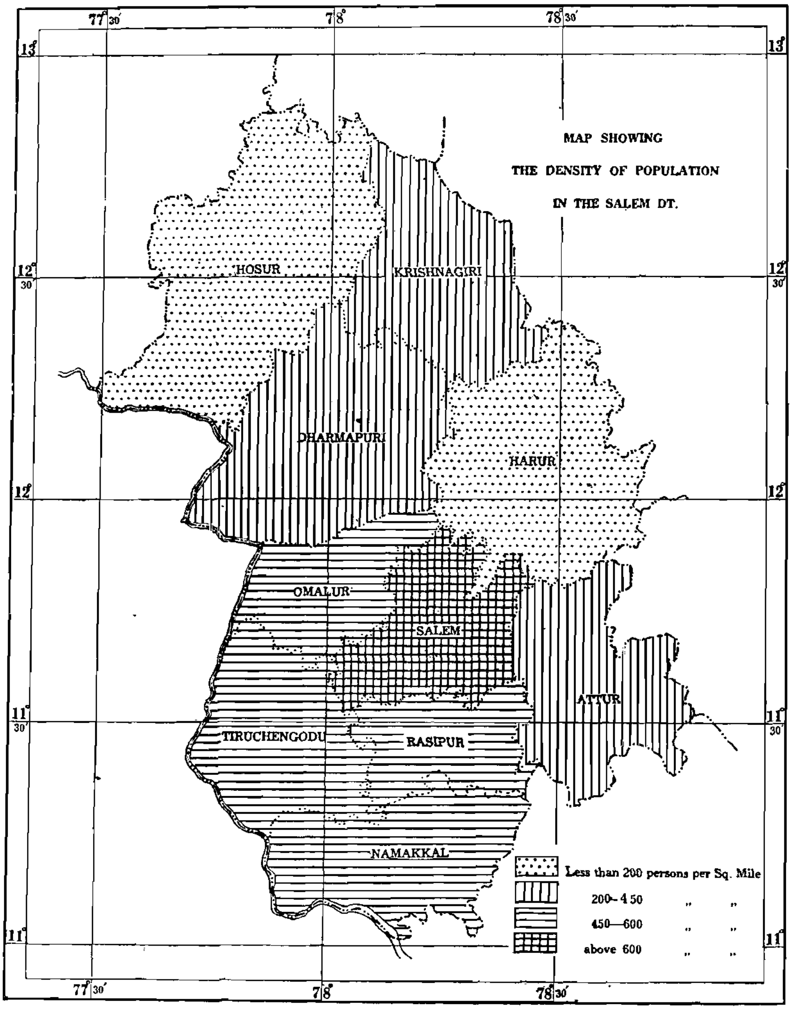
Modern methods of forestation, and plantations and cattle breeding have tended to increase the population of the district and to a certain extent has brought peace and prosperity to the people.

A glance at the table of variation of population in the district shows that there has been fluctuations in the population of the



taluks. This has been due to the great number of constantly recurring famines and the epidemic of plague. On the whole the district has been steadily increasing in population during the last 50 years and has increased by 14% during 1921-31. All the taluks have shown a marked rise during 1921-31.

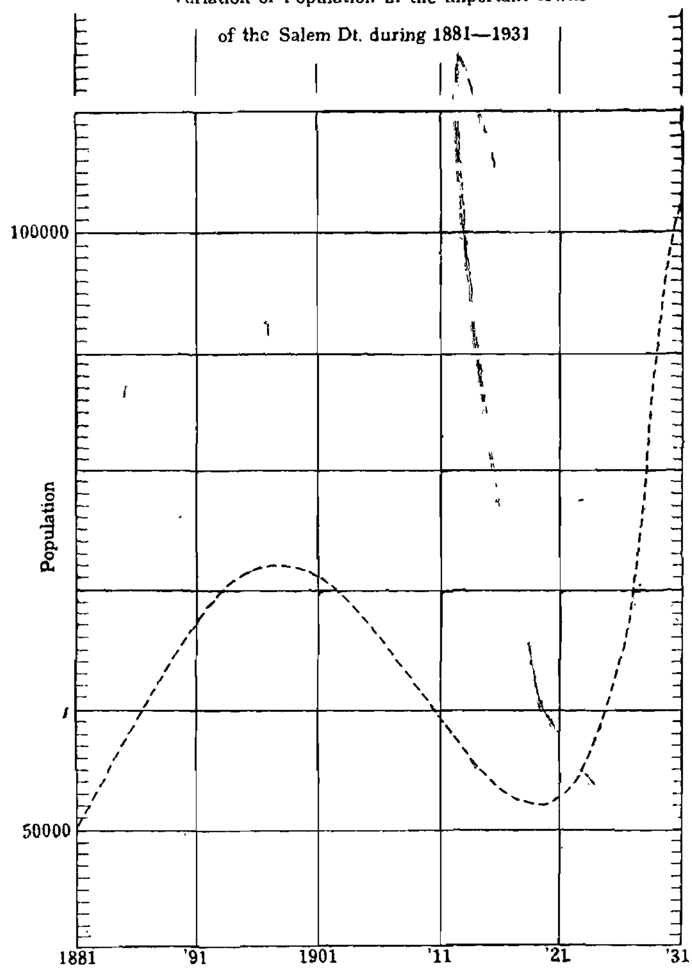
Salem district has an area of 7058 sq. miles and has an average density of 345 per sq. mile. It is not a densely peopled district compared to the other districts of the presidency, though in total population it holds the 5th rank. The distribution between urban and rural (194932 : 2239040) is 1 : 11·5 nearly, indicating a high urban population. But there is only one town of importance and that is Salem with a population of 102179, holding the 4th rank among the 1st class towns of the presidency. The remaining are all IVth and Vth class towns.



Salem Town has grown 100% strong during the last decade. All the towns show a definite and steady increase during 1921-31. The population of all the towns has been slowly rising from

1881-1901, but every town except Attur has suffered a rapid and effective loss sometime during 1901-1921. This has been due to the constant outbreaks of plague and famines in the district during 1901-1921. Attur alone has not felt such rapid fluctuations ; it has had a steady increase and has fallen slightly during the last decade when all the other towns have shot up rapidly. This is because the upper Vellar basin has resisted all famines successfully, though

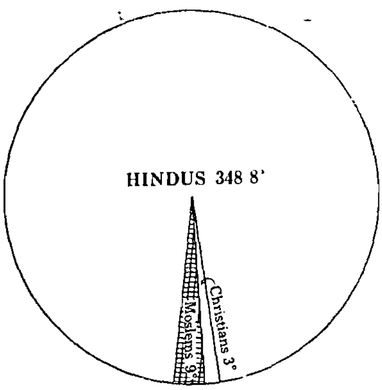
Variation of Population in the important towns of the Salem Dt. during 1881—1931

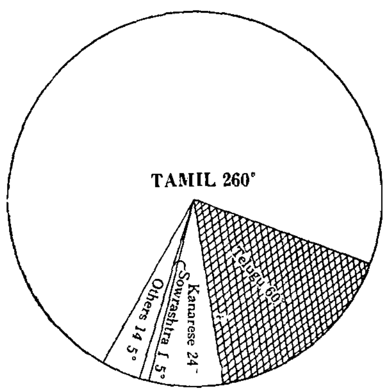


it suffers from cholera and malaria. Better sanitation and economic conditions have favoured the rapid rise of population during 1921-1931 in all the towns and taluks. The densely peopled taluks lie in the level agricultural regions in the South of the district and Salem taluk has a very high density partly due to the concentration in and around the town of Salem. Of all the towns of the presidency Salem has had the greatest increase in population. It has extended its Municipal limits, has started a number of town extensions and has improved its sanitation and health. Again the Mettur dam, the Salem—Cuddalore Railway, and the numerous motor bus routes converging on the city and the position of Salem town at the convergence of five natural routes have contributed to its rapid rise.

It is usual in all areas in the Madras Presidency to find a greater percentage of female population than male population. This is true of the Salem district (M: 1211743; F: 1222229) as a whole and of many of the taluks. Hosur, Mettur and Salem are the exceptions. Mettur and Salem have a greater% of males due to the demand of male labour in those areas and this drawn from all parts of the district. Hosur has an unnaturally predominating male population among the Non-Brahmin Hindus (M: 77286, F: 74656) and Harijans (M: 14228 F: 13454).

Salem district may be considered as representative of the total population of the Tamil districts, considering the proportionate distribution of Tamil, Telugu, Kanarese and Sourashtri. The Balaghat portion of the district is mainly Kanarese while the foot hill region is mainly Telugu. The Telugu population in the Tamil districts is distributed as a wedge or tongue extending along the foot of the plateau in Chittoor, North Arcot, Salem and Coimbatore districts. The Reddis and Kammas who followed in the wake of the





Telugu occupation of the Tamil districts, being specialists in the cultivation of dry crops have settled along this region. The Shevaroys, Kalroyans, and Kolli Malais are peopled by a civilised hill tribe termed the Malayalees (people of the Mountain land) who have their own peculiar customs and manners. The Sourashtris are

POPULATION OF SALEM DISTRICT.

No.	Name of Taluk.	Area in sq. Miles.	Towns.	Villages.	Occupied Houses.	No. of Males.	No. of Females.	Total Population in 1931.	Density per sq. Mile.	Increase % from 1911-21.	Increase % from 1921-31.
1.	Attur	649	1	128	38049	94699	96557	191256	295	5·4	6·8
2.	Dharmapuri	897	1	147	47014	119866	120176	240042	268	—4·8	14·8
3.	Harur	910	-	143	37735	90335	90406	180741	199	—2·5	18·3
4.	Hosur	1182	1	343	38300	100095	96267	196362	166	—4·9	10·4
5.	Krishnagiri	687	1	169	44187	105922	107080	213002	310	—7·0	21·7
6.	Namakkal	618	2	195	69313	136144	145897	282041	456	3·8	—2·0
7.	Mettur	235	-	21	(15450)	34992	33227	68219	290	3·2	73·8
	Omalur	367	-	131	39426	97710	98215	195925	534	12·1	20·1
8.	Rasipuram	387	1	84	39327	88784	90228	179012	463	13·4	4·0
9.	Salem	522	1	283	66673	169203	167844	337047	646	3·7	36·7
10.	Tiruchengodu	604	1	174	81889	173993	176332	350325	580	12·9	5·1
	Total	7058	9	1818	517363	1211743	1222229	2433972	345	3·4	14·0

VARIATION IN POPULATION OF THE TOWNS OF SALEM DT. FROM 1881-1931.

Name.	Class.	Presidency Rank.	Population in 1931.	1921.	1911.	1901.	1891.	1881.
Salem	I	4	102179	52244	59153	70621	67710	50667
Dharmapuri	IV	111	14815	14393	6458	8102	6939	7090
Rasipur	,,	112	14438	13978	15238	11512	10539	7969
Krishnagiri	,,	132	12850	6947	10887	10446	9726	8856
Tiruchengodu	,,	140	12322	10513	4645	8196	7511	5889
Attur	,,	151	11697	12499	10992	9673	9295	8334
Sendamangalam	,,	160	11254	12972	9196	13584	13354	12575
Namakkal	V	206	9306	9293	5196	6843	6341	5147
Hosur	,,	306	6071	5519	5913	6695	5756	5869
Salem District		5	2433972	2135799	2066080	1987532	1758588	

LITERACY IN SALEM DISTRICT.

Religion		Population	Literates	Literates in English.
Hindus	..	2348325	124991	12982
Moslems	..	61882	8938	998
Christians	..	23667	4192	1951
Others	..	98	34	24
Total	..	2433972	138155	15955

DISTRIBUTION OF LANGUAGES IN THE SALEM DISTRICT AND MADRAS PRESIDENCY

Language	Salem District	Madras Presidency.
Tamil	1776762	18896718
Telugu	416224	17782898
Kanarese	165254	1685543
Sourashtri	10476	104076
Others	65256	8724367
Total	2433972	47193602

DEFECTIVES IN SALEM DISTRICT AND MADRAS PRESIDENCY.

		Salem. District.	Madras Presidency.
Total afflicted	..	4486	134611
Insane	..	466	15566
Deaf Mutes	..	1315	33736
Blind	..	1646	52279
Lepers	..	1064	33321

Communication Lines and Nodal Centres of Salem District.

By

Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S.,
Lecturer in Geography, Teachers' College, Saidapet.

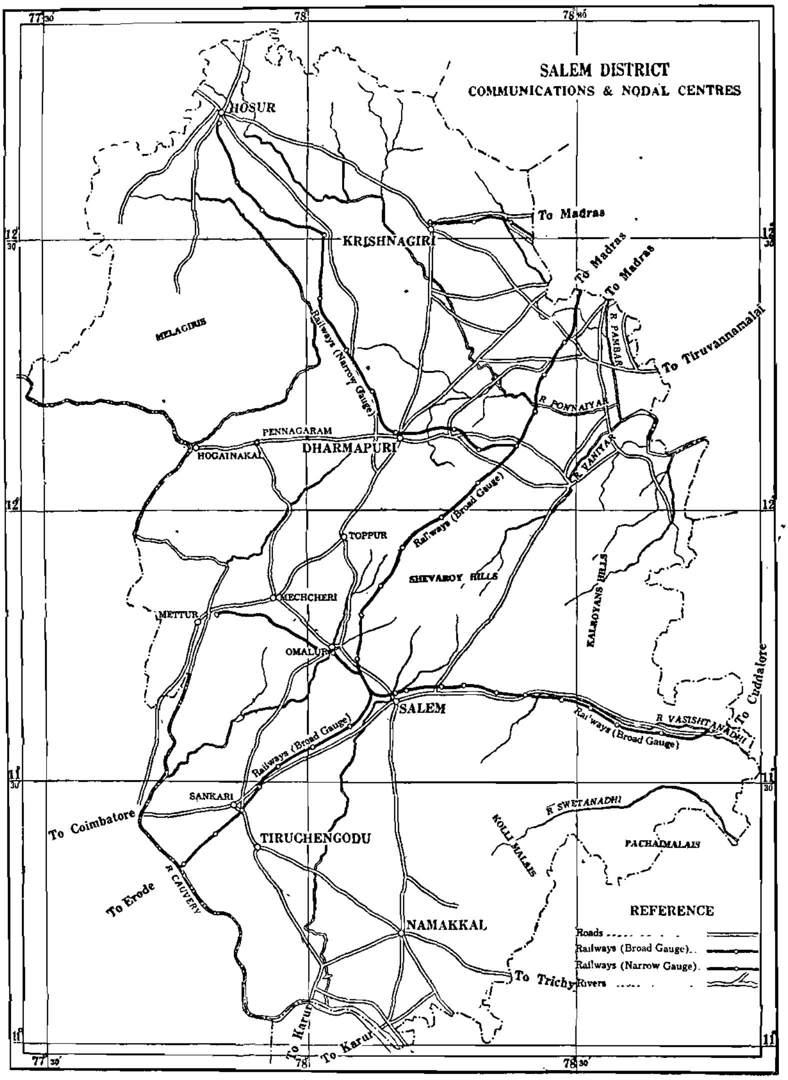
The District of Salem may be looked upon as a very rough elongated oblong with a jagged concavity on the western side, a slight convexity on the eastern side and roughly rounded on the northern and southern sides. It lies between the Mysore plateau and the Carnatic plain nestling itself on, and forming part of, the plateau on its north-western side, and descending from it in two terraces southwards to the plain. Consequently, through it runs the main route from Madras and the Palar valley to the west coast across the Cauvery valley and through the Palghat gap. And through it also runs the route from the Tanjore delta and farther south to the Mysore plateau.

Besides this important location with two main highways crossing each other, *relief* has also played an important part in the *alignment* of these trunk routes as well as of the subsidiary ones in the District. The Melagiris and other hills of the north-west, the Shevaroys and the Chitteris that lie between the Baramahal and Talaghat regions of the District, the Kolli Malais, Pachai Malais and the Kalrayans on the south-eastern and eastern parts—all have had their influence on the communication lines, both rail and road.

The main east-to-west route from Madras to Bangalore and Mysore runs up to Vâniambadi along the Palar valley, which at this point curves away north-westwards up the plateau, while the road and rail at the same time part company. From Jalarpet Junction the railway runs westwards to Bangalore just outside the District, while the corresponding road runs within the District across the north of it, passing through Krishnagiri and Hosur.

The broad guage section of the South Indian Railway starts from Jalarpet, and passing through Tiruppattur in the North Arcot District, runs diagonally across the District of Salem, cutting between the Shevaroys and their western spurs and passing through Salem. After crossing the Cauvery near Erode Junction, it continues thence to the West Coast.

The trunk road from Madras and Bangalore to the West Coast separates from Krishnagiri on the Madras-Bangalore road, and runs southwards through Dharmapuri to Toppur Ghat, beyond which it used to pass through Omalur, Salem and Sankeri to Bhavani by a masonry bridge across the Cauvery. But recently the distance for



through traffic along this route has been reduced by about 30 miles or so, by constructing a cross-cut road from Toppur Ghat to Mettur, which is already linked with Bhavani by means of a pre-existing road along the Cauvery valley.

It is interesting to note that the main route for both road and rail has thus to run the whole length of the District from north to south as the outlet to the West Coast region lies only through the Palghat gap.

Owing to the hilly and rugged nature of the land for the most part in the west of the District, there are few roads on that side; and all roads to Bangalore and Mysore from the East and the South have to converge like a funnel at *Hosur,* which is the natural nodal centre of the Balaghat region of the District. A bad and neglected road unfit for motor traffic runs through the rugged western parts of Dharmapuri and Hosur Taluks from Mecheri through Perumbalai, Pennagaram and Denkanikota to Hosur. This road appears to be used at present mostly for the transport of hill products.

From Dharmapuri two alternative roads run to Hosur, the more frequented one going through Krishnagiri on the Madras-Bangalore trunk road and the other somewhat steeper one passing through Palakode and Rayakotah. Along the latter runs also the branch railway from Morappur to Dharmapuri and Hosur, which was constructed as a famine feeder line. Owing to the difference in guage it has not been found worth while to link up by rail the short distance between Hosur and Bangalore.

Two other short branch lines run westwards from the main S. I. R. line—the one from Tiruppattur to Krishnagiri and the other from Salem Junction to Mettur.

Four routes run eastwards from the District to the eastern seaboard along river-valleys or gaps between the hill-groups. The first of these is the *Madras-Bangalore route* taken by road and rail along the Palar valley, already referred to. The next is *the route through the gap between the Jawwadis and the Kalrayans.* There is no railway along this route. The road from Bangalore bifurcates at Krishnagiri and runs through Uttangarai, Singarapettai, Chengam and Tiruvannamalai to the Karnatic plain and the eastern coastal region. This was the route taken by the invading armies of Haidar Ali and Tippu Sultan in their wars with the English East India Co. at Madras.

Between the Kalrayans and the Pachai Malai lies *the Attur gap* through which runs the Vellar valley; and this road is taken by the road and rail that link up Salem with the sea-board in South Arcot District. It is a fertile well-populated ribbon of land, rarely visited by famines.

The fourth and last eastern route is *the Cauvery valley route.* It runs from Salem southwards to Namakkal, and thence south-eastwards between the Kolli Hills and Talaimalai to Musiri on the north bank of the Cauvery. From there it is continued along the Cauvery bank to Trichinopoly and Tanjore. The corresponding railway line runs from Erode to Trichinopoly, lying wholly outside the District in the south as the Jalarpet-Madras line lies wholly outside the District in the north.

The only hill-road in the District runs up *to Yercaud from Salem,* and is taken to some of the villages on the Shevaroys. It is kept in a good condition from the foot of the Hills by the Public Works Department. There is daily bus service from Salem to Yercaud.

Let us next take up for consideration the chief *nodal centres* in the District. Besides Hosur and Krishnagiri, the two nodal centres in the north already mentioned, Dharmapuri, Salem and Namakkal are the other important ones, all lying along the main route.

Dharmapuri, the old Tagadur, is the natural centre of the Baramahal region ; and six important roads radiate from this place in different directions—two to Hosur already referred to, one of them north-westwards through Rayakota and the other northwards through Krishnagiri, one road runs north-eastwards to Tiruppattur in the North Arcot District, one to Harur eastwards, one to Pennagaram westwards and thence to the Hogainakkal Falls, and lastly one to Toppur Ghat which bifurcates there, one branch (the old trunk road) running through Omalur to Salem and the other running through Mecheri to Mettur (the new trunk road).

Salem, being the Headquarters of the District and due also to its location, forms another important nodal centre on the main route both for roads and for railways , which radiate in all directions. Roads run to Dharmapuri in the north, Mettur in the north-west, to Sankeri and Bhavani in the south-west, to Namakkal and Karur in the south, to Attur and Kallakurichi in the east and to Harur, Uttangarai and Tiruppattur in the north-east. The last road runs through Manjavadi Ghat between the Shevaroys and the Chitteris. The hill-road to Yercaud also starts from Salem. The railway lines meeting at Salem have already been mentioned.

Namakkal is the natural nodal centre of the Talaghat region more than Salem itself, whose position is more marginal than focal. It lies on the highway from Trichinopoly to Bangalore, the importance of which route is evidenced by the fact that it links up all the chief centres of the District. There is a regular daily bus service along this route all the way. Besides the roads to Salem and Musiri-Trichinopoly in the above route, roads run to Mohanur and Karur in the South, to Paramatti and Pugalur in the south-west and to Trichengode, Sankeri and Bhavani in the north-west.

The Cauvery is crossed by one railway-bridge near Erode, by two road-bridges at Bhavani and Mettur respectively, and by coracles of wicker-work lined by leather at several ferries.

The road-rail competition has been as much in evidence in this district as elsewhere ; and quite recently the motor lorry has been seizing the goods traffic from the railway, e.g., in the Bangalore-Trichy route.

The roads of Salem District can easily be improved with a little more attention on the part of the authorities, as the bedrock is hard and gritty road metal is easily available in most parts. Further, there is no fear of rapid erosion by heavy rainfalls as in Malabar. Several of the bridges even on the trunk road such as that on the Pennar near Kaveripatnam and that over the Vepadi Ar near Toppur Ghat are so narrow that no cars or carts coming from opposite directions can pass each other. In this automobile age when every person—the rich man in his car and the poor man by means of the bus—desires to have comfortable and easy access to all parts of the district as well as through the District, it is most harassing to find the roads and bridges in a bad condition. A reasonable and helpful policy of road development and maintenance is badly needed everywhere.

The Shevaroys Region.

By

Mr. V. Natarajan, B.A., L.T.,
Deputy Inspector of Schools, Salem.

The Shevaroys. The Shevaroy hills (spelt in Tamil as the " Servarayan hills" form the noblest mountain mass in the Salem District. They are 17 miles along at the greatest length and 12 miles broad at the greatest width. The whole area covers over 100 sq. miles. The southern slopes rise abruptly to a height of about 4,000 ft. The villages of Gundur and Teppakkadu lie here. The Ghat Motor road passes to the west of the villages.

Most of the drainage of the hills is towards the north where the slopes are broken with deep ravines. The Vaniar valley divides the area into two portions. The river Vaniar, a tributary of the Pennar, rises near Sengadu (near which place is the Mailapatti Coffee Estate) and flows in a north-easterly direction. The gorge through which it flows is one of the grandest. This is parallel to the Manjavadi pass in the east through which the road from Salem to Harur runs. On both sides of the Vaniar Valley there are villages on the plateau. In the eastern plateau are the villages of Talachcholai, Kottachchedu, Pelakkadu (which lies a little to the east), Maramangalam and Kombutukki. The western portion is more massive and reaches a higher elevation. To the west of this mountain mass is the Kadayampatti river which flows west-north-west, and on the top of this valley are the villages of Nagalur, Muluvi and Karadiyur. The southern half of this mountain mass contains the peaks of the Shervarayan, 5,342 ft. (near which is the Bear's Cave), and Sanyasimalai, 5,231 ft. (to the south of which is the Kudarapanjan Coffee Estate), and further south is the plateau of Yercaud. On the way from Sanyasimalai to Yercaud is Eachangadu, where the revered Doctor Miller of the Madras Christian College, has built a fine mansion called the " Mountain Home," by the side of which is an equally excellent home for students ; both of these once served as a summer resort for the Professors and students. These bungalows are now owned by the Zamindar of Kannankurichi, through whose generosity the writer was once able to occupy the " Miller Home " with a party of students, on an excursion trip.

The village of Yercaud is surrounded by a circlet of hills and one of these hills jutting southward affords the place known as the

" Ladies' Seat " from where a picturesque view of the Ghat road with its numerous curves and of the environs of Salem can be had. In the distance can be seen the Mettur reservoir, the blue expanse of water with the hills rising near by.

The northern half of the western plateau consists of the main central backbone of the Shevaroys. The P. W. D. loop road goes round this mountain mass. Besides Shevaroyan, there are other peaks such as the Branfill 5,410 ft., Balamadies 5,370 ft., and Cauveri Peak 5,086 ft. At Cauveri Peak the plateau forks, the left branch running north to the village of Sengalattuppadi and the right branch following the Vaniar Valley to the village of Solambadi.

The eastern portion of this main mass, known as the Green Hills contain the villages of Puliyur, and Vellakkadai. This part of the plateau overlooks the Vaniar Valley. There are some bold cliffs here, chief among them being the Hawthorns 4,899 ft. and the Honeyrock 4,533 ft. Just opposite the Honeyrock (near which place the writer was staying) the Vaniar flows down below at a level of 2,490 ft though only a mile distant. It is a beautiful view down from the precipitous rock.

On the western side is the Nagalur plateau with the neighbouring group of villages. To the south of this is the Kadayampatty valley and to the north is the Veppadi Valley. In the latter is the Thoppur river which rises near Muluvi, and running along the Thoppur Ghat joins the Cauveri at Solappadi. The river, which flows through the Kadayampatti valley, runs past Omalur and combining with another river passes through Edappadi and empties itself into the Cauveri near Kaveripatti.

The temperature on the Shevaroys is most equable. The hottest months are March, April and May, when the thermometer rises to 87°F in shade. The usual reading in December is 65°F. occassionally going down below 60°F. Though the Shevaroys get the advantage of both the monsoons, the winter monsoon gives more rain. The following are the average figures in inches for the period 1870-1930 :—

Jan.	Feb.	Mar.	Apl.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2.38	2.68	1.99	6.37	12.87	11.29	14.16	19.05	19.50	20.36	12.36	5.5

Total 128·36 inches for the year.

It would seem that the heaviest rain occurs when the wind is weakest. When the wind is strong in February and March, there is little rainfall. Sometimes mist covers up the roads and houses.

The general type of the rocks of the hills is said to belong to the great metamorphic or gneissic series. Intrusions are younger igneous ones. The 'white elephant' rocks on the southern and eastern sides are igneous intrusions. Some quartz rocks are visible on the hill spurs in the south.

No systematic survey of the flora and fauna of the Shevaroys appears to have been attempted. Such an attempt would be highly advantageous both as a means of increasing our knowledge and as a means of increasing the opportunities for utilising the natural wealth of the Shevaroys. The ferns on the hills are numerous—ferns known as lace, silver royal etc. Tree ferns and palm ferns are abundant. Of the indigenous trees the chief are the blackwood and Selvanji. These are fast disappearing. Daria, Naga, Almond, and fig trees are common. Gallnut and Jack are also found in plenty. Fruit trees are mentioned later on.

The fauna of the region is not as rich as one would have expected. Though the district of Salem is noted for cattle breeding, there is nothing worthy of special mention about the cattle on the Shevaroys. The Malayalees are engaged in herding—and this very often detracts youngsters from schools. But the cattle appear to be dimunitive in size, though their horns are beautifully shaped and are imposing in appearance. Ponies and asses are rare. Sheep and goats are said to be increasing.

There is practically no wild game on the hills. Tigers are not heard of; but panthers are occasionally heard to prowl about. Bears are found here and there—the very name 'Bears' Cave,' suggests the former abode of bears. Hares, rabbits, jungle cats, civet cats are met with. Big game is fast disappearing. Sambar, bison, and spotted deer are said to have almost died out. Wild pigs are common and they often destroy plants. Wolves, red-dogs and foxes are occassionally seen. The common monkey is found on the lower spurs. Small game such as green and blue pigeons, pea-fowls, jungle-fowls and wood-cocks can be seen almost anywhere. Snakes do not appear to be numerous.

The easy way of approach to the Shevaroys is from the South, i.e., from Salem side, where there is a beautiful Ghat Road for motor traffic. This road maintained by the P.W.D. ascends up from the foot of the hills by means of a number of hairpin turnings. This road is 14 miles; from the foot of the hills, roads go to Salem Junction and to Salem Town which are at a distance of 6 miles and 5 miles. It was originally proposed to take a road from Danishpet Railway Station to Yercaud, up the Kadayampatti Valley; but this was abandoned later on; and the Salem road has developed. There is a shorter way from the foot of the hills. This is seven miles and this path is used by pedestrians, coolies and pack ponies. The ascent from the north and the west and the east are rather difficult.

Roads are fairly comfortable for motor journey especially in and around Yercaud itself. The P.W.D. loop road starts near the Yercaud lake (Shandy place) passes through Eachangadu, Nagalur, Semmanatham, Narthanchedu, Vellakkadi, Puliyar, Manjakuttai and Kombakkadu; thus circling round the mountain mass which contains the Shevaroy Peak, reaches the starting place again. It is 21 miles long. From Yercaud there is a road to Mettukkadu and south of Nagalur there is a road branching from the loop road to Kadayampatti. These roads are not so comfortable for motor journey. There are a good many private roads maintained by the various Estates. Of course foot-paths and tracks take the traveller to interior villages.

3. *Yercaud.*—Yercaud is the chief town on the Shevaroys. In 1911 its population was 1322, in 1931 the population has increased to 2398. The town is on the southern part of the plateau; it may be said that it is very near the junction of the eastern plateau and the western plateau. Though there are more beautiful sites, this spot was selected for settlement about the year 1841, when the Rev. J. M. Lechler built the first house. The "Fairlawns" was built by Mr. Brett, District Collector in 1845. The "Grange" was built in 1849. It was planned to make this house, a place of refuge for Europeans during the Mutiny of 1857, in case there was any trouble. The ground floor was stocked with provisions and guns were placed in position and rehearsals of alarm signals and immediate running into shelter were practised. But there was no need for all these, for there was no rising in South India during 1857. The lake in Yercaud gives the name to the place. Yercaud is Yeri (lake) Kadu (forest). This lake may, with advantage, be converted into a boating place. Near the lake is the shandy ground, the weekly market being held on Sunday (on Wednesday also the villagers bring articles for sale in Yercaud). To the north of the lake is a level maidan, which seems to have been used as a parade ground. The Lady's seat to the south of the bazaar street is a place often visited by newcomers. Further away are Prospect Point and Pagoda Point which are notable heights. It is said that on a clear

gan, Pidaree and others. Recent innovations in dress such as shirt, coat, jacket, etc., are becoming very popular. Meat eating is not forbidden. Men and women appear to be fond of smoking ; and tobacco products were usually got in exchange from the plains ; but now they are easily purchased.

The Malayalee village looks like a bee-hive—the huts popping up on the plateaus and slopes give a beautiful sight from above. Almost all the huts are circular ; the walls are made of clay, with split bamboos put inside to make a sort of frame-work ; the conical roof is thickly thatched with grass. Windows are rare and usually there is only one entrance for the hut. There is a loft (paran) in the inner circular room which serves as a store-place. In the outer circular room calves and poultry are also kept. Separate sheds for cattle and poultry are now gradually coming into use. One or two brick-walled and zinc-sheet-roofed (and sometimes tiled) houses are occasionally seen in some villages.

The Malayalees have their own castemen to serve as barber and dhobi. The Adi Dravidas are generally called in to beat the drum on ceremonial occasions such as marriages and deaths. The Adi Dravidas are also sometimes called upon for agricultural work and to serve as beaters and assistants during hunting.

It is said that there were some reputed cow doctors among the Malayalees ; but of late they are becoming rare. Cattle farming appears to be declining. It would appear that there is plenty of scope for intensive cattle-farming. That is a problem worthy of investigation.

The Malayalees commonly bury the dead ; burning is also occasionally resorted to. They are both Siva and Vishnu worshippers. Their chief god is said to be Kari Raman. Perumal worship is most common. The Malayalee Poojari is a vegetarian. It is noteworthy that there is no blood sacrifice during the Pooja. The village festivals usually occur in March and April.

The hill temple on the Shevaroys has an inner cave. Legend has it that the cave extends some furlongs into the interior. The story is told of one Ramaswami, a servaikaran (same as a Poligar or local chief) who visited the place. Being a devotee of Vishnu, he built a Perumal temple. And this temple was called afterwards the Servaikaran temple. Hence the name Servárayan. There is another story about the origin of this man, which story I heard from an old man in an interior village. There were two notorious brigands—Servarayan (otherwise called also Shevarayan or red Rayan as distinguished from his brother black Rayan) and Kallarayan. The two brothers carried on extensive marauding operations on the plains, and on occasions when they were hard pressed, they used to take shelter in these hills (which are now known as Servarayans and Kalrayans). It is possible that, when he was hunted by the troops, Servarayan might have hit upon this very clever plan of hiding himself in this cave, after having popularised the idea that the cave is a holy temple, and that it is a sin to venture far into the inner recesses of the cave. Whatever may be the truth of this story, it gives, however, some fanciful explanation of the names Servarayan and Kalrayan.

The Malayalees grow ragi, cholam, samai, tinai, avarai, mustard, red gram, chillies, coriander, castor and other minor products. They generally mix two or three varieties of seeds and scatter them broadcast. The short crop matures sooner; and after it is reaped, the long crop has time and space to grow well. As on the plains one can see in many fields the scare-crows, the funny grotesque figure with out-stretched arms in order to avert the evil eye. Seeds are generally sown in May and June; the harvesting is done in October and November. When the harvest is gathered, threshing is done by driving the cattle round and round. The corn is stored in granaries. These are usually cylindrically shaped and built of grass and bamboo, on raised stones so that water can run below easily.

It is generally said that the Malayalees on the Shervaroys are not so enterprising as the Malayalees on the Kollimalais or Pachaimalais. The advent of Coffee estates is supposed to be the cause of the decline of agriculture among the Malayalees on the Shevaroys. They are more inclined to work as labourers in Coffee estates so that they can get immediate payment of wages in cash, which will be ready for use. During heavy season, the labourer can earn more than six annas a day. Of the economic conditions of the Malayalees, reference is made later on.

There is not so much of rice cultivation on the Shervaroys as on the Kollis (the rice of the latter is said to be even superior to the rice of the plains). Cultivation on the hills is a difficult process. In the hollows and in the plains on the hill tops the work may be easier than on the slopes where fields have to be properly terraced.

Coffee growing is described separately. Besides coffee, tea and rubber were also tried, but both have not been successful. Tea evidently requires more rain than is obtained on the Shevaroys.

Rubber as a commercial plant has not been fully developed. There are stray rubber trees here and there. Aloe and Agaves were also attempted but appear to have been abandoned subsequently.

The Shevaroys yield some sandalwood also. It is said that there is not so much of spike disease on the Shevaroys as on the Kollis. Other minor products of the forests are timber, charcoal, lac, gall-nuts; barks for dyeing and tanning, some medicinal herbs and plants. I have not heard of Cinchona trees on these hills. Sometime ago, there was an attempt at perfume making, but now I learn this has been a failure.

Coffee Cultivation.—The importance of the Shevaroys region now lies in the fact that it has taken the field as one of the chief coffee growers of South India. The first person who discovered the possibility of utilising the Shevaroys for coffee growing was Mr. G. Fisher who made some experiments about the year 1825. Since then Shevaroys Coffee is on the market. The coffee market is however said to be dull now on account of a fall in the price of coffee. The cost of production of coffee has also increased due to increased wages of labourers, and the necessity of providing more and more manure year after year. Transport has become easier in these days of motor lorries. At the same time coffee pests have become numerous. Thus efforts at increasing the output have to be coupled with remedies to meet the new difficulties.

Coffee growing is now an art, requiring great skill and expert handling. The plants are pruned and they are topped when they are about 3 years old—the top being cut at a height of about 4 feet from the ground. This prevents branches shooting upwards and helps the branches to grow sideways. The whole plant with outstretched branches looks like a sort of small dome. This is convenient for the labourers to pluck the berries easily and collect them in baskets. After the crop is collected, the plants are pruned well; the shoots that have borne fruits are removed, thus making it easy for the younger shoots to develop well and bear good yield for the next year.

The young plants are now systematically placed in convenient spacings so that there is no overcrowding. By this method, plants have each a greater space for full growth. These plants though less in number give better yield than the overcrowded plants which may be more in number but give less yield. These efforts have helped to decrease the spread of diseases among plants. Diseases destroy more in overcrowded areas. Trenching is done to protect the surface soil on the terrace from erosion and to preserve the oxygen in the layer near the plant roots. The Oxygen brought in by showers of rain, are preserved in the surface soil by various means such as bunding, terracing and pitting. The coffee plants now grow under shade. This has been found effective to protect the plants from the disease known as leaf blight. Silver oak trees are symmetrically planted and the coffee plants grow in the shade of these trees. These trees shed their leaves periodically and these leaves form a bedding of dead leaves which protects surface erosion. Weeds are cut and heaped up along with the dead leaves. Manuring is also done. Thus coffee cultivation is not an easy affair. The planter does not sit at ease and get money. He has to work hard and that at the proper time. From 1870 onwards coffee pests began to appear and the planters have always been attempting to clear their estates of these pests.

Ripe coffee fruit is called berry. The outer coat is the pulp and the inner adhesive layer is the parchment. The seed coat within the parchment is the silverskin. Usually the planters remove the pulp in their own estates and send coffee in parchment.

The coffee plant blossoms about June. Fruits begin to ripen about October and continue till January. The fruit is hand-picked by coolies as soon as it shows a dark reddish tinge: pulping is next done. After the pulp is removed, the parchment is washed and cleaned; and they are then put to dry on specially prepared platforms. Then they are bagged and sent.

Fruit Farming.—It would appear that fruit farming has not been systematically attempted on the Shevaroys. Salem has become famous for mangoes and this is due to the systematic efforts of some mango growers. No such thing has yet been successfully done regarding oranges and fruits, on the Shevaroys. Oranges thrive very well and also the common pear. During the season cartloads are sent down the Ghat Road, the slow moving train of carts giving immense trouble to the fast running motor riders. Of the oranges the common variety is the tight-skinned ones; they require little work, but give good crops. The trees take about 8 years time to give full yield. Grafting and intense cultivation has not yet been well developed. The loose-skinned oranges are now becoming more popular and the cultivation of these trees is extending. Other varieties of oranges are grown in stray places.

Of the other kinds of fruits, lemons, common pears, loquats, plums and peaches grow commonly. Pomeloes, apples, common pine-apples, strawberries, papaws, butterfruits, figs, guavas, jack and pomegranates are also found. Vine growing has not been attempted.

It seems that more extensive and systematic fruit farming can be attempted with possibilities of success as a commercial concern. A jam factory may be thought of, and plenty more of fruits for transport to the towns may be made or grown. Recently it was brought to the notice of the public, that a big city like Bombay is not having enough fruits for its large population. It will be the same case in most of the towns. Fruits are now becoming more and more a part of the daily food of many persons. An increase in the use of fruits is being advocated in order to improve the health of the people. Hence it may be worth while to investigate the possibilities of scientific and successful fruit farming on the Shevaroys.

The Condition of the Malayalees.—Now about the condition of the Malayalees. It is generally remarked that the prosperity of the people is gradually declining. It is not possible to assess exactly the advantages or the disadvantages of '*Modernism*' that is gradually enveloping the Malayalees on the hills. Their poverty, their indebtedness to debtors, the increased cost of cultivation, the strict forest laws, the heavy land assessment, all these are usually heaped up as causes for the deterioration of the people. It will be safer not to indulge in vague generalisations, and to get into the labyrinth of the little understood complexity of forces that go to make or mar the progress of a people.

Firstly it is doubtful, if it is to be accepted as a fact that the Malayalees have deteriorated, this will lead to the general question of whether the plains people themselves have progressed or deteriorated. It appears to be something like the towns-people now going about lecturing on village improvement, while the village people want to talk of town improvement. The Malayalee appears to be as happy as of old. The simple innocent happiness they enjoy, must be a thing to be envied at, by many a man on the plains. It does not appear that the Malayalees are gradually dying out, but modernism, it would appear, has helped to quicken the death of some of the happy traits of the communal economic life of these people. Their wants are now increasing. When a new thing is purchased for use, at first it is a mere love of something new, but gradually the new things are becoming necessary things. In fact the slowly devouring octopus of modernism, having swallowed up the plains, has now ascended up to catch the hill people. True money was rare in old days, but now the hill people have learnt to use money freely. The disasters of the weather are now more keenly felt, and a mere blanket thrown across the shoulders as of old, does not suffice now. Their simple and cheap huts are now considered out of time; brick and tile cottages are slowly coming in.

Somehow the people think that diseases are not only increasing in variety but are also growing more virile. And this is in spite of the enormous progress made in modern medicine and surgery. It looks as if the people are amazed to find that their favourite deities, who were appealed to, in times of serious illness, now appear to be indifferent or powerless. The old village doctors have almost disappeared and their fame is dying out. The modern doctor has not yet penetrated into the interior villages. It would be a good thing therefore if some itinerant dispensaries are organised.

The people are not obsessed with the fear of over-population. Birth control, which has of late, become a common topic in cities and towns, is not heard of. The Malayalees do not look upon their children as a burden. The children, when once they are able to wander about, become workers along with the elders of the family. Just at the age when one would expect the parents to send their children to school, when they are 7 or 8 years they are sent to look after the cattle. The boys and girls also help the elders in weeding, sowing, harvesting or threshing. I came across many boys and girls, in the course of my wanderings, who were chatting and playing in the meadows and shrubs after driving the cattle to pasture. They were indifferent about attending school. This is equally true of the villages in the plains. The Malayalee children are as sensible as the children on the plains. They are more hardy, better walkers and load carriers. They are clever in their own way. It is therefore a hard task indeed to wean away these children from this kind of apparent natural work, and put them in school where they have to spend at least 4 or 5 hours a day and not take in the mere literary education—that of teaching of the three R's which probably appears to be quite natural with urban-minded people.

Conclusion.—I may conclude by summing up the chief points. It does not appear that the Shevaroys have been utilised to its fullest possible extent. Cattle farming and fruit farming may be investigated. The economic condition of the people may be improved by the starting of more Co-operative Societies. Itinerant dispensary may be of great help to the people.

The Place Names in Salem District

BY

MR. RAO SAHEB C. M. RAMACHANDRA CHETTIAR, B.A., B.L.,

The present district of Salem is not a natural division. It came into existence from political and administrative exigencies. According to geographical, historical and natural basis it has been divided into three divisions.

I. *Balaghat* (Uplands) :—Forming part of Mysore plateau and having the same features as Mysore with a general level of 3,000 ft. above the mean sea-level and having mostly Kanarese and Telugu as its principal languages. It contains portions of Hosur and Krishnagiri taluks. In ancient days it formed part of Gangavadi which had its capital at Talakkad on the Cauveri.

II. *Baramahal* (12 palaces or divisions) :—Forming the intermediate basin between the Mysore plateau and the plains and having a general height of 1,500 ft. It has Tamil, Telugu and Kanarese as languages. The taluks of Dharmapuri, Harur and portions of Krishnagiri and Hosur are in this division.

III. *Talaghat* (below ghat or plains) :—Being the lowlands and having more or less the same level as the neighbouring districts of Coimbatore and Trichinopoly. This formed part of the ancient Kongu country, being North and East Kongu, with the capital once at Tagadur or modern Dharmapuri. Tamil is the language. The taluks of Salem, Omalur, Trichengode, Namakkal and Attur are in this region. (Attur could be taken more to the Carnatic country than to the Kongu). The average height is 550 ft.

A study of the place-names in this district proves the existence of these natural divisions. In Balaghat, the names of villages are Kanarese and Telugu, in Baramahals the names come from the three languages spoken there and in Talaghat they come from a purely Tamil origin, similar to those found in the other parts of Kongu Nadu, viz., Coimbatore District. We find, for example, that Hosur contains 56 Telugu and 16 Kanarese names of villages with 19 Tamil names only ; Dharmapuri taluk contains 63 Tamil, 5 Telugu, 214 Kanarese and 3 Hindustani names ; while Namakkal has 167 Tamil names and Attur 126 with neither Telugu nor Kanarese names. The other taluks of Kongu portion have also pure Tamil names.

An analysis of the nature of the names of the villages is also interesting.

Hosur Taluk.

Kanarese.		Telugu		Tamil	
Suffix	No.	Suffix.	No.	Suffix.	No.
Atti	3	Palli	29	Ur	8
Halli	3	Ur	1	Kottai	3
Puram	1	Mangalam	4	Mangalam	2
Karē	1	Kota	2	Durgam	1
Ur	1	Puram	2	Kal	1
Giri	1	Vadi	2	Puram	1
Nattam	1	Durgam	1	Giri	1
		Giri	1		
		Palayam	1		

Dharmapuri Taluk.

Kanarese		Telugu		Tamil	
Halli	172	Palli	1	Patti	16
Puram	7	Ur	1	Ur	7
Ur	6	Puram	1	Padi	5
Malai	2	—		Nattam	4
Betta	1	—		Puram	3
Giri	1			Mangalam	3
Karai	2			Palayam	2
				Kodu	2
				Kulam	2
				Etc.	

Namakkal Taluk.

All Tamil Names.

Patti	42	Kulam	4	Eri	1
Ur	25	Samudram	3	Kottai	1
Palayam	25	Mangalam	3	Pundi	1
Puram	7	Malai	2	Karai	1
Nadu	7	Mahadevi	2	Koil	1
Palli	6	Parai	2	Anai	1
Kombai	5	Padi	2		
Agraharam	4	Seri	1		
Kurichi	3	Kal	1		
		Vadi	1		

Attur Taluk.

(All Tamil names.)

Ur	25	Samudram	6	Vādi	3	Valli, Giri, Kottai,
Patti	23	Pādi	6	Karai	2	Panai, Seri, Kombai,
Palayam	15	Nattam	4	Eri	2	Pundi, Mūlai, Parai,
Puram	11	Agraharam	8	Vasal	2	Puri, Thurai, Madai,
Malai	7	Kurichi	3			Kadu, Palli—all one each.

Salem Taluk.

The prevailing names are:—Patti, Ur, Palayam, Mangalam, Eri, Padi, Malai, Pattanam, Valasai, Giri, Puram, Maduvu, Kombai, Nattam, etc.

It is significant to find that the Kanarese *Halli* and the Telugu *Palli* are predominant in Hosur and Dharmapuri taluks (Gangavadi), while we get down to Namakkal (Kongu) the Tamil names of *Patti, Ur* and *Palayam* are found, and as we go eastwards to Attur which forms the marchland between Kongu and Chola country, the Tamil names of *Ur* and then *Patti* and then *Palayam* come in. There is a historical explanation for such distribution of names. All the names given have the same meaning, viz., a town or village, yet the form prevalent in various places relate to various periods of political influence. The Gangas and the later dynasties of the Mysore plateau had exercised complete influence over the Talaghat. Hence we find *Halli* and *Atti* prevalent there. In the Baramahals (Dharmapuri and Krishnagiri), which lie between *Mysore and Tamil countries the Kanarese Halli, Telugu Palli* and Tamil *Patti* are all found, while *Puram* and *Ur* are slowly getting in. This tract had often been changing hands, the Gangas, Pallavas and Cholas laying claim to it off and on. At Namakkal which is a purely Kongu country, *Patti* is predominant, *Ur* comes next and *Palayam* third. The oft-quoted stanza attributed to the poetess Avvayar "ஊரெல்லாம் பட்டி தொட்டிஉண்பதோ கம்பஞ் சோறு" about Kongu Nadu is significant with meaning in such an analysis. Curiously enough we find the name *Palayam* competing with *Ur* in this taluk. *Palayam* originally meant a cantonment. *Palayagar* was once the head of a battalion. He became the feudal chief during the Naick kings of Madura. The great Tirumalai Naick established 72 palayapats in his kingdom on purely feudal basis. In later days, *Palayam* began to mean merely a town. Any new village newly-formed in Kongu country is called *Palayam* to which suffix the name of the builder is added. The Tamils call it as *Palayam* while the Telugus *Palla* in the common parlance (for example, Tamil Pappanaicken-palayam—Pappanaicken + palayam = *Telugu* Papayya Palla—Papayya + Palla). The existence of the name *Palayam* in Namakkal taluk proves Madura influence. History says that Ramachandra Naick of Senthamangalam was an important feudal chief during the days of Madura Naicks who exercised much influence over Namakkal taluk. As we go eastwards towards Attur which had a mixture of Kongu and Chola civilisations, we find that the suffix *Ur* becomes prominent while *Patti* comes next and *Palayam* occupies the third place. *Ur* is a purely Chola term and hence its prominence is not without meaning. So we find that even the simple names of villages have their own tale to tell us how they came into existence and what influences they felt from political exigencies.

II

Ancient Tamilians had classified land into five natural divisions according to geographical conditions. The nature of land was carefully studied and analysed; and distinctive names were given according to their nature and conditions. A particular name of a division always carries with it a particular set of ideas, regarding for instance, the inhabitants, the flora, the fauna and the occupations, customs and manners of the inhabitants. In later days, the poets developed particular conventions regarding such divisions. When the poet describes a particular place he was generally carried away by the conventional ideas of the land he dealt with and never cared to ascertain if the particular objects and notions he described existed there or not. The conventional divisions are:—

1. Hilly regions known as Kurinji (குறிஞ்சி)
2. Pastoral tracts known as Mullai (முல்லை)
3. River valleys known as Marudam (மருதம்)
4. Desert country known as Palai (பாலை)
5. Sea-side region known as Neithal (நெய்தல்)

It may be noted in this connection that these names are those of the plants which are said to be prevalent in the respective tracts, purely poetic and imaginative ideas.

The people inhabiting each division and their occupation, trade, customs and manners were given distinctive names and even the villages inhabited by them were distinguished by different epithets. Hence it is easy to distinguish a particular region from others by their mere place-names. From an analysis of the the place-names in Salem district we can easily say to what natural division a particular tract belonged. This district contains the first four divisions, viz., the hilly, pastoral, river-side and waste. The district has not got sea-coast and hence the fifth region cannot be found in it. But yet it is curious to note that a few villages have been named after the sea, viz., Samudram. Perhaps the name is purely euphemistic. Religious fervour could lift its votaries to hyperbolical heights. A small tank when it becomes sacred in the eyes of the devoted, easily becomes a sea or an ocean. Hence we find the name *Samudram* in the purely inland district of Salem, just as small earthly mounds and terraces in Tanjore district become huge mountains with dales and forests and water-falls in the eyes of devotees and the authors of their Sthala puranams.

Now we give a classification of the place-names according to the conventional divisions :

1. **Hilly-regions : (Kurinji):**

Suffix.	***Full name example.**
Kurichi	Belu Kurichi
Malai	Naina Malai
Giri	Elagiri
Kōdu	Trichengodu
Pārai	Kuttupparai
Kal	Namakkal

2. **Pastoral tracts : (Mullai):**

Patti	Palapatti
Halli	Ajjanahalli
Ur	Velur
Pādi	Thalampadi
Vādi	Laddivadi
Kādu	Erkadu

3. **River-valleys : (Marudam):**

Palayam	Kumarapalayam
Puram	Varadarajapuram
Nadu	Ariyurnadu
Agraharam	Vengarai Agraharam
Mangalam	Tharamangalam
Aru	Edayaru
Eri	Ponneri

4. **Waste-lands : (Palai):**

Pālai	Perumpalai

5. **Sea-Coast : (Neithal):**

Samudram	Bommasamudram

It will be seen that the abovesaid classification is purely the outcome of Tamilian poetical brain and hence we find the idea current chiefly in the Talaghat division which formed part of the Kongu country. Such natural divisions can also be traced even in the Balaghat and the Baramahal regions, for during the time of the imperial Cholas they came under Tamil influence. But the existence of the large number of Kanarese and Telugu names may resist submission to the Tamil classification there on all fours.

The intermediate division of Baramahals came to be named after the Musalman influence over the Mysore plateau as its very name signifies. *Mahal* means Palace, but the name would have been a corruption of the word *Mohalla* which means a division. For the purpose of administration and defence, the country was fortified and twelve impregnable hillocks were fortified and converted into 12 fortresses. The imperial Vijayanagar had the ingenuity to plan the scheme, whose utility was fully taken advantage of and availed by the successive Mysore dynasties including the Musalman interregnum. The fortresses became the scenes of much activity during the Anglo-Mysore War. After their subjugation their importance has fallen into the background. A visit to these fortresses is worth the trouble and will remind us of the military ingenuity of our ancients. It is worth mentioning that in the pre-mediaeval days these hills had been the resorts of ancient Tamil chiefs known as *Velirs.* Tagadur, the modern Dharmapuri was the capital of Adigaman, a chief mentioned in the ancient Sangam poetry. The name Adaman-kottai signifies his connection to it. We know that Namakkal came under his influence, as is signified by the name of the temple in the rock *Adiyendra Vinnagaram* as evidenced by the epigraphical records. Other hill fortresses had their own *Velir* chiefs. They were always at constant warfare with themselves as well as with their neighbours, the Cholas and the Cheras. Hence this tract had been always the bone of contention between various kingdoms and was therefore completely fortified from the earliest times.

The place-names of Balaghat do not give place to much speculation or thought, as the tract was always under the Mysore dynasties and its history coincides with that of Mysore and of Kanarese civilisation. The Musalman interregnum is commemorated in the names of a handful of villages. Examples : Jērtalāv—Talāv means a lake. Daulatābād—Abād means a city (part of Krishnagiri town), Āmarāyī (Harur taluk).

What strategic position Salem district held during military activities is clearly evidenced by the following names of fortresses and fortified Durgams :—

Hill side forts.	Durgam.	Giri.	Stray forts in the plains.
Adamankottai	Sankagiri	Krishnagiri	Dharmapuri
Bagalur	Hudai	Sankagiri	Namakkal
Berikkai	Nilagiri	Kanakagiri	Salem
Hosur	Ratna	Ankusagiri	Omalur
Rayakotta	Gettarva	Nilagiri	Jagadevpalayam
Denkani	Anchetti	Sulagiri	Dhali
Tengari	Tattakkal		Cauveripatnam
	Veerabadra		Maharajakadai
	Balakundarayan		Perumpalai
			Pennagaram
			Cholappadi
			Toppur
			Harur
			Kambainallur
			Attur

It should be noted that most of the forts on the plains have been destroyed. The existence of the names of Kottai as opposed to Pettai (town portion) in these places proves their historicity. There are remnants of ramparts and other fortifications in the hill forts still existing and they are worth the preservation to show their ancient grandeur and usefulness in martial days.

III

For purposes of administration the country had been divided into revenue villages. The boundaries of the villages had been fixed long ago, and on the British advent they have been adapted without much alteration; but in the cases of a few big villages, they had to be divided into two or three smaller ones to facilitate easy handling. Such division necessitated distinguishing nomenclature given to them and appropriate epithets were adopted. The very epithets signify the intention. We give herein a few examples which are generally in doublets:

Namakkal Taluk.

1. Mel Vs. Kil	Signifying east and west. Ex. Melpatti-Melmugam and Kilmugam. Ex. Sathambur—Mel and Kil.
2. Nanjai Vs. Punjai	Signifying wet and dry. Ex. Edayar-Nanjai and Punjai.
3. Sarcar Vs. Agraharam	Signifying ryotwari and Inam. Ex. Vengarai.
4. Vadakarai Vs. Tenkarai	Signifying north bank and south bank of a river. Ex. Attur.
5. Jodi Vs. Sarvamanyam	Signifying different kinds of Inam. Ex. Aaiaru.
6. Japthi Vs. Sircar	Signifying attached and enfranchised. Ex. Serukkalai.

Attur Taluk.

1. Attavanai Vs. Jari	(these names found in Coimbatore Dt. also). Ex. Kottambadi.
2. Kil Vs. Mel	East and west. Ex. Rajapalayam.
3. Ten Vs. Vada	South and North Ex. Ten Kumarai.
4. Periya Vs. Chinna	Big and small. Ex. Kalrayan.
5. Kilnadu Vs. Melnadu	Lowlands and highlands, Ex. Periyakalrayan.

Dharmapuri Taluk.

1. Hale Vs. Hose	Signifying old and new. Ex. Hale Dharmapuri.

Hosur Taluk.

1. Pedda Vs. Chinna	Big and small. Ex. Kullu-Pedda and Chinna.

Salem taluk.

1. Attavanai Vs. Agraharam	Ex. Pulaveri.
2. Agraharam Vs. Sircar	Ex. Nattarmangalam.

It is noteworthy to find that there are more estate lands in the Salem district than elsewhere. We find throughout the district Mittas, Zamins, Inams, etc. Agraharams are innumerable. The existence of such a land system has necessitated doublets in nomenclature to a considerable extent. The estate lands are governed by Estate Land Act, while other villages are governed by the general Revenue system, viz., Ryotwari. Even in the very town of Salem, there are Mitta lands as opposed to Ryotwari.

IV

Indian names of places generally submit to an analysis regarding their origin and history. The name of a place has two component parts, the first being a proper name while the second a common name. The proper name gives the historical sense, while the common name the nature of the place. For example, in the name *Rayakottai*, the prefix *Raya* is the name of the person who established the place and the suffix *Kottai* signifies the nature of the place that it is a fort. *Such an interpretation suggests another kind of analysis which is worth noting. We can classify the place-names in the district under the following heads:—

I. *Geographical*:

1. *Towns and parts of towns*:

Example of suffixes:—Patti, Atti, Palli, Halli, Puram, Puri, Pettai, Vadi, Padi, Kurichi, Ur, Mangalam, Kuppam, Valasai (Telugu valasa), Kadai, Agraharam, Mahadevi, Vasal, Cheri, Pundi, Pattanam, Abad, Agaram.

* The first part of a name, which gives generally the historical significance, is capable of an analysis which is as follows:—

1. Name of the originator, as in *Rayakottai, Adamankottai* or *Gopalapuram*.
2. Name of the people who occupied it, as in *Oddappatti, Edayapatti*.
3. Name of the flora in the place, as in *Eechampatti, Kallipatti, Tennamgudi*.
4. Name of the fauna, as in *Keeripatti, Karadipatti, Erumaipatti.*
5. Name of a geographical feature as a river—*Kaveripuram*.
6. Name signifying relativity, etc., as in *Peria patti, Sinnakulam, Melpatti, Puttur, Ilampalli*, etc.

2. *Hills and parts of hills* :
   Example :—Kal, Giri, Durgam, Kodu, Malai, Kombai, Thittu, Moolai, Parai, Betta, Kuzhi.

   Countryside and parts :
   Example :—Nattam, Karai, Nadu, Palai, Thindal

4. *Forests* :
   Example :—Kadu, Solai, Veli.

5. *Water-courses* :
   Example :—Eri, Maduvu, Kuttai, Thurai, Karai, Kundam, Utru, Samudram, Kulam, Anai, Aru, Kerai, Koodal, Talav, Madai, Kuzhi, Guttai, Bavili, Teertham.

II. *Historical* :

Example :—Kottai (Fort), Mangalam (remnant of Chaturvedi-mangalam generally a gift by the ancient dynasties, especially Cholas and Pandiyas), Durgam (hill fortress), Agraharam (village gift to Brahmins), Mahadevi (ex. Thipramahadevi, a gift by the queen of the ruling dynasty and hence named after her), Padaiveedu (Military camp).

III. *Commercial* :

Example :—*Kadai* (means bazaar), e.g., Maharaja kadai, a bazaar started by a Maharaja ;

Salem—according to Tamil dictionary, the word Salem means " cloth," being a modification of the word *Selai*. In an old inscription, the name is given as *Sālyam*. *Sāliars* are weavers. The name is derived from *Sēlai*, a Tamil word. Salem is noted for weaving. It cannot be said to be a very old town. Hence the industrial innovation brought by Vijayanagar or any previous enterprising dynasty would have been the origin of the place. The derivation of the name from the word *Syla* meaning ' mountain ' is not convincing.

IV. *Religious* :

Example :—Kovil (temple), the prefix Thiru (sacred) in Trichengode, Matam (monastery).

V. *Agricultural* :

Example :—Panai (Palmyra), Maḍal (leaf-stem), Vēpadi (stem of a margosa).

There are some miscellaneous names which do not submit to the abovesaid analysis. They do not have prefixes and suffixes, but many of them have got fine significance behind them. The following examples are somewhat interesting: —

I. *Names of pure Tamil origin*:

1. Salem (already commented upon above).
2. Pennagaram.
3. Iveli (five hedges).
4. Thannirpandal (water-shed) some philanthropist might have started a water-shed there.
5. Thangal (support).
6. Mani vizhundan (signifies the fall of a gem. The origin would be very interesting if known).
7. Manjani (manju means cloud).
8. Mummudi (three crowns, a title assumed by some emperors and rulers).
9. Panaimadal (palmyra leaf).
10. Thummal (sneezing).
11. Nadathai (conduct).
12. Pottanam (packet).
13. Ilampillai (young one).
14. Kombu thooki (lifting of a branch).
15. Kankatti Alai (the mill which closes the eye).

II. *Names of Sanskrit origin*:

1. Abiramam.
2. Pavitram (purity).
3. Prantakam.
4. Arangam (Rangam-land between rivers).

It may be noted that most of the suffixes given above are of Tamil origin and that only a few are of Sanskrit origin. Those of Sanskrit origin are: pattanam, puri, puram, agraharam, mahadevi, giri, samudram, theertam and matam. The rest are of vernacular origin. Hence the Aryan influence has not been felt much in the establishment of villages in this district. This idea takes us to the mythological lore current in our country. We do not find much of mythology either based on the Itihasas or puranas in this district. The usual attribution to the travels of Rama occur in the names of three places only: Ayodhyapatnam, 5 miles east of Salem which has a fine temple, reminding us of the capital of Dasaratha. Poimankaradu on the way to Rasipuram from Salem is a cloven rock with a figure of a deer which is said to be the false deer which enticed Sita away. Jatayu-Malai is said to be the fossil of the bones of Jatayu who was murderously assaulted by Ravana. As a matter of fact the magnesite ore found therein has nothing to do with bone fossil. The Salem Magnesite Syndicate is working there, and is quarrying out a good quantity of magnesium carbonate for commercial purposes.

The puranic lore is equally meagre in this district. Even sacred shrines sanctified by the feet of saints are not many. Trichengode is the only place sanctified by Thevaram sung by Sambandar, the Saiva saint. It has got a puranam which connects the hill with Adisesha calling it Nāgamalai. The deity is Ardanariswara, half man and half woman, a form which is peculiar to the shrine. Teertamalai is another place having a puranam written by a poet, Saiva Ellappa Navalar. The only other place which has a puranam of recent origin is Belur (வெள்ளூர்). Two other places which have no puranams but have got old temples are Taramangalam and Ayodhyapatnam. The former has a temple of a high sort of architectural value, built by local chiefs called Getti Mudaliyars. Namakkal has a temple, several centuries old but it somehow escaped sanctification by a Vaishnava Acharya. Vaishnavism seems to have made its mark a good deal in this district. The big Nāmams found on the hills surrounding Salem, signify its influence. (Nāmakkal—Nāmam + kal). Arappali in the Kollimalais has been immortalised by the poet Ambalavana in his Arappaliswara Satakam. Kapilamalai and Hogainakal have been given mythological connection as their names indicate. Besides the above-said few instances, we do not find much of mythology in this district.

Curiously, the names of rivers have something to do with mythology, and most of the names have got a local Tamil name as well; hence the loud sounding mythological name may be of later origin. Vasishtanathi, Sarabanganathi, Manimuthar, Swetanathi, Sanat Kumaranadi, and Markandanadi, are a few such names. On the other hand, the names of hill ranges have no connection with mythology. Servarayan, Kalrayan, Kollimalai, Javvadimalai, Pachamalai are such names without any smack of mythology.

Besides Jatayumalai which has its magnesite ore, there are one or two places which denote geological significance. Kanjamalai has much magnetic iron ore. It is said to be the place where Kanjamalai Siddar performed alchemy. Kanjam in Tamil means gold. There is a river named Ponneri which means gold river. Salem district is full of geological interest, but very few place-names are found which signify such a connection.

List of Books. in Geography and History

GEOGRAPHY

D. M. Forsaith—A hand book for Geography Teachers. Methuen, London 1932. 4s.

James Fairgrieve—Geography and World Power. University of London Press 1924. 5s.
Geography in school. University of London Press 1930. 7s. 6d.

K. C. Barnard—Principles and Practice of Geography Teaching. University Tutorial Press, London 1933. 4s. 6d.

M. Whiting Spilfaus—The Background of Geography. Harrap, London 1935. 7s. 6d. seniors.

W. R. Kermack—New Geography of the World. Johnston, Edinburgh and London 1931. 3s. seniors (Secondary, Central or Senior schools).

J. F. Unstead—World Geography and World Problems. (The citizen of the World Geographies). Sidgwick and Jackson, London 1923, 3s. 6d. Seniors (to Matriculation standard).

J. Fairgrieve and E. Young—Human Geographies: Primary series, Books I-VI. Philip, London, 1s. 6d., 2s. each.

Human Geography for secondary schools: Books I to III. Philip, London 1927 and 1928. 2s. 9d., 3s. 6d. each.

Human Geographies.—(i) The World, (ii) The British Empire. Philip, London. 2s. 6d. each.

J. H. Stembridge—The world-wide Geographies: Junior series—I. Seeing the World; II. Peoples and Homes of other lands; III. Exploring the British Isles; IV. The world we live in. Senior series—V. Africa, Asia and Australia; VI. North and South America; VII. Europe and the British Isles; VIII. Geography of Industry and Commerce. Oxford University Press, London 1929-33. 1s. 9d., 2s. 6d. each.

M. Bayne—The World's Goods. The World around us. Book II. Chambers, London 1934. 1s. 9d. Juniors

C. Ridgley—New Picture Geographies: A lower school course (7 or —11 years): I. Peoples of the world; II. More peoples and other lands; III. The world's workers; IV. The world and the Home land. Johnston, Edinburgh and London 1930 & 1931. 1s. 6d. each.

L. Edna Walter—Life in Many Lands: I. Life in other homes, Juniors; II. Work in other lands; III. Men's work to-day; IV. In British to-day. Nisbet, London 1934 & 1935. 1s. 9d. and 2s. each.

H. Alnwick—A Geography of Commodities. Harrap, London 1934.

R. H. Duce—Home and overseas Geography: Regional series: Book 5. A simple world survey, Africa; Book 6. The Americas, Asia, Australia, New Zealand· Book 7. Europe. The British Isles and the Irish Free State; Book 8. The British Empire Regions of the World. Pitman, London 1935. 2s. 6d.—3s. 6d. each.

PRACTICAL GEOGRAPHY

J. V. Cameron—*Maps and Map work.* Harrap, London 1932. 2s. Seniors.

James Walker—*Map Interpretation.* Johnston, Edinburgh and London 1933. 2s. 9d. Seniors. (School Certificate standard).

E. J. Orford—*Junior Practical Geography.* Pupil's book, 1s. 8d. Teacher's book, 3s. 6d. *Senior Practical Geography,* 1935. Pupil's book, 2s. 4d. Teacher's book in preparation. University of London Press.

E. H. Sanders—*Observational Geography.* Philip, London 1932. 2s. 6d. Juniors.

GENERAL HISTORY

H. G. Wells—*A short history of the world.* Watt, London. 1s. Older pupils.

H. G. Wells & H. E. Carter.—*A short history of Mankind,* 1929. Blackwell, Oxford (adapted and edited for school use from the author's "Short History of the World").

I. O. Evans—*The Junior outline of History* by permission of H. G. Wells. Denis Archer, London 1932. Illus. 7s. 6d.

F. C. Happold—*The Adventure of Man.* Christophers, London 1932. Illus. 3s. Senior pupils.

Helen Corke—*A book of Ancient Peoples.* 1931. *A book of Modern Peoples.* 1933. Clarendon Press, Oxford, Juniors.
Class Book of World History: I. The World's Family 1924; II. *The Home Builders,* 1928, 2s. 6d.; III. *The Adventurers,* 1929, 2s. 6d.; IV. *Mankind* the Conqueror, 1930. 3s. 6d. Oxford University Press, London. (I-II for pupils in 2 highest classes of new junior schools, III and IV for 1st and 2nd years of new seniors or Modern schools).

J. F. Horrabin—*An Atlas of European History,* 1935. 3s. 6. *An Atlas of Current affairs,* 1934. 3s. 6d. Gollanez, London.

F. S. Marvin—*The Modern World.* European from the French Revolution to the League of Nations. Longman Green, London 1929 3s. 6d. Seniors.

John T. Greeman & J. Madison Gethany—*Units in World History* Development of Modern Europe. McGraw Hill Publishing Co., London 1934. Illus. 11s. 6d. Seniors.

D. M. Ketelbey—*A short History of Modern Europe from 1789 to the Present Day.* Clarendon Press, Oxford 1934. Illus. 3s. Seniors.

K. C. Knapp Fisher—*The Modern World.* A Junior Survey. Gollanez, London 1933. 5s. (Author of outline of World History for Boys and Girls—not in possession of B. I. E. but said to be very good.)

Stephen King-Hall—*Letters to Hilary,* 1928 from 10 years Hilary Growing Up 1929 Sequel. Benn, London.

No author—*History of Senior Course I to IV.* Edited by Catharine B. Firth Ginn, London.

TEACHING OF HISTORY

F. C. Happold—*The Approach to History.* Christophers, London 1931. 3s. 6d.

H. Ann Drumond—*History in School.* A study of some of its Problems. Harrap, London 1929. 5s.

F. Clarke—*The Foundation of History Teaching.* A Critique for Teachers. Oxford University Press, London 1929. 4s. 6d.
A Handbook for History Teachers. Edited by D. Dymond. Methuen, London 1929. 3s. 6d.

(Recommended by the International Bureau of Education, Geneva)

News and Notes

It is pleasing to note that since the commencement of the new year the membership of the Association has been going up and the number of subscribers to the Journal has been on the increase. We feel we have turned a corner in the life of the Association ; and we appeal to our members to help the Working Council to carry out its recent resolution " that all possible measures be taken to increase the membership of the Association and the circulation of the Journal." With their co-operation in this direction and the resulting increased financial support, we hope to be able to make our Journal more useful and attractive by enlarging its size and adding more of illustrative material of varied kind. Let each member introduce one other in the present year.

* * * * *

The Working Council has resolved that " in view of the fact that the Association has completed ten years and in view of its record of achievement, steps be taken to request His Excellency the Governor of Madras to become the Patron of the Association."

The present issue is a special number of the Salem Conference, containing its Proceedings, the Presidential Address of Mr. B. Rama Rao and the papers read at the Conference. This symposium forms the sixth district monogram, the five earlier districts similarly studied being in order Coimbatore, Malabar, Madura, Trichinopoly and Anantapur. Individual teachers of Geography as well as institutions, who have not been subscribing for the Journal, will do well to take at least these special volumes, which they will find useful as a source-book for the study of the Geography of the particular districts.

* * * * *

The next district to be similarly worked up in the next Conference in May 1937 is Tanjore ; and we feel sure that the members in the District will work for it from now by first getting in all the teachers of Geography and the sympathisers in the District, as members of the Association. This is the first deltaic district to be studied, and presents a unique interest of its own in the peculiarity and complexity of its human landscape.

* * * * *

The Working Council has appointed an *ad hoc* Committee, consisting of the following persons, to organise a series of excursions in the neighbourhood of Madras, covering all aspects of the geography of the region :—Miss E. D. Birdseye, Miss J. M. Gerrard, Miss

H. T. Scudder, Mr. George Kuriyan, Mr. B. M. Thirunarayanan, Mr. P. Sridhara Rao and Mr. N. Subrahmanyam (Convenor). It is expected that the Committee will take within its purview in due course other regions also in South India.

* * * * *

The Association has been presented with a collection of negatives of illustrations, suitable for making slides for geographical purposes; and the Working Council has decided to supply slides made from them for institutions willing to meet the cost.

* * * * *

The Director of Public Instruction, Madras has forwarded to us for publication a list of books on Geography and General History which have been recommended by the International Bureau of Education, Geneva, in connection with the future planning for Education in India. It is hoped that schools and colleges will try to get them for their libraries.

* * * * *

The Standing Committee of the Association met and discussed thrice in the last term to work out a scheme of work and syllabus in Geography for the Elementary School; but, the work, still unfinished, is expected to be completed at its next meeting to be held about the middle of August.

* * * * *

Replies to the Questionnaires sent to the Headmasters of High Schools and Secondary Training Schools in the Presidency are being received; and their scrutiny will also be taken up by the Committee in that meeting. The results of the investigation will be submitted to the Director of Public Instruction, as required by him. It is disappointing to find, however, that so far only 25 per cent. of the institutions responded.

* * * * *

The Report of the Sixth Summer School of Geography, organised by the Association at the Teachers' College, Saidapet, in April-May 1936, will be published in the next issue. It has been suggested that the next Summer School may be conducted specially to serve the needs of the teachers handling Geography in Secondary Training Schools, in view of the recent issue of a revised scheme of work and syllabus for forms I to III.

* * * * *

The Refresher Course in Geography, organised by Mr. D. Samuel, District Educational Officer, Tinnevelly, was conducted by Mr. T. S. Sundaram Iyer, Geography Assistant, Tirthapathi High School, Ambasamudram, for the benefit of teachers of Geography in the Tinnevelly District. The Course was to have been held during the last Christmas holidays ; but owing to want of time, it had to be postponed. It was now held from 15th April to 25th April 1936. 41 teachers attended the Course, which included practical work in land forms, climate and weather, map-reading and map-correlations, statistical work, graphic methods and elementary surveying. An excursion was also made to the gravel-mound west of the railway-line to observe rock-sedimentation and land sculpture.

* * * * *

The permanent reorganisation of the S. S. L. C. Scheme in Madras is still being awaited ; and the future position of Geography in it is uncertain. But whatever happens, we believe that its place in the High School curriculum is assured and that it will not be worse than that of any other important school subject.

* * * * *

Meantime, it is surprising to find that the Cochin Educational Department has taken a very retrograde step in its recent re-organisation by putting Geography in the B. Group of subjects along with Outline of History, but without any place at all among the long list of 19 optional subjects, which include Deductive Logic, Music, Mechanical Engineering, Needlework, Hygiene, etc. As, according to the scheme, the B. Group subjects have to be taught in Form V. along with two optional subjects, the time-table is sure to get too crowded, and only one period a week is to be allotted for Geography in that class. As it happened in Madras schools in days when Geography was a B. Group subject in the Presidency, even that one period is sure to be (mis-)appropriated for the teaching of the options, which are Public Examination subjects. The subject is to be dropped altogether in the VIth Form. It is hoped that the Cochin Teachers' Conference will discuss the undesirability of treating an important school subject in this fashion, and represent to the Educational Authorities the urgent need for rectifying this mistake. Otherwise, by the neglect of such an important subject, education in the State schools is bound to get lop-sided.

* * * * *

It is understood that a qualified lady has been deputed by the Travancore Government to undergo higher studies in Geography in London with a view to introducing Geography in the Training College at Trivandrum as one of the special subjects for teachers' training. The early provision for the teaching of Geography in the Arts College is also worth serious consideration ; and we hope that it will be taken on hand soon.

* * * * *

The next session of the Indian Science Congress will be held at Hyderabad in January next; and in view of the fact that the Geology Section has now been widened to include Geography also, it is hoped that papers on Geography will be contributed by specialists in sufficient numbers. It will then be possible in time to separate Geography into an independent section, as was done in the British Association.

* * * * *

Under the auspices of the Karnatic Historical Research Society, the Vijianagar Sex-Centenary Association proposes to bring out a Vijianagar Commemoration volume. Along with papers on various aspects of Vijianagar History, some papers on the geographical aspect of its History are also expected to be contributed.

* * * * *

We have much pleasure in congratulating Mr. S. Muthukrishna Das, B.A., L.T., on his success in the B.A. Honours Degree Examination in Geography of the University of London. He is a member of our Association, and had undergone Summer School training and taken the L.T. Degree in Geography, before going to England for his higher studies. We hope the Educational Department or one of the Universities of South India would utilise the services of this qualified teacher of Geography.

Reviews

Lands & Life : Our Food, Clothes And Shelter. By E. C. T. Horniblow. (The Grant Educational Co., London, Ltd.). 1936. Price 2sh. 6d.

This book is a middle volume in a series of Human Geographies meant for junior school children in England. It is intended to serve a double purpose. Firstly, it gives a simple course of World Geography to children through the medium of the things of their everyday life. At the same time they are continually kept in touch with their own country, partly through their familiarity with such things as the materials of their food, clothes and shelter and partly by the application of the Geography of their own country in terms of these things.

Suggestive questions and exercises tending to rouse the interest of the pupils are given at the end of each chapter ; and simplified sketch-maps have been added at several places. The volume is copiously illustrated with a large number of typical pictures, illustrative of the regions, industries, and products dealt with. Bold print on glazed paper and a fine-get-up make the volume highly attractive.

Longmans' Descriptive Geography (Book I)—Tamil Edition. By L. D. Stamp. (Longmans, Green & Co., Ltd., Madras). 1936. Price 10 annas.

We welcome this text-book of Geography for Form I, prepared in accordance with the recent Scheme of Work and Syllabus issued by the Madras Educational Department. The treatment is simple and clear, and suited to the children of that class. A large number of suggestive and stimulating exercises and questions at the end of each chapter, plentiful illustrations and simplified sketch-maps and diagrams are some of the features that make the volume highly useful. In spite of these good features and its size, the price has been kept fairly low.

A New Geography (Book II)—In Tamil. By R. J. Johnson and B. Clutterbuck. (Macmillan & Co. ltd., Madras). 1936. Price Re. 1.

This is also another text-book, written in accordance with the recent middle school syllabus of the Madras Educational Department for the use of pupils in Form II. As in the first book, there is undue emphasis on the factual side, a reminiscence of old Geography. The volume is illustrated with a large number of sketch-maps, diagrams and pictures ; but some of the blocks appear as mere blotches as on pp. 145 and 146. The few colour relief maps are quite good, being simple, bold and free from crowding of names ; and it is hoped that pupils will use them as basic maps.

World Studies. By Eva D. Birdseye. (Macmillan & Co., Ltd., Madras). 1936. Price 5 annas.

This is an elementary geography of the major natural regions of the World, treated in a simple and practical manner, with emphasis on the essentials. Suggestions for further practical work are given at the end of each chapter. World maps showing the distribution of each of the regions and a number of typical pictures increase the usefulness of the book, which can be used in one of the High School classes.

Major Natural Regions of the World : North America East of the Prairies. By Eva D. Birdseye. (Macmillan & Co., Ltd., Madras). 1936. Price 6 annas.

This book is prepared in accordance with the syllabus for the special region, prescribed for C. Group Geography of the Madras S. S. L. C. Scheme. The treatment is similar to that of the World Studies with emphasis on practical work. A good number of necessary sketch-maps and diagrams enhance the value of the volume.

How to Look at Geographical Pictures (Second Series). By W. J. H. Watkins and H. S. L. Watkins. (Macmillan & Co., Ltd., London). 1936. Price. Paper cover, 1sh. 3d. Limp cloth cover 1sh. 6d.

This is the second series, the earlier volume of which was reviewed in a back number last year. The aim of this book as of the first is to give some training in the analysis of pictures ; and for this purpose hints on the method of analysing a picture are given on the front fly-leaf. Mere seeing of pictures in the mass is of very little geographic value ; and teachers sometimes require some guidance in the use of them. These series are therefore suggestive to the teacher while being directly useful to the pupil. A similar series of Indian views can be used with great advantage in Indian schools.

Books and Journals Received

How to Look At Geographical Pictures. (Second Series). By W. J. H. Watkins and H. S. L. Watkins.

Longmans' Descriptive Geography (*Book I*) in Tamil. By L. D. Stamp.

An Elementary Practical Geography of the World: *World Studies.* By Eva D. Birdseye.

Major Natural Regions of the World: *North America East of the Prairies.* By Eva D. Birdseye.

A New Geography (*Book II*). By R. J. Johnson and B. Clutterbuck.

Lands and Life: *Our Food, Clothes and Shelter.* By E. C. T. Horniblow.

Indian Culture: April and July 1936, and Index.

The South Indian Teacher: April, May and June 1936.

Kalaimagal: May, June and July 1936.

The Indian Educator: April, May, June and July 1936.

The Geographical Journal: May, June and July 1936.

The Educational Review: May and June 1936.

The Indian Journal of Economics: April 1936.

Die Rumliche Gliederung der Landwirtschaft in nordlichen Kalifornien. By Gottfried Pfeifer.

The Scottish Geographical Magazine: May 1936 and General Index 1885-1934.

Geography: June 1936.

The Indian Co-operative Review: April 1936.

The Himalayan Journal: Vol. VIII, 1936.

Educational India: May, June and July 1936.

Our Home Magazine: May 1936.

The Geographical Magazine: June and July 1936.

Bibliography of the Orient: (Leningrad): Books VIII & IX (1935).

The Geographical Review: July 1936.

The Quarterly Journal of the Mythic Society: January-April 1936.

Proceedings of the Royal Geographical Society of Australasia (South Australian Branch): Vol. XXXVI.

Foldrajzi Kozlemenyek: Vol. LXIII, 8-10. 1935.

HOLIDAY TOURS

BY MOTOR BUSES

The STANDARD ESCORTED TOURS of the undersigned afford a choice of some of the most attractive routes in South India, full of grand scenery, historic towns and pleasure-resorts.

The provision of an EXPERT GUIDE with each tour ensures that all arrangements are made satisfactorily, and the party are saved the petty annoyances and trouble incidental to travel otherwise.

The BUSES provided are of the latest type, dust-proof and rain-proof, with plenty of room, and fully equipped to permit of the largest runs being made with the minimum of fatigue and without the least interruption. The DRIVERS are men with vast experience in driving over difficult country and thoroughly familiar with all the routes, and are good mechanics, besides being sober and well-behaved. The JOURNEYS will, as a rule, be in the day-time, not only affording the greatest possible scope for the study of the country traversed and the enjoyment of the road-side scenery, but eliminating chances of accident as well.

The FARES charged generally include : Reserved seat in bus ; accommodation in Travellers Bungalows or other decent buildings ; tiffins and meals in the best available hotels ; gratuities to servants ; the services of the Guide and any admission fees to the places of interest.

A special feature of our line is the PRIVATE ESCORTED TOURS for Families or Private Parties, and for School and College Children. A Science Excursion, a Geographical Excursion, a Historical and Archaeological Excursion, a Family Pilgrimage or an outing for picnic or for health, can be easily arranged with the maximum of safety and comfort and at a minimum cost, in charge of a Travel Specialist.

Enquiries about these, or Road-Travel in general, or even a combined Road-Rail-Travel, are always welcome, without any obligation—no matter how small or large the party is, or how long the tour is to last.

The EDUCATIVE VALUE of these excursions will be apparent when it is considered that a large number of them will be in collaboration with, or under the auspices of, the MADRAS GEOGRAPHICAL ASSOCIATION, with the guidance of their EXPERTS.

Detailed itineraries and estimate for any tour will be supplied on request.

V. S. MAHADEVAIYAR,
12, Nore Virasami Street,
Nungambakkam, Madras S.W.

SOME IMPORTANT PAPERS PUBLISHED IN PREVIOUS NUMBERS OF THE JOURNAL

1. *Some Aspects of the Geography of Madras*: By Miss E. D. Birdseye.
2. *The Geographical Evolution of Madras and its Environs*: By Rao Bahadur H. Narayana Rao.
3. *The Flora of Madras and its Environs*: By Mr. M. S. Sabhesan.
4. *The Planting Industries of Southern India*: By Mr. R. D. Anstead.
5. *Rural Geography* (With special reference to South India): By Mr. N. Subrahmanyam.
6. *The Birds of South India: their Distribution and Habits*: By Mr. C. Lakshminarayana.
7. *South Indian Cattle: their Breeds and Distribution*: By Mr. A. Swaminatha Ayyar.
8. *Stages in the Growth of the City of Madras*: By Professor Srinivasa Chari.
9. *Sewage and City Geography*: By Mr. A. Swaminathan.
10. *Rural Life on the West Coast: A Study in Environment*: By A. Appadorai.
11. *The Geographical Data of the Sangam Works*: By Professor V. Rangacharya.
12. *Notes on the Maps of Old Madras preserved in the Madras Record Office*: By Professor C. S. Srinivasa Chari.
13. *The Buckingham Canal: A Survey—Historical, Geographical and Economic*: By Mr. V. K. Sourirajan.
14. *The Geographical Basis of Ancient South Indian Culture*: By Professor P. T. Srinivasa Ayyangar.
15. *Some Results of Recent Upper Air Investigations*: By Dr. K. R. Ramanathan.
16. *Studies in the History of Some Common Commodities*: By Professor V. Rangacharya.
17. *The Comorin Continent*: By Mr. C. P. Gnanamuthu.
18. *The Geographical Distribution of Disease* (With special reference to South India): By Major A. M. V. Hesterlow.
19. *Environments and Economic Activities in the Madras Presidency*: By Mr. K. C. Ramakrishnan.
20. *South Indian Pearl Fisheries*: By Dr. B. Sundara Raj.
21. *Migration of Labour* (With special reference to South India): By Dr. P. S. Loganathan.
22. *Statistical Sources for the Study of the Economic Geography of India*: By Mr. K. C. Ramakrishnan.
23. *The Geography of Kalidasa*: By Mr. C. Sivaramamurthy.
24. *Localisation of Industry in India*: By Dr. P. S. Loganathan.
25. *South India of Venkatanatha's Days*: By Mr. C. Sivaramamurthy.
26. *Economic Geography of the Vizagapatam District*: By Mr. T. Appalanarasayya.
27. *The Geographical Evolution of India*: By Mr. T. N. Muthuswami.
28. *Sugar Industry in India*: By Mr. K. C. Ramakrishnan.

A limited number of back issues of the Journal are available at specially reduced prices. The Conference numbers contain papers on various aspects of the Geography of the following Districts:—Coimbatore, Malabar, Madura, Trichinopoly, Anantapur and Salem. They are of permanent value as reference books; and no school or college library in South India can afford to remain without them.

The Journal of
The Madras Geographical Association

Vol. 11 October, 1936 No. 3

Recent Trends in the Distribution of the Cotton Mill Industry in India

BY

P. S. LOKANATHAN, M.A., D.Sc. (ECON.), *London.*

IMPORTANCE OF THE STUDY

There is special appropriateness in my addressing the Geographical Association on a subject of this kind dealing with the localisation and distribution of a particular industry, for it is one of those subjects in which there is urgent need for fruitful collaboration between the Economist and the Economic Geographer. The migration of population from one region to another under the stimulus of changing geographical and economic conditions and the shift of industry from one locality to another, resulting in poverty and suffering in the depleted areas invest the problem of industrial location with great interest. The rise and development of the cotton industry in India and Japan has created problems not alone in those countries but even more so in Lancashire where those dependent on the cotton industry have been thrown out of work. New methods of production or new sources of power or new inventions completely alter the importance of old locations of industry which has to move out to other regions more suited to the changed conditions. The utilization of new forms of power such as hydro-electric energy and the new possibilities of electric transmission in India offer scope for the use of machinery in localities not supplied with coal.

CONCENTRATION OF INDUSTRY IN INDIA

Modern industry in India is concentrated in a small number of towns and in a few geographical regions. More than half the factory workers of the country are employed in two cities and their neighbourhood, Calcutta and Bombay ; and a small number of other centres like Ahmedabad, Cawnpore, Jamshedpur, Madras and Rangoon account for nearly all the rest. In Delhi, Lahore, Lucknow and Nagpur the factory population is only a small part of the total population, but there is some concentration of factories in those capital towns.

FACTORIES OF LOCATION

Why is industrial life so much concentrated in these cities ? If purely natural factors were decisive, we should expect economic activity to be widely dispersed in accordance with the distribution of natural resources and raw materials. It is true that in agriculture and mining the principle still holds good. The extraction of metals and minerals, the raising of various kinds of agricultural produce, the development of plantation industries like tea, coffee and rubber and generally speaking the production of what may be called the first order of goods are all conditioned by natural factors. Thus the raising of cotton and jute and of the various food crops like wheat and rice, the extraction of coal or of gold and silver and the opening up of oil fields are all carried on in regions where natural conditions are suitable for the purpose. But as soon as we reach the second order of production, new factors begin to operate. While wheat must be raised from the wheat lands, wheat flour may be produced almost anywhere if certain conditions are satisfied. The spinning of cotton yarn requires, it is true, a fairly moist climate; but artificial humidity can be secured at a cost and if there are compensating advantages, the cotton spinning industry may be located in regions not only far away from the raw material but even in places having but little moisture. At the same time natural factors always remain in the picture and are ready to make themselves felt if conditions of production in an industry begin to change.

I propose in this paper to do two things. I shall in the first place deal with those causes which had brought about the high concentration of the cotton mill industry of India in the nineteenth century, in the light of the general theory of industrial location. Secondly, I shall note the changes that have taken place in the distribution of the industry in recent years and examine the causes of such changes and estimate their effects.

BOMBAY'S PRE-EMINENCE IN THE 19TH CENTURY

The cotton mill industry of India had from its origin been localised in the Bombay Presidency and more especially in the two cities of Bombay and Ahmedabad. In 1894-95 out of 144 mills in

India 100 were in the Bombay Presidency, of which 67 were in Bombay city. Towards the close of the last century, out of 167 mills of all kinds, i.e., including purely spinning and purely weaving mills, there were in Bombay city alone 74 mills or 44·3% of the total. The extent to which Bombay Presidency was responsible for the development of the Indian cotton industry could be understood from the fact that in the period of 1901-04 nearly three-quarters of the yarn and over 82% of the woven goods made in the country were supplied by that province. Bombay city's share was 57% of the total yarn and 54% of the woven goods produced in the country and Ahmedabad was a poor second with a share of 8% of yarn and 19% of woven goods. The position was more or less the same right up to 1920-22, the Bombay Presidency maintaining the same percentage share in the total production in yarn and cloth, although within the province itself Bombay city was losing ground steadily to Ahmedabad. Thus in the period 1919-22 Bombay Presidency spun 70% of the yarn and wove 83% of the cloth in India, Bombay city's share being 50% in yarn and 53% in woven goods. To get some idea of the concentration of the industry in these two cities, the following figures will be instructive. In 1919-20 out of a total of 235 mills in British India, Bombay had 83 mills and Ahmedabad 66 and these were responsible for 63% of the number of mills in India, 62% of the yarn and 76% of the woven goods produced. While 63% of the mills were located in those two centres, the other mills were widely scattered all over India, although in Sholapur, Nagpur, Madras and Cawnpore there was some degree of concentration. But the scattered factories turned out only about 24% of the cloth and 38% of yarn made in the country. Contrast this with the position of Bombay which turned out 50% of the yarn and 53% of the cloth and you have some idea of its absolute predominance.

CAUSES THEREFOR

How is it that Bombay had ever been the most dominating textile centre of the country right up to quite recent times ? The main raw material of the industry is raw cotton and this is evenly distributed in the productive areas of the country. A glance at the cotton map of India will show that with the exception of Bengal, Bihar and Orissa, parts of the United Provinces and coast districts of Bombay including the regions near the city and island, cotton is available in varying quantities. The *Oomras* of Central India, Khandesh, C. P. & Berar, the *Dholleras* of Kathiawar and Ahmedabad, the *Bengal-Sind* of U.P. and Rajputana, the *Broach* of Bombay

Presidency, the *Westerns and Northerns* of the Circars, the *Salem, Cambodias* and *Tinnevellis* of the southern parts of the Madras Presidency and the *Punjab-American* of the Punjab are some of the trade names given to the varieties grown in the several tracts of the country. The distribution of cotton mills was not in accord with the distribution of the raw material of the industry. There are still vast cotton-growing tracts like the Punjab in the north and Circars in the south, with practically no cotton spinning and weaving factories; and this lack of correlation between the sources of the main raw material and places of manufacture requires some explanation, especially when it is borne in mind that the cost of the primary raw material, *i.e.*, cotton accounts for about one-half of the total cost. It may, however, be recalled that neither Lancashire, nor Japan, the two great world suppliers of cotton goods, grows any cotton. In the U.S.A. while the Southern States grow cotton, the manufacturing was carried on till recently almost entirely in the Northern States. So far as cotton industry is concerned, it would seem therefore that nearness to raw material does not constitute a necessary condition of the location of the manufacturing industry.

THEORY OF INDUSTRIAL LOCATION

The reason for this phenomenon may be explained by the general theory of industrial location. Every industry requires various kinds of raw materials including coal, if steam power is to be used or oil, if oil engines are used. In addition to the question of raw material and power, the problem of transporting the finished product to the region of consumption remains. The relative distance of a producing centre from the region of the raw material (including therein coal) and from the market combined with the weight of the raw materials to be moved to the producing region and of the finished product to the market will determine whether an industry should be located near the source of the material, or near the source of power or near the market. In general, it may be said, that if a raw material is more difficult to transport than the product made from it, production tends to be placed near the former. But not all raw materials exert the same kind of locating force. For this purpose the raw materials may be distinguished into "pure" and "weight-losing" materials on the one hand, and "localised" materials and "ubiquities" on the other. Pure materials are those that enter without any loss of weight into the product and therefore by themselves cannot bind production to their deposit, for whether they are converted into finished product in the region of their deposit or are carried over to the place of consumption and there converted into finished product makes no difference so far as actual transport is concerned. On the other hand, the presence of raw material of which a large proportion is waste, *i.e.*, a weight-losing material will attract manufacture to it because a saving in freight can be effected. Examples of this kind are the saw mill industry, the woodpulp industry, the cocoanut oil industry and these find their location near the place of material. "Raw materials, therefore, tend to attach industries to their place of production in inverse proportion to the amount of the raw material that enters into the finished product." Raw cotton after it is ginned becomes a "pure" material and enters fully into the weight of the product. There is therefore no compelling reason binding the textile industry to the region of the sources of raw cotton.

But the case is different when it comes to the use of large quantities of coal. Coal is a weight-losing material and an industry like the textile industry having to use considerable quantities of coal for power is drawn to the regions of coal and before coal-mining industry was developed to the regions of water-power which too could not be transported. Thus when an industry has to use materials of various kinds some of which are weight-losing, the latter will exert a great influence as a locating factor.

There are some materials which are localised in certain regions and others are to be found almost everywhere. The latter, termed ubiquities, have no locating force at all. They will be available wherever production is carried on and there is no need to transport them. But their influence is felt in an indirect manner. Their weight being included in the final product, the question as to whether an industry should be located near the regions of the localised material or the finished product, results ultimately in a comparison between the weight of the localised material and the weight of the final product in which ubiquities have been absorbed. It is true that in course of time there is a tendency for the ubiquities by being used up to become "localised" and this together with the fact that the increasing control of nature tends to increase the weight losses in production strengthens the locating force of the material component in contrast with that of the finished product.

It will now be clear that the relative pulls of the weight of the material and of the weight of the product will determine in each case as to whether the location should be near the raw material or near the market. The distance to be covered in each case and the relative costs of transportation of the materials and of the product are the other factors determining location. The distance is more than mere geographical distance and the systems of transportation, whether they are by land or by water and the freight rates by land and by water determine ultimately the location. Until a few years ago most of the Punjab wheat was sent to Bengal, there to be converted into flour and sent back to the Punjab; but now on account of the changes in freight rates, the wheat is milled into flour locally. In all this the relative freights on raw material and finished product come into play. If the rate on raw material is low, the remoter area will be favoured; if it is high, manufacture will take place near the source of the material.

TRANSPORTATION COST—THE DOMINANT FACTOR OF LOCATION

Fundamentally therefore it is transportation costs and the transport relations which a region enjoys in respect of the material and of the market that determine industrial location. One region may have good transport relations in respect of materials and another in respect of the market but the industry would be located in a centre where the combined transport costs of materials and product are at a minimum. The movement of the iron industry from Eastern to Western Pennsylvania since 1890 is to be explained by the fact that the latter has better transport relations to the market. Again the steel industry in the Chicago District is an example of localisation in a place which has the advantage of the lowest transportation costs, taking both the material and the product into account. Other places have better access to coal and ore, but Chicago gets the advantage of close proximity to a large consuming market.

The consuming market is itself governed by the distribution of productive factors, *i.e.*, labour and capital. Where large numbers of people work and live, consumption also increases and the market for various kinds of goods becomes extensive. The conditions for many kinds of industrial activities exist there better than elsewhere and many industries are thus drawn to such consuming markets. They thus affect and are affected by the localisation of industry. We may sum up the whole matter by saying that localisation of industry depends upon the transport relations of each place and product with regard to natural resources and consumers' markets and upon the transportability of the various goods required.

THE CASE OF THE COTTON INDUSTRY

We are now in a position to see why in the first place the cotton industry of the nineteenth century was located in India and in other countries far from the regions of the main raw material and far also from the place of consumption. Raw cotton as already pointed out is a pure material and enters fully into the finished product but the other important material, namely, coal (for power) was "weight-losing" and being more difficult of transport drew industry to it. Water power could not be had away from the regions of water-fall and hence the textile industry was drawn to the sources of its power and located near the region of coal or of water-power. It was possible to locate the industry far also from the consumers' markets because of the system of transport. Ocean transport is always cheaper than land transport, and the cost of transporting both cotton and cotton goods by water is so small that it causes very little addition to the total costs. It costs no more to take cotton from Galveston to Lancashire than to take it to the chief manufacturing areas of the U.S.A. Japan is able to take cotton from India at nearly the same cost as the Bombay mills because of the exceptionally low ocean freights. The cost of transporting cotton from Bombay, Madras or Tuticorin to Japan was only 4·56 yen per bale (400 lbs.) of which 1·40 yen was returned by the shipping company as rebate. (1 yen = 2s.). Again as the Tariff Board pointed out in 1927 the one-way railway freight on piece-goods from Bombay to Sholapur, a distance of 283 miles, was exactly the same as the combined freights on raw cotton from Bombay to Japan and of piece-goods from Japan to Bombay. The advantage of a highly trained labour force in Lancashire and of the extremely low labour costs in Japan, combined with their transport advantages, contributed to the location of the cotton industry in those countries.

BOMBAY'S TRANSPORT RELATIONS

For similar reasons, Bombay was found to be the only suitable location for the rising Indian mill industry. It was favoured by the cheap sea transport and could import raw material, machinery stores and other accessories more cheaply than any inland centre. Until the Indian coal industry had been developed, coal had to be imported in any case and Bombay could import foreign coal. Although its raw material had to be drawn from the interior, other centres nearer the raw material had other serious handicaps and Bombay had the advantage of being a good assembling and collecting centre of raw cotton. The advantages of reliability of supply, of wide choice of selection and of mixing various cottons are often so great that a factory will prosper better in a raw material assembling centre than in the region of production of any one variety of cotton.

The Indian cotton industry was for a long time a spinning industry and most of the yarn was exported to foreign markets and Bombay had therefore excellent transport relations, being an important port town. Like Calcutta, it is a place where two transport systems meet—the ship and the railway and the converging points of transportation offer relatively favourable transport relations to manufacturing industries for two reasons : (1) The existence of a net-work of transport lines and (2) a reduction in the number of times goods have to be reloaded. Thus to manufacture imported raw materials saves the expense of loading them on railways, which must be done if industry is located close to a railway station at some distance from the port. For these reasons, whenever there is a break in the transportation systems, the tendency has always been to evade the costs of it by locating production there. Examples of break localisation are numerous. The Scandinavian Pulp industry, the Chicago steel industry are instances in point. Calcutta might have developed a cotton industry of its own and indeed one of the early cotton mills was actually located there. It was however more distant from the raw material than Bombay and although nearer to coal, the coal mining industry had not then been developed. When however the mining industry had actually been established, Calcutta interested itself only in the jute industry and the enormous profits made therein led to a total neglect of the cotton textile industry.

ITS PRODUCTIVE EQUIPMENT

Another important reason why the cotton mill industry was concentrated first in Bombay and later in Ahmedabad was that it was only in those places that productive equipment as represented by labour, capital and organization was available in sufficient quantity and quality. All capital that was available for industrial development was to be found only in those centres and for a long time industrial capital was unavailable in any smaller centres. The managing agency firms who were mostly financial entrepreneurs established themselves in Bombay and Ahmedabad and all industrial development was due to their enterprise and management. Until recently Bombay like other port towns enjoyed also the advantage of cheap rail transport because the railway rates to and from the ports were cheaper than for inland towns.

AGGLOMERATING FORCES

To summarise the position then, the concentration of the cotton industry in Bombay may be explained by the superior transport relations which it enjoyed in regard to all the materials required for the industry and to the market and by the presence of its enterprising managing agents who had sufficient capital and industrial ability. Climate also undoubtedly added to its advantage. The humidity required for the purpose of spinning yarn was present in its climate although efficient humidifying plants are nowadays installed everywhere for the spinning of finer counts. These natural advantages were increased by certain " agglomerating " factors which usually accompany large-scale production and concentration. An agglomerating factor is any advantage or cheapening of production or of marketing which results from the fact that production is carried on to some considerable extent at one place. Thus the economies of concentration of industry in general such as the development of a trained labour supply, the saving in marketing costs and overheads are agglomerating forces which draw industry more and more to the place. Bombay had the full benefit of these agglomerating forces for quite a long time.

BREAK-UP OF THE COTTON INDUSTRY

Recent Tendencies. I now pass on to the second part of my paper and shall consider the changes in the distribution of the cottage industry in recent years and more particularly during the last 15 years. The most striking change is in the relative position of Bombay. From the year when the first cotton mill was started in India in 1851 to the year 1930, Bombay was singly the largest textile centre, judged by every conceivable standard ; whether the test was the number of mills, spindles or looms or the quantity of yarn spun or cloth turned out. In 1931 both Bombay and Ahmedabad had an equal number of cotton factories at work but in 1932 Bombay had to give away the pride of place to Ahmedabad, while in 1933 each centre had 73 mills at work, in 1935, Bombay had only 66, while Ahmedabad had 79. But although Ahmedabad has now become the largest textile centre judged by the number of mills, Bombay still has larger spindle and loom equipment and produces even to-day the largest quantity of yarn and largest quantity of cloth. This of course is due to the fact that the average spinning and weaving mill in Bombay is much larger than that in Ahmedabad. While the modal class mills in Bombay have an equipment of 30 to 45,000 spindles, the modal class mills in Ahmedabad have only 15 to 30,000 spindles. Similarly the modal class in Bombay were mills having 800 to 1,000 looms while in Ahmedabad the modal class were those having 400 to 600 looms. Thus despite a greater number of mills in Ahmedabad, its share in the total Indian production of yarn and cloth was only 18 per cent. and 25 per cent. respectively as against Bombay's share of 26 per cent in yarn and 30 per cent. in cloth. However, the trend is clear. Bombay is steadily, and after 1920 somewhat rapidly, losing ground and it is likely that its pre-eminence will soon disappear. In 1901, it had 42.6 per cent. of the mills in India in 1935 its share was under 20 per cent.

It is necessary to find out first of all which centres have gained the ground lost by Bombay and, secondly, to enquire as to whether the resulting change has only meant a concentration of industry in other centres. At first sight it might appear that what Bombay lost, Ahmedabad gained and, therefore, the concentration of the textile industry in one or two centres has not been broken up. It is true that Ahmedabad has more than gained the ground lost by Bombay. While in 1913-14, it had only 60 mills, in 1935, it had 79 and the rest of the Bombay Presidency did not also show any expansion. But a study of the distribution of the industry in recent years shows that the breaking-up of the excessive concentration of the industry is now in process and that the cotton industry is getting more widely scattered all over the country. The Indian States of the Bombay Presidency and Central India, Mysore and Hyderabad, Bengal and particularly Madras are witnessing a very important development of the textile industry and the share of these centres in the number of mills and in the quantity of production is steadily increasing. I give below the distribution of the 333 mills (excluding 3 at Pondicherry) at work in India and the share of each centre in the production of yarn and cloth.

PRESENT DISTRIBUTION OF THE INDUSTRY

	No. of mills.	Percentage share in production of Yarn.	Cloth.
Ahmedabad	79	16	27
Bombay	66	28	34·5
Madras	34	11	2
Indian States in Bombay Presidency	31	15*	15*
Rest of Bombay	27	7	6
United Provinces	21	10	6
Bengal	19	4	4
Central Indian States	15	—	—
Central Provinces and Berar	11	4	2
Mysore	6	—	—
Hyderabad	6	—	—
Delhi	6	2·5	2
Rajaputana	5	—	—
Punjab	4	·6	·5
Cochin	1	—	—
Travancore	1	—	—
Burma	1	—	—
	333		

Although Bombay's share in the production of yarn and cloth is still considerable, it had fallen from 50 per cent. in 1920 to 28 per cent. in 1935 in respect of yarn and from 54 per cent. to 35 per cent. in cloth during the same period.

CAUSES FOR THE MIGRATION OF THE INDUSTRY FROM BOMBAY

The causes for the migration of the cotton industry from Bombay are to be found in a number of factors. In the first place, Bombay is losing its advantage in respect of transport relations owing to the change in the character of its production. As long as the market was in other countries, Bombay had undoubtedly a superior advantage over inlaid centres which were nearer the source of the material. But since the loss of its export trade in yarn, it is engaged

* Includes other States also.

more and more in the production of cloth for home consumption and supplies an internal market where its transport relations are certainly inferior to regions nearer the market centres of the country. Secondly, it is now faced with certain deglomerating tendencies which have the effect of breaking down excessive concentration. The very agglomerating forces which formerly helped local concentration have by raising the prices of natural resources, cost of land, internal costs of transport and of labour brought about counteracting influences tending to destroy concentration. The high rents of land, high local taxation, high local rates for water and other municipal services are making it difficult to hold its ground against new rivals. Thirdly, high labour costs combined with labour unrest and strikes have rendered its position somewhat shaky compared to its rivals.

Compared to Bombay, Ahmedabad is in many ways in a more favourable position. Its nearness to raw material and to north Indian markets, its contented labour force and lower labour costs and its relatively low rates of local taxation have contributed to the rapid growth of the cotton industry. Further in the management of the industry, Ahmedabad has a decided advantage over Bombay. There is much closer attention given to the details of management in Ahmedabad, where each industrial unit is managed by a separate managing agency firm. However, there are reasons to think that Ahmedabad too is reaching saturation point. It has, judging from certain tendencies, reached the stage which Bombay had reached about 20 or 30 years ago. Further Ahmedabad, no more than Bombay, can resist the force of certain factors now at work to bring about a much greater dispersion of the cotton textile industry, the beginnings of which we are now witnessing to-day.

Reasons for the growing dispersion of the industry. There are several reasons why it is likely that the Indian cotton industry would be more widely distributed in the country in the future than it had been in the past. The distance to the consumer is an important factor in India with its vast size and scattered population. If a factory or a group of factories in one centre is to supply a vast area, the average distance to the consumer will be much larger than if factories are evenly distributed over that area. Again the greater the cost of transport, the more evenly each industry will have to be spread over the area and the smaller the area which can be served by any factory or group of factories. Both these considerations are very relevant to the question on hand. As railway rates are more and more adjusted in proportion to the cost of service rendered and as exceptional and unduly favourable rates charged to port to port traffic are replaced by more equitable rates, transportation costs tend to confer advantages on a large number of centres near the region of consumption. Actually this process is going on in India. Thanks to the work of the Railway Rates Advisory Committee, rates are adjusted according to costs of service based on distance and have the effect of bringing about a rapid decentralization of industry. There is a large local demand for different varieties of cloth which is governed by local tastes of consumption and which can only be met by a number of small factories in the neighbourhood of cotton ginning areas. Above all the most dominant factor tending towards decentralization of the industry is the supply of electric power. The development of hydro-electric power in South India is already revolutionising the location of the cotton industry. This factor combined with the attracting force of lower rents and cheaper labour in the smaller towns would further decentralize the cotton mill industry in India. Similar influences have been felt in other countries too. Thus the cotton industry in U.S.A. has been moving south in recent years, the stimulus being cheaper labour and rent as well as cheaper transportation.

PROSPECTS OF MADRAS

Of all the centres which are likely to reap the full benefit of decentralization, our Presidency stands foremost. The development of the Pykara electric scheme has already contributed to the establishment of a large number of new textile mills in Coimbatore, which to-day has as many as 32 mills all of which are using electric power. Salem, Erode, Trichinopoly and North Arcot are erecting new mills under the motive of cheap electric power. The price charged comes to about 6½ to 7 pies per unit and compares most favourably with the cost of power generated by steam or oil, which cannot be had for anything under 9 pies even for a well-managed plant. But the great advantage of electric power apart from its reduced power cost is that the factory can save on capital investment. Not being compelled to have its own power plant, it can either start with a modest capital or use the capital thus saved for installing more spindles or looms. There is also considerable saving in operation cost. Breakdowns are avoided and reliability of supply is guaranteed by the public utility company which in this case is the hydro-electric department of the Government of Madras. These are no small advantages for small factories which cannot afford to raise large capital or employ expert engineers to look after their steam or oil engines. As long as steam was the main motive power large units and location in large cities were required ; but development of electricity has the contrary effect and will bring about a more even distribution of industry. Coimbatore and other neighbouring regions also get the full benefit of cheaper labour and cheaper rents. A further cause of decentralization is the use of motor transport. There is now no longer any compelling reason why the cotton industry should be located at a railway town. Motor transport has now rendered the superiority as to transport relations of factories in the neighbourhood of railways largely a thing of the past in some western countries. If the goods must be transported from the railway station by motor trucks in any case, location near the railway is of little importance.

Of the 34 mills working in Madras in 1935, 19 were purely spinning mills and all of the 12 mills which were in course of erection in 1935 and the newly-registered ones are also spinning mills. Except in Madras and the United Provinces the number of spinning mills is generally falling off. But in these two provinces the existence of a considerable volume of handloom weaving keeps the spinning industry going. The limit of expansion is nearly reached in Coimbatore and its neighbourhood as most of the raw cotton available in the area would be just enough for the existing mills and the mills in the course of erection. Unless, therefore, the mills draw cotton from other areas or take to weaving, their demand for power will not increase rapidly in the future. But if it does, there will be sufficient supply available from the Mettur electric scheme.

Of the 5 million bales of cotton produced in India, Madras contributes nearly 1 million bales. The *Cambodias* are fully utilized by the mills of Coimbatore and Madura. Already Madura and Tinnevelly have important textile mills and the development of the Papanasam electric scheme is likely to cause a further expansion of the industry in the southernmost districts. It is in the Ceded Districts where the *Northerns* and *Westerns* are available and in Kistna and Guntur which grow *Uppam* bearing the trade name of *Cocanadas* that practically no mills exist. They must await the development of hydro-electric power. The Vizagapatam power scheme is not likely to benefit these regions, and it is only when the Bellary scheme is developed that some mills are likely to be established.

Of the other centres in India having large potentialities, Bengal and some of the Indian States are the most important. Between 1931 and 1935 the number of mills there increased from 13 to 19, while the number of mills in course of erection was as many as 21—a very rapid rise. Apart from the proximity of raw cotton, cheap labour, cheap rents, etc., the States enjoy a competitive advantage over British India on account of absence of labour legislation in some States and of laxer administration in all. Apart from Bengal's easier access to coal, the superiority of Bengal lies in her large consuming markets. The jute industry having reached the saturation point long ago, the capital and enterprise of her managing agents are now directed towards the expansion of the cotton industry. Bengal is also favourably situated for the import of machinery, stores and cotton for spinning and weaving superior varieties.

The Punjab is another province where the growth of an important cotton textile industry is only a matter of the next few years. The Punjab grows the largest quantity of cotton in India amounting in the year 1934-35 to 946,000 bales or 25 per cent. of the total Indian production. Yet there are only four textile mills in that province. Here again as soon as the projected hydro-electric schemes are completed, the expansion of the cotton industry might be looked for.

LOCALISATION IN QUALITY GOODS

Although in the next two or three decades the cotton industry in India would be more evenly distributed, there is bound to be still a considerable degree of localisation for special kinds of yarn and cloth. Bombay and Ahmedabad have definitely switched off to the production of finer counts. Bombay's advantage in fine yarn will remain for a long time. The raw material required for yarn of 40 counts and over is not available in India and has to be imported. India is of course the largest exporting country in the world of short staple cotton. Her long staple cotton of about ⅞ inch to 1 inch is suitable for the spinning of 24—40's and is available to the extent of about 700,000 —750,000 bales. But there do not seem to be any near prospects of her growing long staple cotton in sufficient quantity and quality to enable her to produce the 20 per cent. of the total consumption of cloth or about 1,000 million yards represented by finer types of goods. The Indian Central Cotton Committee is of the view that high quality cotton having a staple of 1⅛ to 1¼ inch and capable of spinning up to 60's, could be grown in certain areas in Sind as a result of the Sukkur Barrage scheme. In the meantime Indian spinners have to draw much of their supplies from other countries, chiefly East Africa, Egypt, Sudan and U.S.A. Out of 44 million lbs. of yarn over 40's produced in India in 1935, Bombay produced nearly 14 million lbs and Ahmedabad 16 millions. The extent to which Ahmedabad and Bombay are specialising in the production of yarn may also be noted from the fact that while 22.34 per cent of the yarn produced by Ahmedabad mills and 13.2 per cent. of the yarn produced by Bombay mills are over 30's, in the rest of India less than 6 per cent. of the total yarn was 30's and over. Bombay is concentrating more and more on dhoties. While its share in dhoties was only 26 per cent in 1926-27 as against 41 per cent of Ahmedabad's, its share increased to 33 per cent in 1935 as against a fall to 26 per cent. of Ahmedabad's. Indian States are specialising in long cloth and shirting and are responsible for 21 per cent. of the total production in that line. Bombay's greatest handicap is in coloured goods where on account of the insufficiency of fresh water and high water charges, it has been unable to march with Ahmedabad or other centres. In 1926-27 Bombay's share in coloured goods was 61 per cent. while that of Ahmedabad was only 19. In less than a decade Bombay's share fell to 30 per cent. (a fall of 50 per cent.) while that of Ahmedabad rose to 38 per cent. showing a rise of 100 per cent.

THE FUTURE OF BOMBAY AND AHMEDABAD

The future position of Bombay and Ahmedabad depends upon the extent to which they concentrate in certain special lines of production where their superior advantages will more than offset the disadvantages of distance to the markets. For it is a well-known law that the greater the economies of specialization and large-scale production, the more negligible will be the proportion of transport costs to the total costs of the product. In any case it is very unlikely that small and scattered factories in India would be able to satisfy more than local needs and varieties. There is still room for some degree of specialization and concentration and while natural advantages will continue to play an important part in the trade relations between various centres, the distribution of productive power and organisation and capital will exercise no less decisive influence. There are again incalculable forces which may completely alter localisation. To take only one instance, the demand for artificial silk and silk goods which compete so effectively with cotton goods may not merely bring about new centres of the silk industry but cause extensive changes in the distribution of the cotton industry. But the problems raised by such factors cannot be dealt with within the limits of this paper which, I am afraid, has already become too long.

A Geographical Study of the Vellar Basin

BY

MR. K. SRINIVASARAGHAVAN, M.A., L.T., DIP. GEO.,

The Vellar Basin lies roughly between 11° and 12° N. Lat. and 78° and 80° E. Long., and has an area of about 4,000 sq. miles. It is bounded by the Bay of Bengal on the East, the Shevaroys and Kollimalais on the west and the low-lying ridges separating it from the Coleroon on the south and the Pennar and the Gadilam on the north. It comprises roughly the Attur Taluk of the Salem District, the Perambaloor and Udayarpalayam Taluks of the Trichinopoly District and the Kallakurichi, Vriddhachalam and Chidambaram Taluks of the South Arcot District. It occupies an important position between the Pennar and Cauvery basins. It has ever been a land of plenty and has not suffered so severely during the many famines that have ravaged the surrounding areas. It has a well distributed system of irrigation and cultivation of crops of all types. It is only in this basin that we meet with excellent artesian wells in the whole of South India, or, even in India. The region has a unity about it, in its arts and crafts and the daily life of its inhabitants. The newly-introduced railway lines that traverse it from east to west and north to south have opened it to the surrounding regions.

Physically, this region can be divided into 3 great divisions :—

I. *The Hilly Regions* lying to the west.

II. *The Undulating Region* from the foot of the hills up to the low deltaic area.

III. *The Low Deltaic Area* supplied with plenty of water from the Vellar and Coleroon Anicuts. This is more the work of man than of nature.

I. THE CHIEF HILLY REGIONS

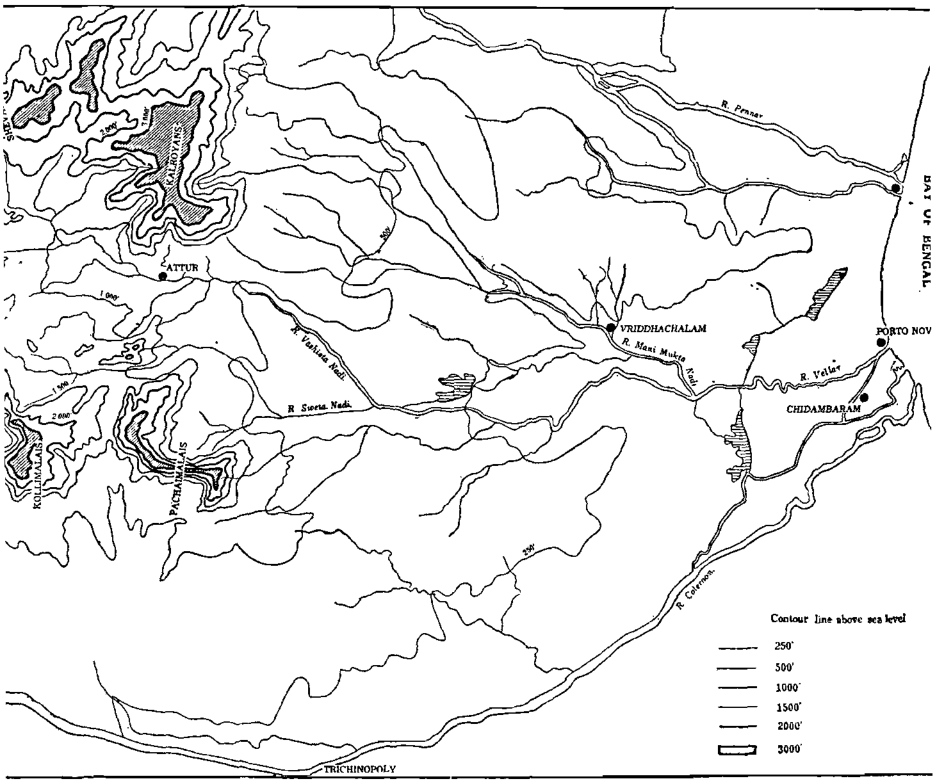
(1) The Shevaroyan Malai lying north of Salem.

(2) Tennande Malai which falls into three sub-divisions.

- (*a*) The Tirtha Malais of Uttankarai.
- (*b*) The Chitteri Plateau, a tangled mass of highland and ravine.

(c) The Aranattu Malai in Salem Taluk immediately east of the Manjavadi Pass. The Vasishtanadi takes rise in this last hill.

(3) The Kalroyans.—It is about 25 miles in length and presents to Vellar a continuous front of 23 miles from east to west. They are only of moderate height. The general level is being 2,000′ to 3,000′. But they rise abruptly from the surrounding country and from a distance they have the appearance of a great wall shutting off the country from the west. At either end are passes, the Attur Pass in the south and the Chengam Pass in the north leading from South Arcot to Salem District. These passes have been of great importance in ancient and modern days. They were the easiest



MAP 1. SHOWING THE PHYSICAL FEATURES OF THE VELLAR BASIN.

routes for Haider's troops; and their existence can be easily felt during the South-West monsoon when a strong cool breeze blows through them (vide S. W. Monsoon Rainfall Map).

To the south of the Vellar lie chiefly (4) the Pachaimalais and (5) the Kollimalais, and a few other scattered hills.

II. THE LOW COUNTRY

It occupies a region of large area. Though much less diversified in surface than the hilly country, it yet shows considerable variety of aspect, coinciding in great measure with the changes in geological structure. A great part of the low country is occupied by rocks of sedimentary origin resting on metamorphic rocks of which the entire mountain country is formed.

On the northern side close under the Kalroyans the level is 500′ to 700′ above the sea and it falls to 153′ at Memattur Anicut; but after that it slopes away gently to the sea. It is a great plain, almost everywhere covered by jungle. With the exception of 3 or 4 isolated hills lying close to the foot of the mountains, it is broken only by a few very low rocky hills.

In the southern portion of this region, the land is more undulating being cut into numerous ridges and furrows by the valleys of the Manimuthar and the other tributaries of the Vellar rising in the Kalroyans.

The country south of the Vellar, sloping from the Pachaimalais eastward, is very similar to the above in appearance, but a little less undulating in character. There is very little jungle except quite close to the hills.

East of this, the plain becomes more and more tame and the land sinks into an almost dead level, excepting where broken by the low scraps of the small plateau rocks belonging to the Cuddalore series which rest on the rocks of the cretaceous periods. The extensive portion of this plateau is in the Udayarpalayam Taluk. These scarps, though low, form rather marked objects on the northern and southern boundaries of the alluvial valleys of the Vellar. Where it is not cultivated the surface is covered by low scrubby and often thorny jungle. They terminate suddenly to the eastward, the alluvium resting against the foot of the low lines of cliff.

III. THE ALLUVIAL REGION

The region watered by the anicuts of the Vellar and the Coleroon has a surface sediment of alluvium. It is a flat country well watered, where paddy is grown extensively. Near the sea we find sand spits stretching along the coast.

There is little in the way of scenery in this region. Such beauty as this possesses is due less to the liberality of Nature than to the handiwork of man who has diversified the country with broad tanks and pleasant groves of trees. The irrigated areas of Chidambaram have at least the charm produced by a prosperous, if not a romantic landscape. The most uninviting parts of all this uninteresting side of this region are the alluvial plains in the dry season when the "sad-coloured" soil of the interminable level paddy flats, shorn of their crops and broken only by their low bunds and a few scattered babul trees, is revealed in all its monotonous nakedness.

But in the west the landscape is by no means so tame. All along the side of the mountain range, the hills provide an effective background to the scene, trees are more plentiful, and there is some scrub forest, and the country is more undulating and less wholly given up to the plough. The most beautiful part of this portion of the region is however the tract round about the scattered hills. Not only have these hills a strong fascination from the wildness of their outlines and setting, but the wonderful play of colour upon them and their surroundings is infinite in its variety.

THE HYDROLOGY OF THE REGION

The Hydrology of the region is very simple. The region is drained into the Bay of Bengal. The waters gathered from the Shevaroys, Kalroyans, Kollimalais and Pachaimalais are carried by its various tributaries into the Vellar.

The Vellar (White River) is formed by the junction, about four miles west of Toludur in the Vriddhachalam Taluk, of two rivers, the Vasishtanadi and the Swetanadi, which rise in the Salem District. The former of these drains the Tenandemalai and the western slopes of Kalroyans. The Swetanadi rises in the Kollimalais in the Salem District and drains the northern side of the Pachaimalais. The Vasishtanadi enters South Arcot District through the Attur Pass just south of the Kalroyans and becomes for some sixteen miles the boundary between that District and Trichinopoly. After the junction with the Swetanadi, the boundary still follows for another 25 miles the course of the united streams and then the Vellar strikes north-eastwards and flows through the Vriddhachalam and Chidambaram Taluks to join the Bay of Bengal immediately south of Porto Novo. Its banks are often high and steep. It is bridged at the Shatiatope Anicut and the South Indian Railway crosses it near Porto Novo. A new bridge, recently opened across this river between Chidambaram and Bhuvanagiri, facilitates through motor traffic to Chidambaram. The river is navigable for small boats of some four tons burden for four or five miles from its mouth, and is affected by the tide for seven or eight miles. About 4 miles east of Srimushnam, it is joined by a considerable tributary, the Manimuktanadi, which drains the eastern slopes of the Kalroyans. To the north of this region runs the Penniar and Gadilam. The Uppanar or Paravanar has its source in the Vriddhachalam Taluk, flows eastwards along the boundary between Chidambaram and Cuddalore Taluks and falls into the Bay of Bengal by the north of the Gadilam. It is largely a drainage channel for the lands irrigated by the Shatiatope Anicut across the Vellar.

The Coleroon lies to the south of this region. It flows into the sea about six miles south of Porto Novo and forms the southern boundary of the flat region in the Chidambaram Taluk. Its waters from the Lower Anicut across it flow into the Veeranam Tank ; and together with the Vellar it irrigates the wet lands of Chidambaram Taluk.

THE SOILS OF THE REGION

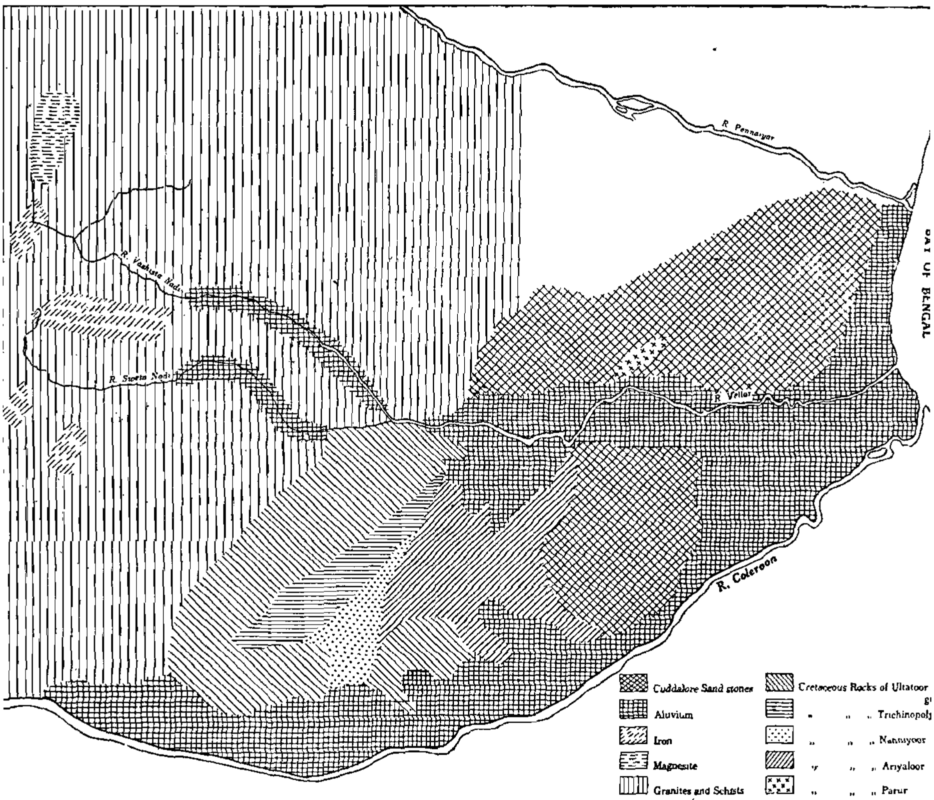
The soils of the region are classified into 3 main groups, namely, black or *regar*, red ferruginous and arenaceous. These are again subdivided into clays, loams and sands. The most fertile of them are the black earths, especially black loam, the next best the red kinds and the worst the sands. These last occupy a very small portion of the total area, while nearly one-half is covered by black and the other half by red. The former is very fertile, even when unirrigated. But the red soils here are not as barren as those of some other parts, e.g., Deccan. The black earth is commonest in Chidambaram, Vriddhachalam, Udayarpalayam and Perambaloor Taluks, and the great spreads of it in the valley of the Vellar are believed to have been formed in a huge inland lake caused by the backing up of the river by the line of high ground of which Mount Capper is the most prominent survival. The sandy soils are only found to any considerable extent in the low strip of country which faces the sea in the Chidambaram Taluk. They are largely used for the cultivation of casuarina and cashew trees.

GEOLOGY OF THE REGION

For a geological study of this region, it can be subdivided into the mountainous area and the low country. In general, the geological structure of the mountain region is very simple :

(*a*) By far the larger part is made up of rocks belonging to the great metamorphic or gneissic series of Southern India, which belong to the Archaean Group.

(*b*) Intrusive in these are (1) the older charnockite series, (2) the younger igneous intrusions of which the basic trap dykes and the Magnesium Series of the Chalk Hills are the most conspicuous features. The remaining part is occupied by the sub-aerial deposits and alluvia of the different rivers. The two forms of sub-aerial rocks are (*i*) Kankar and (*ii*) pseudo-laterite. They are not extensive. The former is formed by the decomposition of lime-hold-



MAP 2. SHOWING THE GEOLOGICAL STRUCTURE OF THE VELLAR BASIN.

ing rocks by rain water, and the latter is a ferruginous clay incrustation formed on the surface of ferruginous rocks weathering in a damp atmosphere.

Let us now consider **the important mineral resources** of this area for commercial purposes:

1. Magnesite: The Chalk Hills between Salem and Shevaroys are just outside the region; but there is a magnesite belt near the upper course of the Vasishtanadi.

2. The iron ores of Salem District are well nigh inexhaustible. Most of these beds lie at the headwaters of the Vellar river.

Magnetic iron ore occurs in many localities on the Kalroyans. Till about 1855 local iron-smelting was carried on; and in Kallakurichi Taluk alone there were 70 such places. There were many local blooms in the Attur and Salem Taluks of the Salem District.

3. Chromite is found in the Chalk Hills and Kanjamalai and was worked by the Porto Novo Company till 1860.

4. Steatite, an impure hard talc occurs in the Attur Taluk. It is used for the manufacture of culinary vessels.

The Geology of the lowland extending from the foot of the hills to the Bay of Bengal:

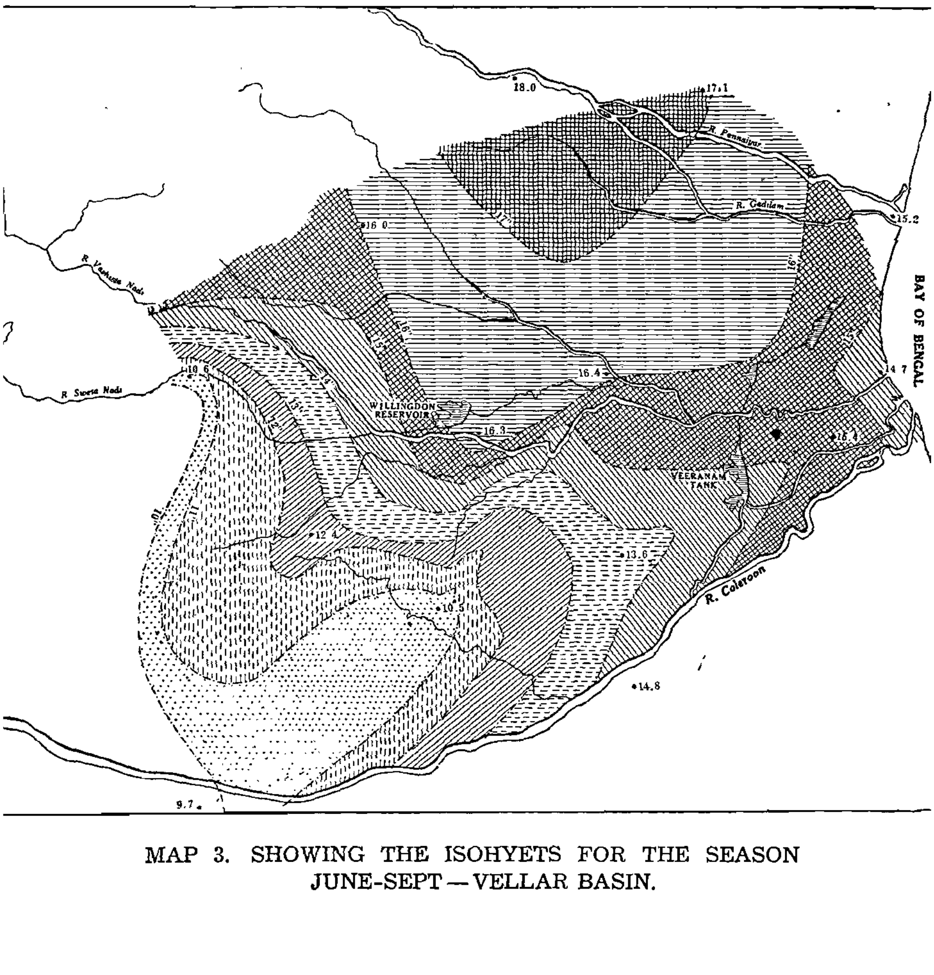
The general geological formation is simple. The greater part of it is covered by archaean rocks of the gneiss family, resting on which are three groups of sedimentary rocks belonging to different geological periods and overlying each other in regular succession from the coast on the east to the hills on the west. The lowest of these great groups is the fossil-bearing cretaceous limestone. Above this comes the younger group of sandstones which are known as "The Cuddalore sandstones" and form the Red Hills near Pondicherry and the Mount Capper Range south-west of Cuddalore. The uppermost are the alluvial deposits. They are formed by the deltas of the Vellar and the Coleroon. The former stretches from near Cuddalore to the mouth of the Coleroon and runs inland as far as Tittagudi, a distance of 40 miles. Near Lalpet, at the southern end of the great Veeranam Tank, the alluvium of this river unites with that of the Cauvery delta.

But none of the rivers are now forming deltas. The silt carried down by them is swept away by the strong current along the coast. Sand is blown up by the wind into considerable dunes and form prominent features in the landscape. They are utilised for the cultivation of casuarina and cashew trees. This region cannot be said to be remarkable for its minerals. The building stones only are of commercial importance. The temples show to what use gneiss can be used for building purposes, especially as it lends itself easily to excellent carving. A visit to Vriddhachalam, Srimushnam and Chidambaram will prove this.

The laterites of the Capper Hills are quarried and sent to distant places as road material. The hard rocks are used locally for building purposes.

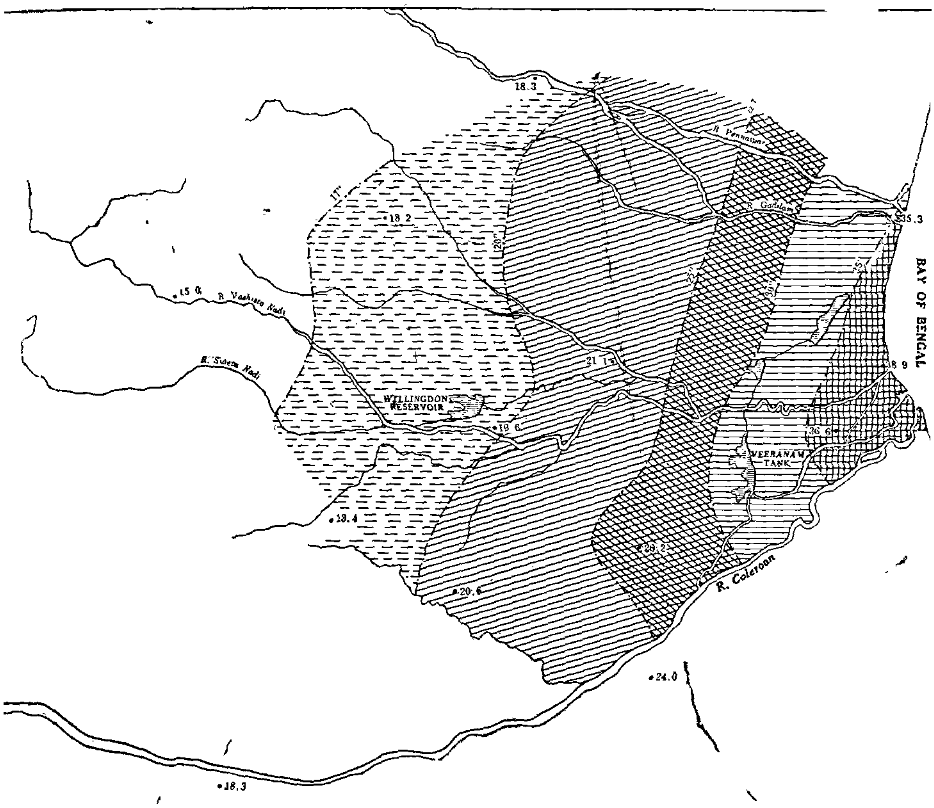
RAINFALL AND TEMPERATURE

The climatic conditions of this region can be easily understood from a general look at its situation in the Madras Presidency. It can be fairly well said that it is bound by the six important meteorological stations—Madras, Cuddalore and Negapatam on the coast, and Vellore, Salem and Trichinopoly in the interior. The region lies practically between Salem on the west and Cuddalore on the east.



MAP 3. SHOWING THE ISOHYETS FOR THE SEASON JUNE-SEPT — VELLAR BASIN.

The temperature is fairly high throughout the year and is more even near the coast and even in the interior it does not fluctuate very much. April, May and June are usually the hottest months, and with the setting in of the South-West Monsoon early in June the temperature drops gradually. Little rainfalls during this season, but the Attur Gap enjoys plenty of wind and rain ; and the Perambaloor Taluk suffers because of the mountains lying to its west. The whole area is very dry during summer ; and with the monsoon freshes the alluvial flats are cultivated and appear green, being supplied with plenty of water.

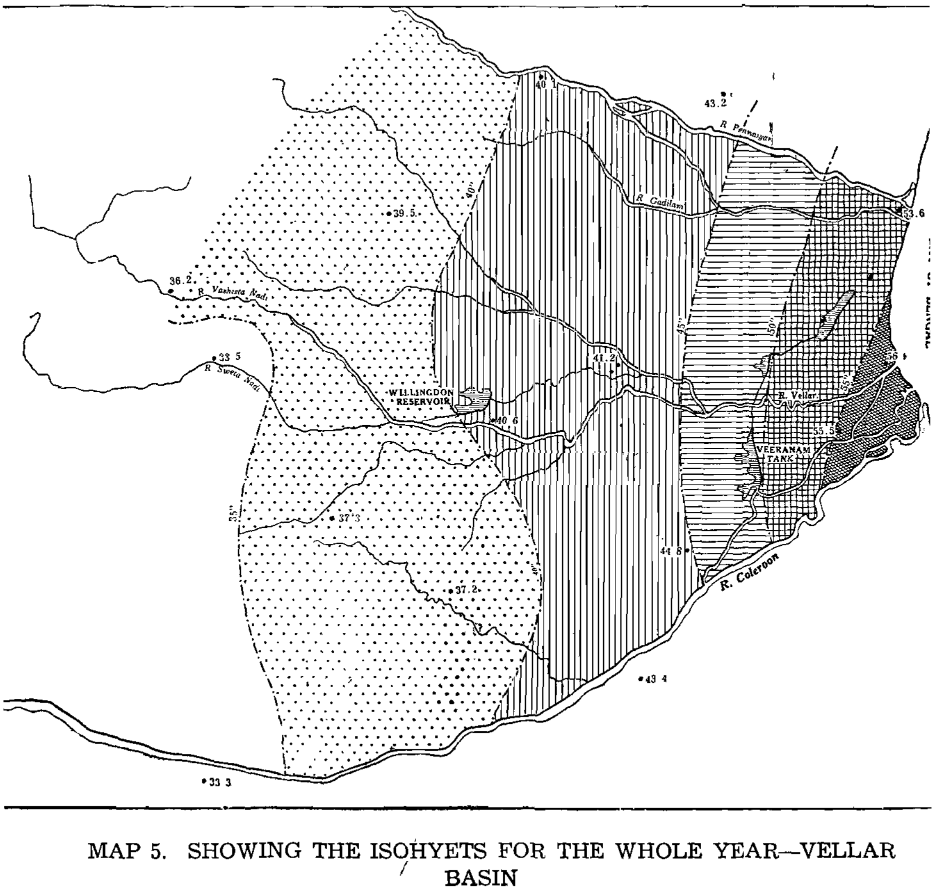


MAP. 4. SHOWING THE ISOHYETS FOR THE SEASON OCT-JAN — VELLAR BASIN

Then, during September, the North-Eastern Winds are expected. These bring the major portion of the rain. They continue till January, though the greatest amount falls in October and November.

The wind travels all round the compass in more or less regular stages during the course of the year. The interior regions are often visited by hailstorms during the hot weather. Near the coast the heat in that season is never so severe as in other places, but the coolness in the cold season is always very slight. This region is more eqable than Nellore and Cuddappah. The effect of the sea breeze does not penetrate far into the interior to alleviate the heat of the sun. But the Attur Pass enjoys the South-Westerly Wind, and much milder temperatures are felt there than further east. The country next to the sea is moist and damp; but on the whole the district is healthy. In fact, Cuddalore was formerly a health resort.

Climatically, the region can be subdivided into (1) the Attur Pass region, (2) the coastal region as far as Vriddhachalam which



MAP 5. SHOWING THE ISOHYETS FOR THE WHOLE YEAR—VELLAR BASIN

receives the effect of the sea breeze in summer and the North-Eastern Monsoon in winter, and (3) the land lying between the two abovesaid regions comprising mainly the Kallakurichi, and Vriddhachalam Taluks of South Arcot District and the Perambaloor and Udayarpalayam Taluks of Trichinopoly District.

FLORA AND FAUNA

For this study also the region can be subdivided into (1) the mountainous region, (2) the sea coast and (3) the low country lying between these two.

The hills in the region have a variety of trees and shrubs. In the Shevaroys, Pachaimalais, Kollimalais and Kalroyans, one can see the variety of vegetation extending up to 4,500′ above sea level and flourishing on plenty of rainfall and sunshine. Coffee has been a new introduction in the Shevaroys. Kadukka (Gallnut), Bamboo, Sandal, Teak and a number of other kinds of trees grow there.

In the third region, i.e., the low country, cocoanut, tamarind and palmyra can be seen according to the amount of water available. Graft mangoes are grown in certain places. Jack, guava and orange are grown near the hills and on the hills. Illuppai (Bassia Longifolia) and Karuvel (Gum Arabic) are quite common. Scrub jungles contain deciduous and evergreen trees.

Near the sea-shore thorny grasses grow on the sands. They are useful sandbinders and common along the coast. There are also casuarina and cashew plantations. The salt marshes have their usual flora—the Mangrove; and there are ever so many varieties of them.

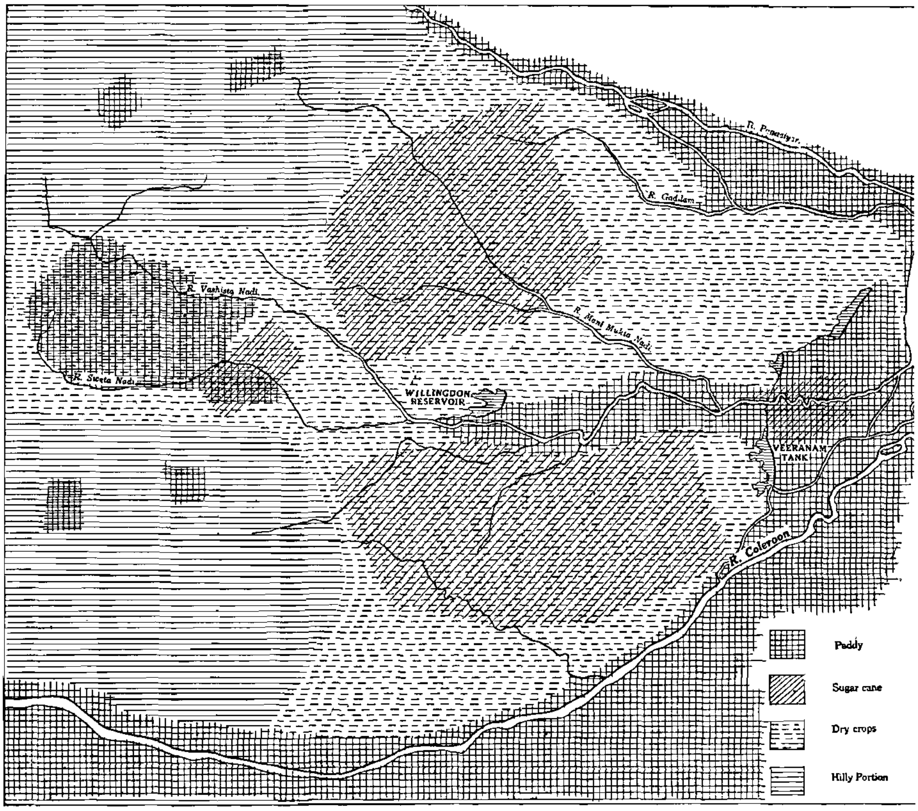
Among the animals sheep and goats are prominent. Cows, oxen and buffaloes are kept in the wetter areas and are small in number. Most of the oxen needed for agriculture are brought in from surrounding areas.

Among the game animals, elephants in the Kalroyans, and cheetas, tigers, foxes, etc., in the hilly country must be mentioned. Deer are in plenty in the scrub jungles in the low country. The tanks supply plenty of snipe and fish.

AGRICULTURE AND IRRIGATION

The agricultural year can be divided into 3 seasons: (*i*) *the dry season*—January to April, (*ii*) *the early rains* inclusive of the Mango Showers and South-West Monsoon, from April to September; and (*iii*) *the later rains* of the North-East Monsoon from September to December. The break between the monsoons is variable in duration and in its time of occurrence. Each monsoon has its cultural occupations and operations.

The lands are divided into irrigated and unirrigated groups termed the wet and the dry lands. In Chidambaram Taluk almost the whole area is irrigated ; while in the other parts of the region, dry and wet are distributed according to the facility of water supply.



MAP 6. SHOWING THE AGRICULTURAL REGIONS OF THE VELLAR BASIN

The crops depend on the character of the land. The distinction between *dry and wet crops* is not inflexible. "Dry Paddy" is cultivated on a small scale all over the region where suitable rainfall conditions prevail ; and in some places even plantains are cultivated without irrigation. On the other hand, ragi, cumbu, cholam, gingelly and castor are cultivated both as dry and wet crops by irrigation from wells, tanks and channels. Tobacco may be rain-fed or irrigated. Rain-fed paddy, plantains and tobacco are usually considered superior in quality.

An interesting feature is *the mixing of crops* on dry lands. Two systems of mixed cultivation are in vogue; one is to sow broadcast, and the other is to plant in parallel rows with the help of a plough termed the "guntaka." By sowing together two crops of short and long duration, space and labour are saved, and the vagaries of the monsoon are alleviated and the soil is not exhausted. The short crop matures in 3 or 4 months; and after it is being reaped, the long crop has time to mature.

The *broadcast system* is seen to perfection on the Kollimalais, where on the richest fields, in a good season, six or seven kinds of grain can be seen growing together in one rank tangle, aptly described as the "Riot of contending crops." Elsewhere it is not so prominent.

Under the *furrow system*, seeds are drilled in regular rows. Grams and cereals are mixed together with gingelly and castor. Ground-nut was very important in this region as a cash crop till recently, but of late it has lost its importance, due to trade depression and other international causes. Varagu is grown extensively in Perambaloor and Udayarpalyam Taluks.

In Attur Taluk the wet lands under Swetanadi bear five crops in two years and the rotation is judiciously selected. In the first season paddy, irrigated gingelly and kambu are raised, beginning in Adi and ending in Adi in the next year. The second year's crop series ends by Avani; and the 3rd year paddy is sown in Krittigai and harvested in Chittarai and the gingelly and kambu follow up to Adi. Thus goes on the endless routine of cultivation.

There are a number of *varieties of paddy* grown in this region. Each is suitable to the local climatic conditions and the facilities for irrigation. In Chidambaram Taluk especially under the anicut irrigation a number of varieties are grown. In general, they can be classified as *Kar and Samba.* The samba is the choicer of the two and is usually white or golden in colour, while the kar is red usually. Samba stands longer on the ground, and requires careful cultivation and plenty of water. In Chidambaram the excellence of soil and irrigation enables paddy to be raised everywhere. It is cultivated all along the Vellar under river irrigation, and in many places under tank irrigation in Perambaloor, Udayarpalayam and Kallakurichi Taluks. The Artesian Wells of Vriddhachalam Taluk and Chidambaram Taluk have facilitated more acres to be brought under paddy. Toludur project (Yamaneri), known as Willingdon Reservoir has brought an extensive area under irrigated paddy cultivation in Vriddhachalam Taluk.

The lands near the hill regions have to be protected from wild pigs, birds, etc., and great precaution is taken against these.

Hill cultivation is different from that of the plains in so far as wet cultivation is concerned. The Malayalis of the Shevaroys are demoralised and slovenly due to the coffee plantations paying them fairly high wages; but in the Kollimalais and other places, cultivation is scrupulously clean; and on the best lands finer crops are grown than can be seen anywhere in the plains. The fields are carefully terraced and the cost of terracing is expressed in terms of grain. A sharp distinction is made between Ulavukadu (land that can be ploughed) and Kottukadu (that can only be hoed). On the Kollimalais nearly 500 acres are classed as wet. Some of this is situated in high level and depends for moisture on the water oozing from the hill-sides; some are situated in hollows where drainage is difficult. The high level paddy fields are firm and are ploughed; while those in pits are marshy and full of quagmire. The single crops of the bog-paddy flats yields as much as the double crop of the high level fields.

A small quantity of *wheat* is grown in the hills as a dry crop, and in the foot plains of Attur Taluk under well irrigation. *Sugarcane* is not so important in the Attur Taluk and the upper Vellar basin. But, it is more important in the middle and lower Vellar regions. It flourishes in black clays and black loams, but exhausts the soil. It is principally grown in Kallakurichi Taluk under small anicuts of the Gomukhanadi, round about Srimushnam under the Pelandurai Anicut, near Tittagudi under the Willingdon Reservoir, and in Vriddhachalam watered by the Manimuktanadi.

Two main varieties are grown (1) the white red cane, (2) the striped cane termed the namadhari. Of late, the new strains specialised by Nellikuppam Factory are being introduced in these places. In the Attur Taluk and Kallakurichi Taluk jaggery is made by special methods in bamboo baskets, unlike the balls of other places. Modern iron mills for crushing the canes are used everywhere. In Chidambaram the rotation is two years paddy and one year sugarcane.

Betel Vine is cultivated extensively on clayey soils, where paddy or sugarcane can be grown. The presence of lime in the soil is favourable to its growth. It is usually grown by local Musalmans known as Labbais.

Tapioca.—The only place on the east coast where tapioca is grown to any extent is on the alluvial damp banks of the Vellar and Coleroon. It is called Maravalli Kilangu, and the plant grows 4 or 5 feet, somewhat like a tree. It is cultivated as a garden crop with heavy manuring. It is propagated from cuttings six inches long, made from the woody stem and planted by hand from January to April. It takes 10 to 11 months to mature and then it is dug up. The tubers do not keep well, and so are dug up as needed and boiled or roasted or used with vegetables. Sometimes they are sliced, dried and pounded into flour from which cakes are made, mixed with jaggery.

There are a number of varieties of *plantains* grown in this region. Certain types are specialised in Attur Taluk, and certain others in the Perambalpor, Udayarpalayam, Kallakurichi and Vriddhachalam Taluks. Chidambaram has its own peculiar variety. This depends on the purpose for which it is grown and the quality of the land and water facilities. There are some varieties which bear 400 fruits in a single bunch. Where there is heavy rain on the hill-slopes, trenches are made crosswise, and plantains are grown as dry crops, e.g., on the Kollimalais. That region is noted for its choicer varieties, especially the Karuvalai or the black plantain and the pattuvalai, a big variety.

Of the dry crops, *castor, groundnut* and *cotton* must be mentioned. The two former are gradually dying out, due to want of a good foreign market.

Of the *cotton* grown in this area special mention must be made. The chord lines from Villupuram to Trichy, and Cuddalore to Salem serve this crop very well. Uppam and Nadam are the two kinds of cotton grown here. Nadam is more common, and is grown in red loamy soils. It is sown with Kambu usually. Nadam plant bears for 3 years, and usually twice a year. The Uppam or Semparutti favours black cotton soil. It is a single year crop. It was a very important crop in the economy of the land. Formerly they were ginned and spun in the villages themselves. Now there are a number of ginning mills established all over the area, at Attur, Labbai Kudikadu, Tittagudi, Vriddhachalam, Ariyaloor, etc., wherefrom it is exported. The old weavers still carry on their trade not with hand-spun yarn, but with mill yarn; and each taluk is noted for its particular kind of Dhoti or Sari. The Kallakurichi, the Ariyaloor, the Vriddhachalam, and the Attur are special qualities produced in the region.

Indigo was once a very important agricultural product of this area. Even now one can see old discarded dye vats of this region in villages. The introduction of Aniline dyes has practically killed this trade; and indigo is not at all cultivated now.

The implements of husbandry are the ordinary wooden plough, spade, hoe, sickle, the parambu or leveller; the ordinary picottah and buckets are used as water lifts. They are worked by sets of 2 or 3 men and there are some worked by pairs of bullocks, termed the kapilai. There are two varieties of ploughs, one with a blunt spade for use in paddy fields and the other with a sharp pointed spade for use in dry land. The use of iron ploughs has received more encouragement during recent years; and there are a number of them in use now. There is a Government agricultural farm at Palur in the Cuddalore Taluk and one at Aduthurai in the Tanjore District. These are making good effort to introduce new varieties of paddy into Chidambaram Taluk. The Coimbatore and Nellikuppam varieties of sugarcane are also gradually introduced.

Artesian wells are springing up in great numbers in Vriddhachalam and Chidambaram Taluks, and many new borings are being tried. Irrigation by oil engines is also spreading in Attur and Kallakurichi Taluks.

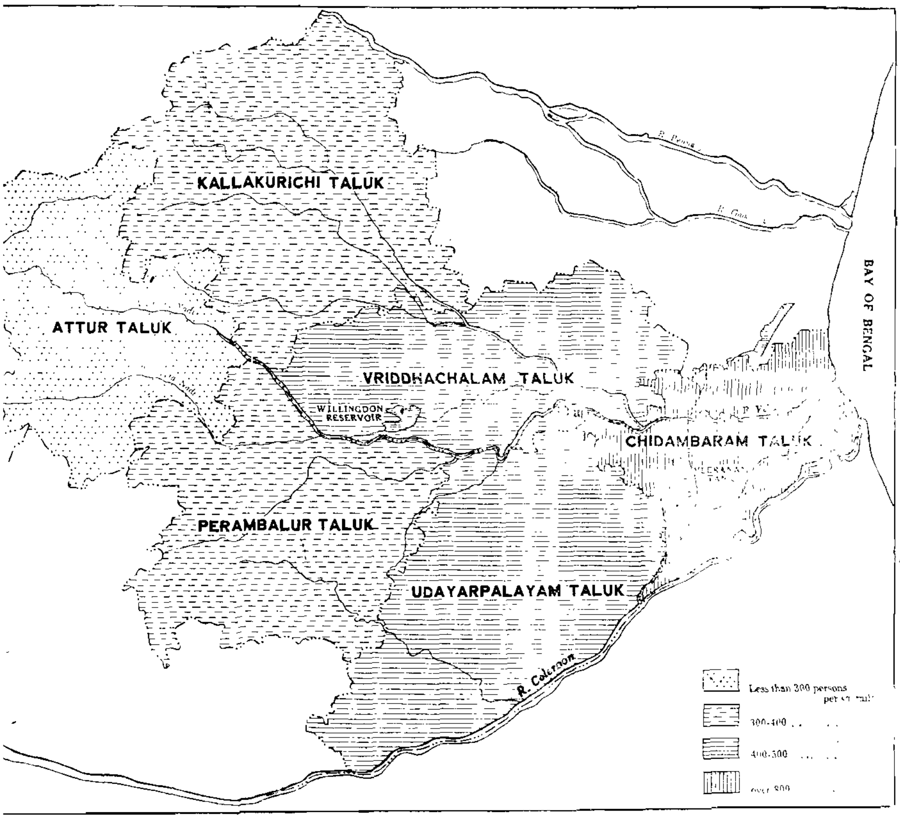
The methods of manuring vary with the locality, the status of the ryot and the nature of the crop. In general, it can be said that the Indian farmer does not pay much attention to manuring, due to so many causes, both economic and otherwise. Silt, sheep droppings, farmyard manure, house refuse, mineral manure and green manure from shrubs and trees are the common ones used everywhere in this region. Much of the cattle excreta is used as a fuel, but those of sheep and goats are specially kept on the land, and are exposed to wind and sun and rain, and lose much of their value.

The ryots in this region especially in the drier parts are very hardworking, and are beginning to take advantage of the modern methods of agriculture. But the economic depression has severely told on their efforts; and already many are not able even to pay the Government kist and prefer to sell their lands at whatever price it may fetch, to cultivating it at a great risk. The advantage of growing trees for fuel and fruit has not yet been realised. This area can grow very well excellent fruit trees of very many kinds, but so far the ryot has not begun to appreciate the economic value of that kind of cultivation.

Monsoon rains are precarious and partial failure of crops is by no means rare ; and there have been a number of famines. But this region under study has not been very much affected as other parts of the Presidency where dry cultivation prevails. Attur Taluk has been the one taluk of the Salem District that has withstood all famines. The Chidambaram Taluk has never felt a famine, though its trouble has been one of economic struggle for the sale of its paddy. The dry areas have now and then suffered due to late rains or failure of monsoon.

PEOPLE

Chidambaram Taluk is the densest area with 807 per sq. mile, while Attur is the least dense with 295 per sq. mile. Perambaloor



MAP 7. SHOWING THE DENSITY OF POPULATION IN THE VELLAR BASIN

Taluk has seen a fall in population during the last decade. It is due to the industrialisation of Trichinopoly which has pulled out a number of people from this infertile area, as also to the fact that the agricultural people are going out of India as indentured labourers. Chidambaram is the only area that is almost saturated, and is not able to increase its population further.

There is an important fact about the *distribution of languages* in South India. The Telugu population is distributed in the Tamil Districts of the Madras Presidency along the region bordering the plains and the mountainous region. They seem to have spread along this line from North to the South. East of this line the Tamils predominate and the Telugu population is practically negligible. In the western parts of Attur Taluk, Perambaloor and Kallakurichi Taluks there are more Telugus than in the eastern taluks.

The religion of the people is mainly Hinduism. There are a few Labbais or local Musalmans scattered in groups, and their important centre is Porto Novo. The Christian population is very small in this region. The Brahmin population is far less than in the adjacent regions of the Cauvery and Pennaiar. They are concentrated mainly in the Chidambaram Taluk. The Adi-dravida or Harijan population of this region is, as elsewhere, very poor and uneducated. There are a few religious centres in this region, the important of which are Chidambaram, Srimushnam, Vriddhachalam, Chinna Tirupathi; and a number of smaller ones are scattered throughout the area. The religion of the people is partly Vaishnavism and partly Saivaism. The bulk of the population are agriculturists. There are a few traders and local workmen. The weavers are gradually decreasing in numbers in spite of the Khaddar movement. The number of money-lenders seems, however, to be increasing, showing the indebtedness of the people.

The status of the peasant proprietors is still worse. The price of agricultural products has fallen, and they are neither able to pay the government kist nor to cultivate the land. Meanwhile they have to pay at least the interest on the loans, as everyone of them has practically borrowed on mortgage of his land.

The cattle problem is still worse, as the poor farmer is unable to maintain good bullocks, whose quality is very low. There are periodical cattle fairs in a number of places, where the peasants buy their bullocks. The cow is not usually cared for by the poor peasant except in the vicinity of towns, where he can at least supply milk to the innumerable coffee hotels.

In the central regions and the mountainous parts, a good number of *sheep and goats* are grazed. Much of the wool is exported, though there are local spinning wheels and hand-looms in Kallakurichi and Attur Taluks. In many of the fairs, one can see the crude black " cumblies " sold at a cheap price. This serves the purpose of the poor cottages on the hills or on the plains in cold weather.

Silk weaving is also carried on in certain places ; and a special kind of cloth termed " Kailis " worn by the Musalmans is woven for local consumption as well as for export to Rangoon, Singapore and other places.

The only other local industry is *oil crushing* in crude wooden oil mills. Even this is being threatened. The *hand pounding of rice* has vanished. There are a number of *mills*, small and big, distributed everywhere throughout the region. Each small place of note has a mill to serve the local area. The big mills in the Chidambaram area cater to exporting merchants.

Mats of date leaves were originally made in a number of villages ; but the industry has now practically died out. Reference has already been made to the killing of the indigo industry after the introduction of German dyes. But, the manufacture of *jaggery* has not decreased, though it is still carried on by crude old methods.

Rough grass mats and woollen carpets are woven in Perambaloor Taluk (Rajangudi). There is a ginning mill at Perambaloor.

Glass bangles were originally manufactured in great quantities in Perambaloor and Kallakurichi Taluks where the special materials were easily obtained. The industry has almost died out, though it is being kept alive by a few families here and there.

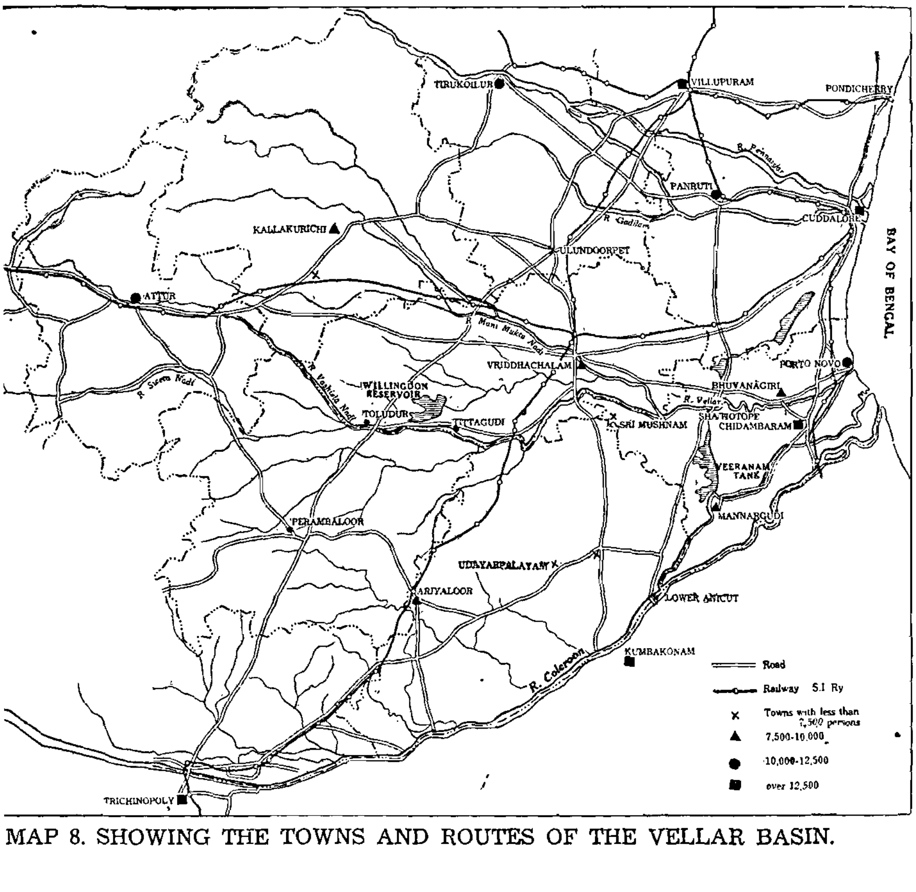
Steatite is cut into culinary vessels in the hilly regions of the Attur Taluk. It is being taken to far-off places in Tanjore District and even as far as Madras.

Trade in hides is carried on in important fairs, though there are no important tanneries anywhere.

The health of the people is tolerably good, compared to their poverty, apparently due to the excess of sunshine and fresh air they are forced to take in. But fever in some form or other is endemic. Cholera breaks out in seasons, and carries its toll regularly every year. Better conditions of sanitation and good drinking water facilities will surely control the disease. Plague is unknown in this region. But small-pox rages during summer, and it has its victims every season. In spite of compulsory vaccination, the death role due to this disease has not diminished, thus proving the uselessness of this process of safe-guarding the health of the people. Guinea-worm is prevalent in the Kadarambam parts i.e., the dry forested interior. Malarial fevers prevail in the hilly tracts of the Kalroyans, Pachaimalais and Kollimalais, and of Kallakurichi and Vriddhachalam Taluks. With the introduction of better sanitary conditions, the Kollimalais can be converted into a sanitarium like the Shevaroys. The fevers of the hill tracts are not so dangerous to the local hill-men, as they are to the men from the plains.

COMMUNICATIONS

Two important roads run across the region, one north to south from Villupuram to Trichy and the other east to west from Cuddalore to Salem. They have local connections to all the various places, and are the two main arteries of the region, for exchange of produce and movement of men and things. They also connect the southern



MAP 8. SHOWING THE TOWNS AND ROUTES OF THE VELLAR BASIN.

regions with the northern regions, and the coastal areas with the Mysore Plateau and Upper Cauvery areas.

There is one other important road running along the coast from Pondicherry to Cuddalore and thence to Chidambaram: but the bridge over the Coleroon was destroyed by the floods in 1903 and ever since this road has lost its importance. Even Chidambaram was not directly connected to Cuddalore till a few months back when the bridge over the Vellar near Bhuvanagiri connected it to the northern parts of the region. There is the alternative road from Cuddalore via the Shatiatope Anicut to the Lower Anicut over the Coleroon and thence to Aduthurai and Kumbakonam. This has been used very much. The proposal for a bridge across the Coleroon between Chidambaram and Shiyali has been discussed so often. It has been felt to be a definite need, but it is a question of " who is to spend and how much is to be spent."

The old South Indian Railway main-line follows this road from Cuddalore to Mayavaram. The two Railway Chord lines across the region opened recently follow the two trunk roads from north to south and east to west. Vriddhachalam has thus become an important junction.

After the introduction of bus service, this area has profited very much from this means of transport. A number of routes are now having regular service. The roads are all well maintained. There is cheap road material available everywhere in the whole region. The roads cannot be classified as class I, but they serve the bus service fairly well.

CONCLUSION

A study of the Human Geography of this region is a vast subject by itself. There are very many different tribes and communities in this area. Each group has its own social and religious customs. I do not propose to deal with this aspect of the subject at present.

Again, a study of the political history of the region is a fairly big subject. The history of the rulers of this region from ancient times to modern days, the part this region has played as the policeman's arena in the early days and the important invasions of the coastal regions, the Carnatic Plains through the Attur Gap and the final cataclysm of the wars between the British and the French in this area, and how it settled once for all the fate of the French in India, are all to be studied in detail, but will unnecessarily lengthen this paper.

Finally, the importance of this region can be gathered from its varied agricultural activities, from its mineral resource, from its focal position between the two important regions on the north and the south and the two important regions on the west and the east. This has been an important region in South India that has resisted the vagaries of the Monsoon and has withstood the ravages of recurring famines.

A Geographical Study of Manganese with Special Reference to India

By

Mr. P. G. Dowie, M.A., L.T. (Dip. Geo.)

INTRODUCTION

As manganese ores form one of the four important mineral products of India the values of which exceed one million pounds sterling in normal years, and as manganese is an indispensable metal for certain key industries, it has been felt that a concise account of it viewed from the point of Economic Geography may be useful not only to Geographers but also to others.

OCCURRENCE OF MANGANESE IN INDIA

Occurrence and Relief.—Manganese occurs in nature only in the form of compounds as oxides, manganates, carbonates or silicates. As in the case with many heavy metals, manganese minerals also occur in highly folded and denuded regions; for, in the original cooling of the earth's crust from the molten state these heavier minerals seem to have sunk as the result of their greater specific gravity. During the folding of the earth's crust by orogenic or mountain-making movements and later denudation, these inner layers rich in various useful minerals have been brought nearer the surface and partly exposed together with igneous intrusions. Besides, various economic minerals are deposited by ascending heated waters and vapours which carry them in solution and as during the folding of the outer crust many cracks and crevices are formed, these facilitate the ascending and deposition of these metals. It has, further, been found that plenty of igneous intrusions accompany periods of severe folding; these molten intrusions by their great heat bring about various chemical changes which may result either in the formation of new economic minerals or in the concentration of the already sparsely distributed metals in the country rock. Moreover, the ever active forces of denudation, which are all the more energetic in mountainous regions, remove the lighter materials as quartz and aluminous clays to be deposited in the plains leaving the heavier metals as gold, platinum, silver, copper, etc., which may be recovered by further hydraulic washing.

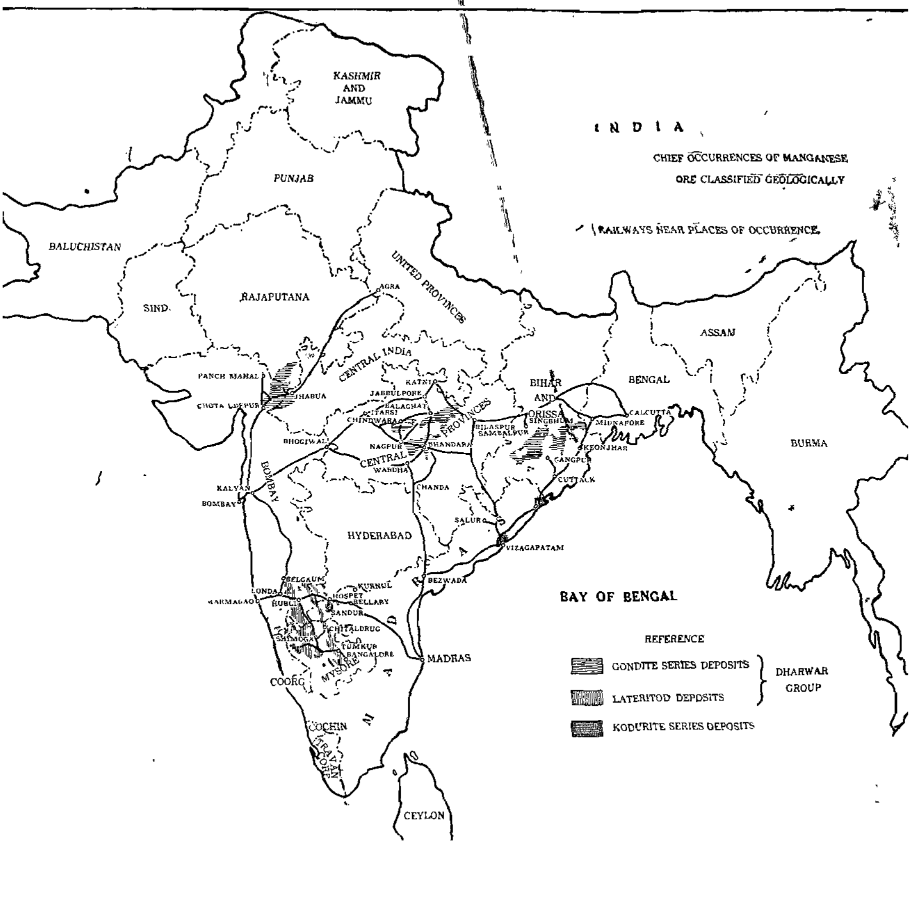
Occurrence and Age.—There is also a close relation between the occurrence of useful metals and the age of the rock in which they are found: as a general rule, the older the rock the more abundant is it in metallic minerals; for, as has been pointed out, denudation is responsible for the exposure as well as for bringing the ore bodies nearer the surface; and denudation would have been the more effective the greater the interval of time it had been allowed to act. Further, the degree of mineralisation of a rock depends upon the extent to which the rock has been affected by igneous intrusions and other changes: usually, the older the rock the greater is the chance of its being affected by plenty of intrusions and other changes called metamorphism. Besides, the work of various atmospheric agencies, both mechanical and chemical, consists in the concentration in places of useful metals which form important workable sources of these metals; and the older the rock the more perfect is the concentration. This is true of many minerals like iron, aluminium, manganese, etc.

Careful Observation Necessary.—All the above characteristics are clearly brought out in India in the occurrence of various heavier metals as gold, iron, manganese, etc. But in these cases the real folded or mountainous nature of the country may not be made out at first, because these regions have been denuded to such an extent as to become practically peneplains; yet, the gentle unevenness of the surface, the nature of rocks and the intricate folding and plication of the strata would reveal to a careful observer that these are 'relicts' of once very high mountains.

Occurs in Peninsular Region.—Bearing in mind the above facts, we can easily correlate the occurrence of all workable deposits of manganese in India with the geological age of the rocks; as geologically very old rocks as those belonging to the Archaeans do not occur either in the extra-peninsular area or in the Indo-Gangetic alluvium, we do not find any economically important deposits in these two regions; hence, all the important manganese deposits of India are confined to the peninsular part of India. It may be remembered here that the Peninsular part of India in the geologic sense not only includes the Geographical peninsula, but also extends as far as the Aravallis on the North-West, Gwalior in the North and Bihar and Orissa in the North-East.

Chief occurrences classified geologically.—The following table gives the chief occurrences of manganese in India:—

Age.	*Formation or Series.*	*Important producing areas.*
		Sandur, Chitaldrug, Tumkur.
	Lateritoid series.	Singhbhum, Bellary, N. Kanara.
		Shimoga, Jabalpore.
Dharwar.	Chilpighat series.	Balaghat.
	Champaner series.	Panchmahal.
	Aravalli series.	Jhalna.
	Gondite series.	Balaghat, Bhandra. Chhindwara, Nagpur.
?	Kodurite series. (Intrusions into the Khondolites).	Vizagapatam.



Four Important Manganese Minerals.—There is a large number of minerals which contain manganese to a less or greater extent: of these some are so rich in metallic manganese content as to contain only traces of other metals; but even among these many are not important economically on account of their rarity. Hence, of the various manganese-bearing minerals, which have been identified in India, only *four* are the most important as well as the most widely distributed; these are Psilomalane, Braunite, Pyrolusite and Wad; of these Psilomalane and Braunite form probably 90 per cent. of the manganese ores exported from India.

Resources of Manganese ore in India.—In 1909, Dr. L. L. Fermor stated that within a short period of 30—50 years the first grade manganese ore in India would have been mined, leaving only second and third grade ores. This he calculated at the rate of production of manganese ores in the early years of this century.

In the light of later discoveries, this prophetic statement has been found to be incorrect, so much so, Dr. Fermor himself in reviewing Indian resources of minerals and metals stated that in the case of manganese data are not available for the correct estimation of ore resources, and "all that can be said is that resources are far in excess of probable requirements for many years to come."

THE USES OF MANGANESE—USES IN METALLURGY

Introduction.—By far the largest proportion of the world's output of manganese, in all probability more than 90 per cent of it, is used in the manufacture of iron and steel. The first use of manganese in this industry is, likely to be of interest to any investigator. It is interesting to note that one of the early successful investigators on a larger scale in this direction was Mr. J. M. Heath, who left the Madras Civil Service in 1839, and succeeded in transforming the low grade wootz steel made by the Indians of the North Arcot District into excellent steel. He first smelted a mixture of manganese oxide with coal tar and then got an impure form of metallic manganese with some carbon; this he used in the manufacture of steel; he improved his method afterwards by mixing manganese oxide and tar, and making them into bricks which were then sold to the steel manufacturers of England. This gave a great impetus to the steel industry of England, where the best and costly iron from Sweden was being used in the manufacture of steel; for, with the invention of the Heath's process (i.e., the use of manganese in steel manufacture), steel of equally good quality could be manufactured with less cost from the low grade iron of English manufacture.

Manganese for Steel manufacture known to Indians.—It is also interesting to note here, that the use of manganese in the manufacture of steel was practised by the Indians from time immemorial; this is proved by the facts that some smelted iron in India revealed on examination the presence of manganese; that the Dhavads or iron smelters of the Western Ghats have a special name for manganese ores—'waral'; that the iron smelters of the Jabalpur district make use of manganese ores even to-day in the manufacture of a variety of steel known as Kheri, which has a great demand among the local blacksmiths, who weld it into ordinary country-made soft iron to form edges of scythes and axes; and that there is a tradition amongst the Dhavads that the Phoenicians carried away from this country manganese ores evidently for the same purpose. It is also quite probable, that Mr. Heath himself would have taken the hint from the iron smelters of the North Arcot District. Dr. L .L. Fermor relates how he visited a small native furnace at Ghogra in the Jubulpore district, where such steel was being made.

Manganese in Bessemer process.—With the introduction of the Bessemer process in the manufacture of steel in 1858, the use of manganese in the form of the alloy spiegeleisen, which contained 5 to 27 per cent of manganese and 4 to 5 per cent of carbon, became necessary. The Bessemer process consisted in burning away all carbon and silicon in the convertor by blowing cold air into the molten pig-iron; and the necessary amount of carbon was afterwards added to the molten iron by a repetition of the blowing. This process as invented by Sir Henry Bessemer, yielded steel which was very brittle. Mr. Mushat modified the process by adding ferro-manganese alloys, which removed the brittleness from the resulting product. Manganese may be introduced either in the form of ferro-manganese alloys or in the form of iron ores rich in manganese as those occuring in the Siegerland district in Germany, in Spain, Sweden and Greece. The amount of manganese in spiegeleisen was not found to be sufficient for several purposes in the manufacture of steel; hence, alloys of iron containing manganese from 25 to 90 per cent were invented; such alloys are called ferro-manganese. This naturally increased greatly the demand for manganese.

Manganese as Desulphurizer in Iron Smelting.—As manganese has a great affinity for sulphur it is also used to desulphurize iron in the manufacture of the latter metal from highly sulphurous ores as occuring in Luxemburg and Lorraine ; the resulting phosphoric pig-iron is then converted into steel by the basic process. The presence of manganese in foundry pig-iron, provided the amount does not exceed 2 per cent, is said to be beneficial ; for, it makes the pig not only harder, but also closer grained ; the manganese present also prevents the absorption of sulphur from the coke during smelting.

Manganese Steel.—Manganese steel was invented by Sir Robert A. Hadfield in 1883 ; it contains 11-14 per cent of manganese and 1.25 per cent of carbon ; the effect of manganese in such steel is to make the steel more brittle, if the amount be 1 to 7 per cent, but renders it strong and ductile without any decrease in hardness if the amount is 7 to 30 per cent ; carbon steel is brittle and less ductile. Its principal characteristics may be summarised as follows :—

Properties.—(a) It is practically non-magnetic, notwithstanding the fact that it contains about 36 per cent of iron. Hence, it has been employed in armoured and other structures near the magnetic compass in ships and aeroplanes.

(b) Its electric resistance is seven times that of pure iron and its ductility only 1/6th that of pure iron ; this makes it useful for the manufacture of resistance coils.

(c) The alloy is greatly toughened by quenching instead of being hardened, and made comparatively brittle, as in the case of carbon with steel.

(d) It has a high tensile strength (60-70 tons per square inch) when suitably heat treated, combined with extraordinary elongation (50 or even 70 per cent exceeding that obtained with purest iron).

(e) Its resistance to wear by abrasion is greater the more severe the service to which it is applied. The jaw-type crushers for crushing rock in the Cauvery-Mettur Dam, having a crushing capacity of 200 tons of stones per hour were made of cast steel with the wearing part of manganese steel. Manganese steel is used in special railway and tramway trackwork, the wearing parts of excavators, and dredgers, wheels of mine cars, wireline sheaves for oil machinery, sprockets, clutches and other articles exposed to severe shock and abrasion.

During the War thousands of British and allied troops owed their lives to the protective helmets made of manganese steel. In addition, it has excellent casting qualities as regards *fluidity* and ability to fill moulds of intricate shape ; articles made of this alloy are free from blow-holes.

Effect of Manganese on Steel.—The effect of manganese and manganese alloys on the steel manufacture by acid process has been summarised as follows :—

(a) The prevention of over-oxidation of the steel by the reduction of small quantities of oxide in the bath.

(b) The addition of the requisite amount of manganese necessary in the finished steel.

(c) The hindering of the formation of blow-holes.

(d) The elimination of sulphur from the bath.

(e) The making of iron slag fluid and easy to run off.

(f) The addition of carbon to the bath; this, however, is incidental and is allowed for when recarbonizing.

No other substitutes.—Silicon and aluminium, indeed, remove oxygen more easily from iron than manganese, but do not pass away into slag easily. Without the use of manganese, mild steel (with ·10 to ·25 per cent of carbon) and medium steel (with ·30 to ·60 per cent of carbon) of to-day cannot be manufactured. Further, the presence of manganese makes the steel finer in structure with higher elastic limit and with low ductility.

No other substitute has yet been found for manganese in the manufacture of steel ; indeed, when Germany was cut off from the import of manganese ore during the war, she tried various substitutes, but with little success. It is remarkable also to note here, that in spite of the great mineral wealth of U.S.A., she is not rich in manganese minerals and that her iron and steel industry has to depend to a very large extent on imported manganese ores, chiefly from Brazil and from elsewhere.

Other Manganese Alloys.—Of the other manganese alloys mention may be made of *manganese bronze* containing 75-76 per cent of copper, 16-17 per cent of manganese and 5-6 per cent of tin ; it is tough, malleable and brass yellow in colour ; the addition of about

5 per cent of aluminium is said to increase the strength and elasticity. On account of its *toughness, strength and non-liability to corrosion by sea-water,* it is used for ship-propellers and other parts of the ship where this quality is necessary. *Manganese, German Silver or Silver-Bronze* with 60 per cent of copper, 15 per cent of zinc, and 40 per cent of ferro-manganese with 80 per cent of manganese is used for the manufacture of bearings, valves, and cocks. *Manganni* is an alloy of manganese used for electrical resistances; it contains 82 per cent of copper, 15 per cent of manganese and about 3 per cent of nickel and iron.

In smelting gold, silver.—Manganese dioxide is also used in the Kolar Gold Fields to help the oxidation of impurities of zinc in the final smelting of gold after recovery by the cyanide process. Similarly, it may be used also in the smelting of silver and lead as a flux.

CHEMICAL USES

Chemical uses.—As an oxidiser, the value of the ore depends upon the available quantity of oxygen; very rarely pyrolusite which is used for this purpose contains as much oxygen as required by the Chemical formula (MnO_2S); when other minerals are used as psilomalane (Mn_3O_5), their value will depend on the amount of oxygen which is expressed in terms of (MnO_2) pyrolusite and the chemist buys his ore at so much per nit (1 per cent. of MnO_2). The chief chemical use to which it may be put is for the manufacture of chlorine and bromine; for this purpose the ores should be not only free from impurities of iron oxide, but also contain no carbonates; for, these involve greater consumption of acid. Ores from Kodur in Vizagapatam and Mysore are sometimes exported for this purpose; but with the coming into practice of the electrolytic process for the manufacture of chlorine from sea-water, the demand, on this account, has dwindled greatly.

Savon de verre.—Pyrolusite of very great purity containing no or only a trace of iron often fetches a high price for decolourising green colour in the manufacture of glass.

Other chemical uses.—Manganese may also be used in India for the manufacture of bleaching powder, which has a great demand in paper manufacture, cotton textiles, etc. As a disinfectant manganese is used very widely in the form of permanganates under the name of Condy's fluid both in India and elsewhere; it is, indeed, a deplorable fact that a great amount of potassium permanganate is imported when it can be prepared with less cost in India with her large resources of manganese. Further, potassium permanganate, in addition to being useful for general purifying purposes, may also be used for bleaching vegetable fibres. Pyrolusite is also used in dry electric batteries and in Leelanche cells; as yet, much money is washed in importing dry cells from foreign countries, which use to a less or greater extent Indian Pyrolusite; but Russian ore on account of its soft nature is said to be more suited for dry cells than hard Indian Pyrolusite. Pyrolusite may also be used in the preparation of oxygen.

Colouring of glass, enamel, etc.—As a colouring material, manganese is used in glass, enamel, tiles, bricks and pottery manufactures; the violet, green or brown colour in glasses is due to its presence; violet colour of enamels is due to ($MnCo_3$) manganese carbonate. It gives highly attractive and beautiful colours to pottery and ornamented tiles; the deep brown glaze of tea-pots and the chocolate colour of certain ornamental tiles are due to its presence. It is also used in calico-printing, dyeing and in the manufacture of certain paints of brown, green and violet colour.

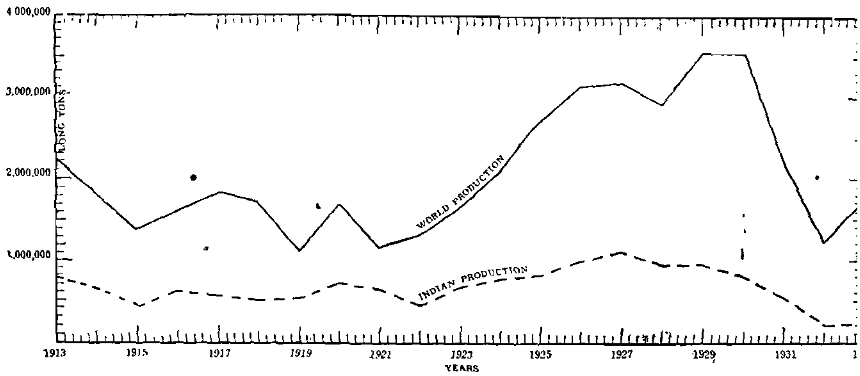
Ornamental purposes.—Some manganese minerals like rhodonite ($MnSiO_3$) and Spessartite (Mn garnet) may be useful as ornamental stones, if found in large quantities. Pure and clear spessartite is sometimes used as a gem-stone, which is violet or red in colour; rhodonite is pink or flesh-coloured.

As manure.—Dr. Oswald Shreiner of the Bureau of Chemistry of Soils, Washington has found out that manganese helps the formation of Chlorophyll in certain unhealthy plants growing in alkaline soil, which lack manganese. Thus, manganese seems to produce healthy and fully vitalized plants. But manganese should not be used in acid soils. The same authority says also that an addition of 50 lbs. of $MnSO_4$ per acre increases the yield of oats by 20 per cent., rice 30 per cent., and other products proportionately as barley, wheat, corn, peas, carrots, etc.

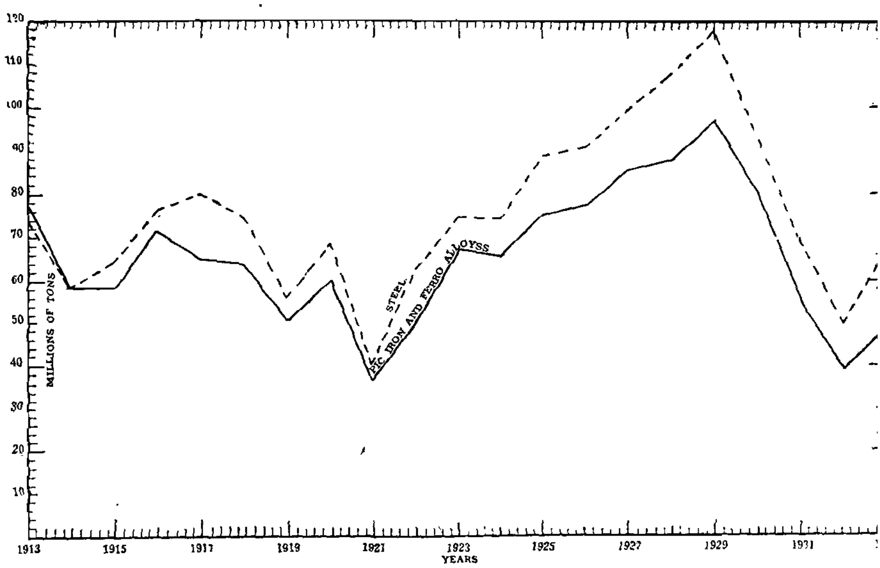
Useful to plants.—As manganese passes into solution in the surface water, it is easily absorbed by plants through the root-hairs. Hence, manganese has been found in many plants as radish, turnips, beet-root, carrot, sugar-cane, bamboo, oats, potatoes, etc. In all these cases manganese probably helps the plants in the extraction of oxygen from air and thus takes part in the vital activities.

Useful to animals.—Manganese is also said to be present in hair, bones, etc., of animals; it is found in minute quantities in the liver and spleen of human beings and also in the human blood with iron in the ratio of 1 : 20. Here also, probably its presence is beneficial to the system.

The Development of the Trade in Manganese of India.—With a view to bring out the close relationship between the world production of steel, pig-iron and ferro-alloys and the world production of



WORLD PRODUCTION OF MANGANESE AND INDIAN PRODUCTION.



WORLD PRODUCTION OF STEEL, FERRO ALLOYS, AND PIG-IRON.

manganese, separate graphs in the same sheet are drawn (see graph) ; the close relationship can easily be inferred from the fact that more than 90 per cent. of the production of manganese is used in the manufacture of iron, steel, and manganese steel. From the graphs it will be noted that the maxima of iron and steel production coincide with the maxima, and the minima with the minima of manganese production of the world except in the war quinquennium (1914-18) when the minimum of manganese production lags one year behind the minimum of iron and steel production; this is, of course, due to over-production and the consequent accumulation of stock during the years of lessened demand. In order to compare the Indian production with the other graphs, it is also drawn in the same sheet ; the same fact namely, the lagging behind of the Indian minima of manganese production from the minima of the world production of iron and steel can be more clearly noted.

DEVELOPMENT OF MANGANESE TRADE IN INDIA

We shall now consider the development of the manganese industry in India under the following six periods which have more or less well-marked characteristics :

1st Period-Earlier to 1892.—Though there appears to be no ancient records, it seems probable that the existence of manganese ores in India was known to the Indians from time immemorial. They probably regarded them as a sort of iron ore which made them to be used in colouring glasses, enamels and also in iron smelting ; it appears, that they also confounded this with " Surma " (Sb_2S_3 or antimony sulphide), which was used in colouring eyebrows ; they, however, distinguished manganese ore used for this purpose from true surma (Sb_2S_3) by paying lower prices for them. As referred to by Dr. L. L. Fermor, there is a tradition among the Dhavads or iron smelters of the Western Ghats, that the Phœnicians used to carry away manganese ores from this country. Various native names have been in use for manganese ore in the various parts of India as " Charcoal Stone," Iron Stone, Surma, etc.,"

IInd Period : 1892-1913.—Manganese ore mining began in India in 1892 in the Vizagapatam district when 674 tons were exported for the first time ; the existence of manganese ores, however, was known in the district as early as 1851 and in the Central Provinces since 1829. Till 1899, Madras was the only province which exported manganese ore, and the progress was steady and a figure of

84·652 was reached in 1899. Production in Central Provinces began in 1900 and in Central India in 1903 ; Bombay began next in 1905 and Bihar and Orissa and Mysore in 1906. The progress was rapid and by 1905, the industry had maintained a position of comparative stability. The zenith was reached in 1907 with an output of 902,291 tons of ore, and India took the lead amongst the producers of the world in 1900, hitherto held by Russia, which, however, temporarily again took the lead between 1912-1915.

The year 1908 saw a marked check in the world's production of manganese both in India and Russia due to the fall in the demand for steel.

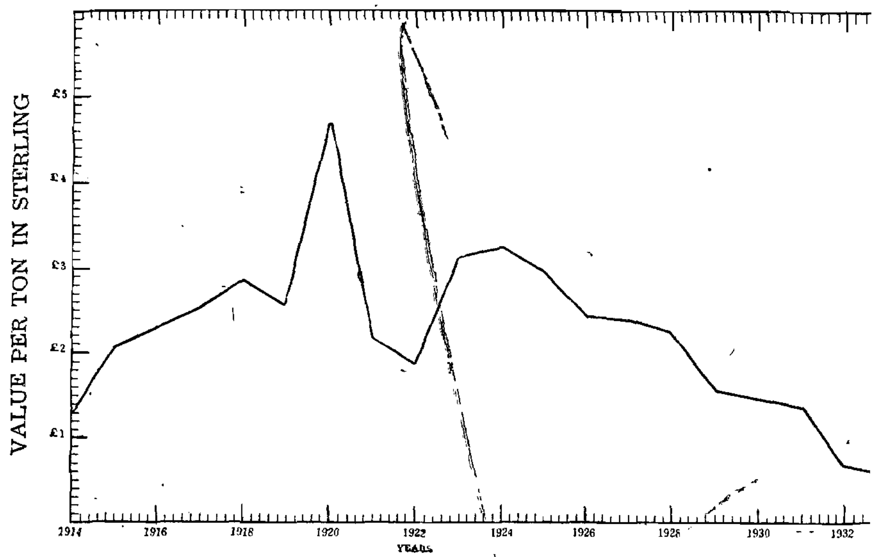
IIIrd Period : 1914-1918.—This period roughly coincides with the great war and is hence different from the other ordinary years in several respects. The period was characterised by a great restriction in the export of manganese ore from India ; this was necessary in order to avoid manganese and manganese alloys which were so important in the manufacture of iron and steel reaching the enemy country. In spite of this annual average for the quinquennium was 577,457 tons.

Russia.—Russia retained her position as the leading producer till 1914, but subsequently the closing of the Dardanelles which isolated Russia from friendly consumers, and still later her own internal political troubles combined with the system of giving priority to shipments of food-stuffs, reduced the production to the actual internal needs of the country. The disappearance of Russia from the allied market was not of much importance in the allied market, for not only one of the chief consumers of manganese, namely, Germany became isolated, but also the increased production in India and Brazil partly compensated for the decrease.

Manganese 'boom.'—Exports from Brazil chiefly went to the United States of America ; in spite of this, the great demand for manganese ore in America increased so much chiefly for the manufacture of munition of war, that all the poorer sources of ore bodies were tapped so much that Brazil became the third country in 1918 in the production of managanese ore, and that the composition of standard ferro-manganese was reduced from 80 per cent. to 70 per cent. of metallic manganese. The great demand for ferro-manganese may be easily understood from the fact that many smelters in the U.S.A. used Spigeleisen in the absence of ferro-manganese. Indian ore was not able to reach U.S.A. in large quantities on account of the lack of shipping. Production was accelerated during this period in Cuba, Italy, Japan, Spain and Sweden, and new producers as the Gold Coast and Egypt also came into the field.

IVth Period 1919-1923.—As the result of various causes, the war period was marked by a great restriction in the export of manganese ore from India ; this resulted in the accumulation of stock during this period which entered now into the world market.

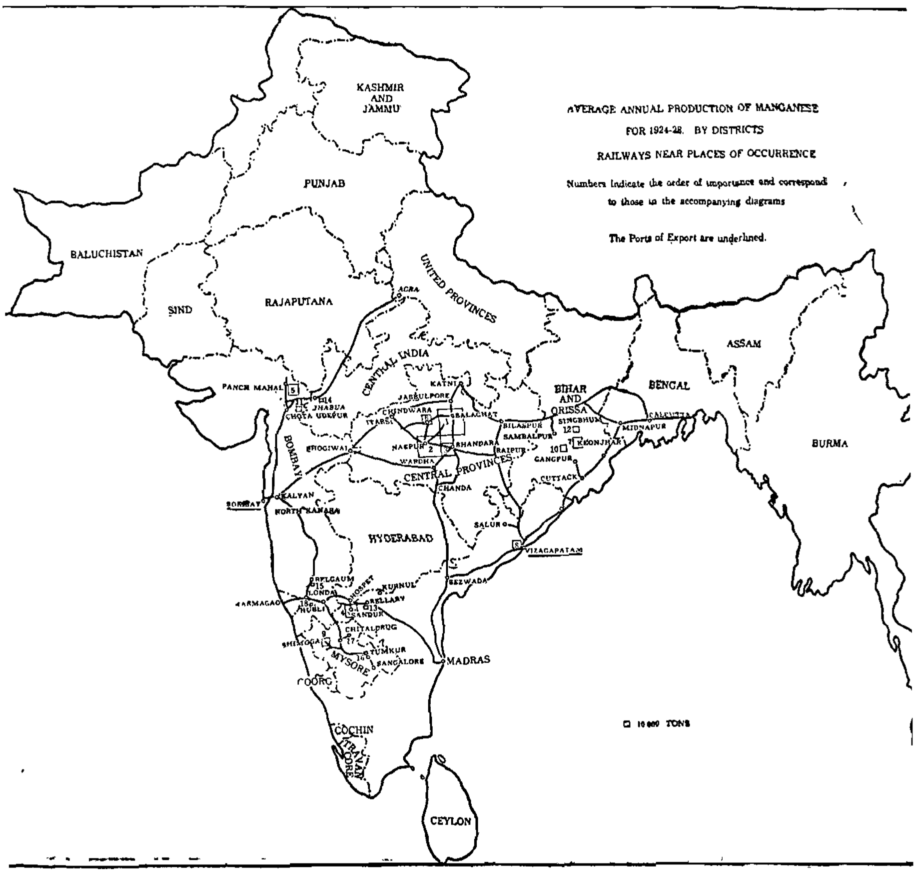
The quinquennium 1919-'23 was in several respects an interesting one; consequent on the cessation of hostilities, there was a



EXPORT VALUE F.O.B. AT INDIAN PORTS OF MN. ORE PER TON

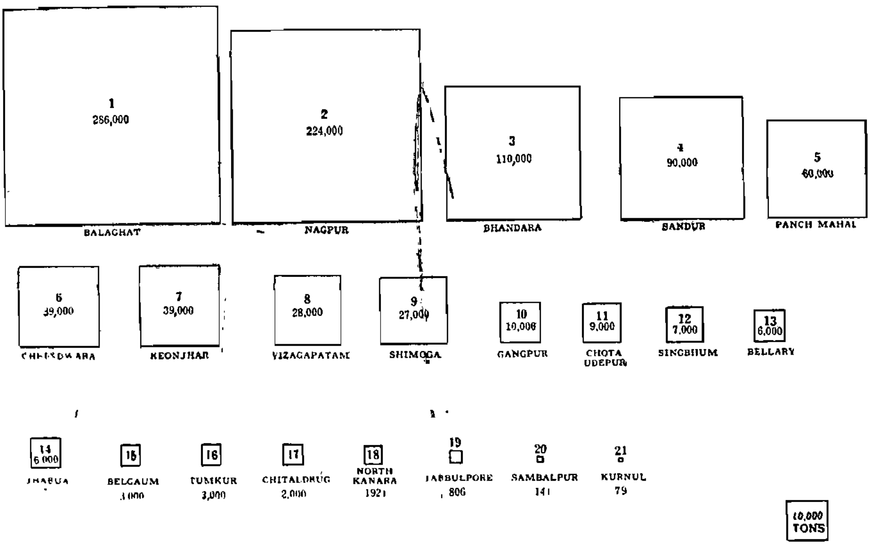
rapid decrease in the world production of iron and steel in the year 1919 : as a result though the price and freight charges also fell, the Indian production was as low as about 53,800 tons. The record for the quinquennium was reached in the next year (736,439 tons), as the result of the increase in the out-put of world production of iron and steel in general and in particular of ferro-manganese in the U.S.A. ; this was in spite of the great rise in ocean freights and the high increase in the price per unit of manganese. The year 1921 was one of world-wide trade and business depression with the world's output of pig-iron and steel lowest since 1896 and 1904 respectviely. In spite of the great fall in the ship freight, and the depreciation of the rupee, there was a heavy fall in the export, probably due to the low price of manganese per unit and the lack of demand. The trade depression continued in the earlier part of the next year. But conditions improved towards the close of the year ; and as the result of the gradual recovery of the iron and steel industry and the rising prices, the exports increased ; anyhow, this recovery came too late for the Indian manganese industry. However, full advantage was taken of the accumulated stock of the mining companies. 1923 was a prosperous year for the iron and steel industry. Freights remained low but the price of manganese rose considerably.

Russia vs. *India*.—During the years 1915 to 1923, Russia ceased to be a serious competitor with India in the production of manganese. The disappearance of Russia in the world manganese market was, however, not of much significance as one of the chief importers of the Russian as well as to a less extent Indian ores, namely, Germany, also became isolated.



Brazil vs. *India.*—The production of Brazil, however, fluctuated even as that of Indian production ; but, as compared with her exports during the earlier years the increase was so great that she became the second in importance in manganese production in the world, the first being India. Her chief market was U.S.A.

Vth Period, 1924-27.—The years 1924-'27 were prosperous for the manganese industry in India ; for, there were little variations during the whole period as the result of the return to normal conditions. There were no serious fluctuations in exchange. The



AVERAGE ANNUAL PRODUCTION OF MANGANESE FOR 1924-28.
BY DISTRICTS (to be studied with Map)

world's output of pig-iron, ferro-manganese alloys and steel increased continuously. But the rate of increase of the world production of manganese was much greater than the demand as revealed by the rate of increase of the world iron and steel industry. This was shown by the lowering of the price of manganese.

VIth Period 1928-1933.—This period was not at all a prosperous one for the manganese industry in India. Probably no other industry was so much affected by the trade depression as the manganese industry, as the result of the great slump in the iron and steel industry. The intensity of the depression cannot be better, expressed than in the words of Dr. L. L. Fermor : " The full magnitude of the slump may be best realised from the fact that whilst the quantity of the production in 1933 was little over 1/5 of that of the peak year 1927, the value was less than 1/22 part of the value of the 1927 production. In fact, in none of the major Indian mineral industries have the effects of the slump been so seriously felt as in the manganese industry. ...... During 1932 and 1933 the majority of mines in the Central Provinces were closed including several mines that had never been closed since the commencement of work in 1900 and 1901. There was a total cessation of production in the Nagpur district and almost total cessation in Bhandra."

The chief causes for the decline of prices of manganese ore may be summarised as follows :—

(1) The increase in the world production of manganese ore was much greater than the rate of increase in the world production of pig-iron and steel in 1924-'27. And although there was a fall in 1928 in the production of manganese ore, yet in 1929 the increase was greater than was justified by the increased production of iron and steel.

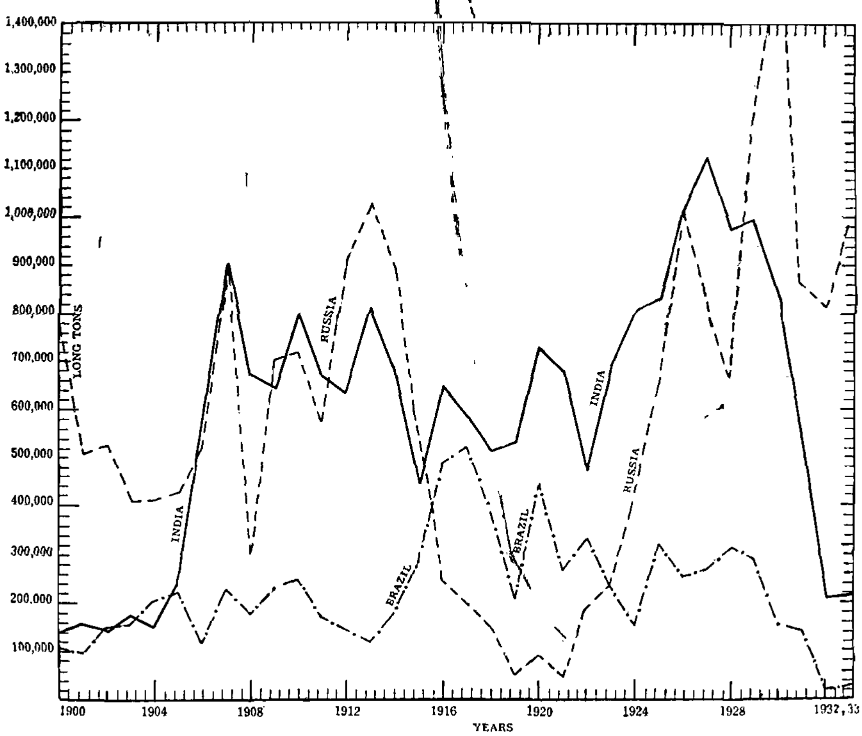
(2) The non-economic methods of exploitation and finance of Russia make it posible to place manganese ore at very low prices.

(3) The finding of high grade ore in South Africa at Postmarburg and the consequent competition of South Africa in the world market.

(4) Lastly, the great trade and business depression was also one of the chief causes. It is, hence, no wonder that in spite of apparent prosperity of the Indian manganese industry in 1929 and 1930, the industry fell into such a slump that in 1931 and 1932 many of the companies which had not stopped working since their formation in the early years of this century had to suspend work. The fall in the world production of steel in 1932 to 50 million tons from 122 million tons in 1929 gives some idea of the magnitude of the depression.

Ports of Export.—From the map it will be seen that the chief producing region, namely, Central Provinces is more or less equally distant from the ports of Bombay and Calcutta. The only district of production in Central India (Jhalna) is, however, nearer Bombay than to any other port. Hence, Bombay and Calcutta are the two important ports of export of manganese ore ; Bombay has the further advantage of being nearer the European market than Calcutta. Vizagapatam is the chief port for manganese ores produced in the district. Marmagao is the nearest port for mines situated in Mysore, Sandur, and Belgaum. It may be noted from the map drawn to show the average production of manganese by districts for 1924-28 and important railways for transport that actually Vizagapatam is nearer to the chief producing areas in Central Provinces than either Bombay or Calcutta; but the lack of proper railway connections to the former port makes it impossible to take advantage of the shorter distance. Secondly, the shipping facilities also seem to be less at Vizagapatam than either in Calcutta or Bombay in other years.

Competing Countries.—The graphs drawn to show the production of manganese in the three principal countries namely, India, Russia and Brazil clearly indicate the nature of the competition. The chief competitor with India in the European market has been



MANGANESE PRODUCTION OF INDIA, RUSSIA AND BRAZIL, THE THREE PRINCIPAL COUNTRIES.

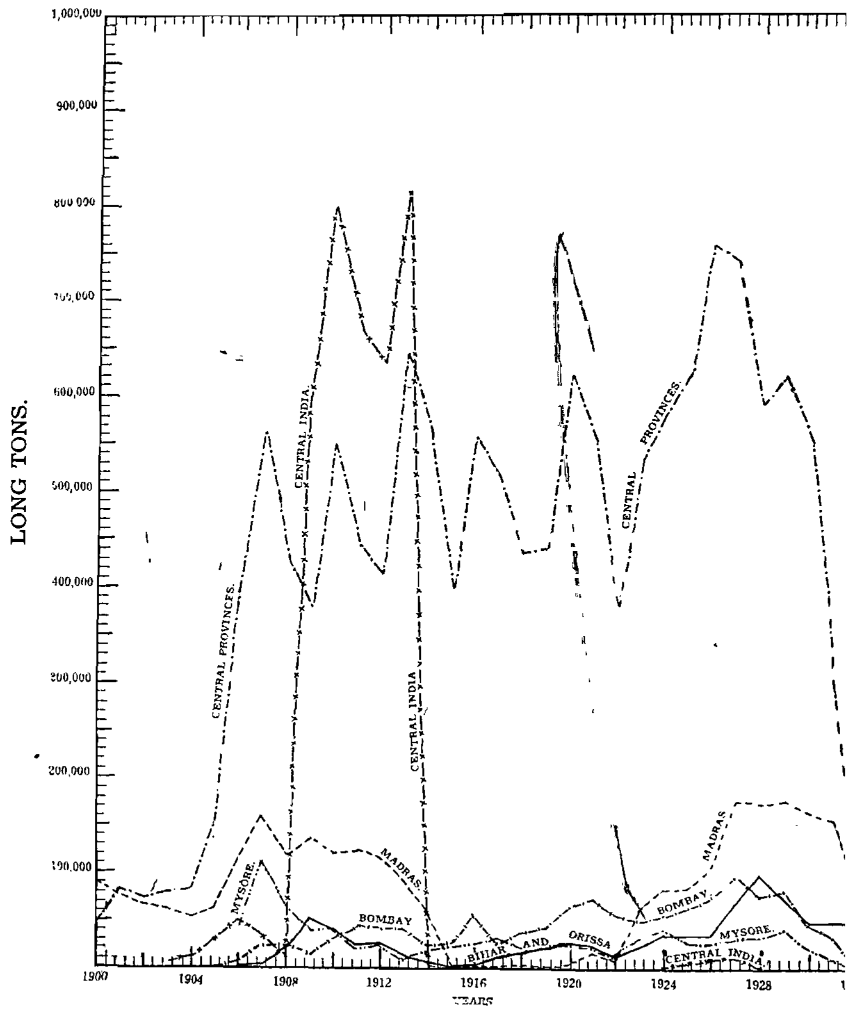
Russia; for, Brazil chiefly supplies the needs of U.S.A., though to a certain extent Indian ores are also exported to North America. It is difficult to forecast the position of Russia in the manganese industry of the world, though it appears likely that she may capture the world market by underselling India. But there are certain obstacles to progress in Russia as (1) the still ill-organised and individualised nature of the workings; (2) the Russian ore requires washing before export; (3) the ore is too soft to be used separately in smelting without mixing with hard Indian or Brazil ore: it is also too impure to be used for chemical purposes, for which its soft nature may be very useful.

Other competitors.—The other likely competing countries will be Egypt, where the manganese deposits occur only 10-15 miles from port Abuzenina with the ore containing 32·3 per cent. of manganese and 25 per cent. of iron, and the Gold Coast which yields first grade ore with 52 per cent. of manganese. Rich deposits of manganese ore have also been discovered near *Postmarburg in Griqualand in South Africa;* the ore is as compact as that occurring in Central Provinces in India.

Manganese and World Peace.—Sir T. Hotland in a paper read before the British Associaiton at Johannesburg in 1929 spoke about the International Relationship of Minerals; he pointed out that the British Empire and U.S.A. which have the largest and in some cases almost exclusive resources in certain important minerals, by refusing to export these to belligerent countries could prevent wars of long-duration. As has been already pointed out, the importance of manganese in the manufacture of iron, steel and other alloys used in the manufacture of war materials is very great, and as yet no other substitute has been discovered. Indeed, it was probably one of the reasons which made Germany in the last Great War to come to terms. It is to be noted that though manganese is produced to a certain extent in most countries, the larger deposits, with the exception of Russia and Brazil are concentrated in the British Empire—in India, South Africa, the Gold Coast and Egypt; thus a working agreement between these mineral powers will go a great extent towards the ensuring of the peace of the world.

THE DEVELOPMENT OF THE MANGANESE INDUSTRY IN INDIA

Central Provinces.—The most important province from the point of view of production is the Central Provinces. As already pointed out, the depression has affected this region very deplorably. This region, though having the richest ore bodies has the disadvantage of being far from ports of export; for this reason in the recent severe depression only mines nearer the ports of Calcut and Bombay were able to export some ore in spite of the fact th produced only second-grade ore, and several fields producing firs grade ore were not able to export anything at all, on account of tl distance from the ports of export, and the consequent light railwa freights. This points to the great necessity of granting some co



MANGANESE PRODUCTION IN INDIA ACCORDING TO PROVINCE

cession in railway freights for manganese ores. The chief distric of production are: Nagpur, Balaghat, Bhandara, Chhindwara an Jubbalpore; except Jubbalpore the other districts are close roun Nagpur.

Central India.—The next important province was Central India. where the only district of production was Jhalna. But in the last five years this province has not produced anything.

Madras.—Madras was the first province to begin production in India and till 1899 was the only province. The chief district of production was Vizagapatam which had the advantage of being near the sea. Till about 1904 Vizagapatam was the only producing district when new fields were opened in Sandur and other parts of Bellary.

Other Provinces.—The chief districts of production in Bombay are Panch Mahal, Belgaum, Chota Udepur and Ratnagiri. Both. Mysore and Bihar and Orissa began production in 1906. The production in all the three provinces has been more or less steady when compared to those of Central Provinces and Central India. The districts in Mysore are Shimoga, Tumkur and Chitaldrug of which Shimoga is the most important. Singhbhum, Gangapur and Keonjhar are the chief districts for manganese ore production in Bihar and Orissa.

Lack of proper communication.—Lack of proper communication is one of the chief reasons against the rapid development of the manganese industry. As already pointed out, the heavier mineral occurs in very old rocks which are mostly unsuitable for human settlement, resulting in the chief occurrences being far from the lines of communication. It will be seen from the map drawn to show the production of manganese ore and important communication, that most of the deposits are unfavourably situated; thus Vizagapatam harbour is the nearest port to the chief places of occurrence in Central Provinces; yet, on account of lack of proper communication, ore is exported either *via* Calcutta or *via* Bombay. All deposits in Bihar and Orissa are situated far from railways and hence were affected first in the recent depression. Even in the case of places whcih appear close to the railways in the map, they are situated a few miles away and in many cases light trams of 2 or 2½ feet gauge are laid to facilitate ore transport; thus in Central Provinces nearly all the deposits are found to be fairly distant from railways, the distance varying from 8 or 9 to as much as 33 miles. In Central India, the deposits of Jhalna district are situated about 5½ miles, in Sandur at least 6 miles (served by an extension of the Madras and Southern Maharatta Railway) and at Kumsi about 20 miles from the Shimoga railway station.

THE MANUFACTURE OF FERRO-MANGANESE IN INDIA

Industry equivalent to loss.—It was pointed out as far back as 1905 by Sir T. Holland that India sustained a great loss by exporting manganese and getting back the same in the form of finished steel from the chief steel producing countries, (U.S.A., England and Germany) which import Indian manganese, and that if an iron and steel industry existed in the country itself, this could be avoided. Also, it would be much more profitable to India to export ferro-manganese than manganese ore itself. Dr. L. L. Fermor has calculated that till the year 1906 India has suffered a financial loss of more than 9 million pounds sterling.

History of Ferro-manganese production.—The manufacture of ferro-manganese began in India in the year 1913 at Sakchi, Jamshedpur; the starting of the industry was the result of the high price of ferro-manganese during the war-time. Only one blast furnace with a daily output of 80 tons was used for this purpose. In 1917 the manufacture was discontinued on account of the necessity of using the furnace for the manufacture of pig-iron. From November 1917 one of the similar blast furnaces of the Bengal Iron Company at Kulti was engaged in the production of ferro-manganese with a guaranteed minimum of 74 per cent. of metallic manganese and .55 per cent. of Phosphorus. The average monthly output was 1,150 tons and the balance after satisfying the home requirements at Sakchi was exported to France, U.S.A., Italy and Natal. With the cessation of the war, ferro-manganese has been manufactured both at Kulti and Sakchi.

FUTURE OF FERRO-MANGANESE

Indian ferro-manganese is unusually rich in phosphorus which amounts to ·55 to ·66 per cent., while the acceptable maximum in the western countries is ·30 per cent. With better selection of ore (e.g. as those occurring in Balaghat) and coke (e.g. as those from Giridih coalfield) the phosphorus content may be reduced; but the future possibilities are small, as Indian coke as well as manganese ores contain a lot of phosphorus. With electric furnace, probably better ferro-manganese may be manufactured.

MANGANESE ORE USED IN INDIA

With the establishment of Iron and Steel industry in India, manganese ore is also used in the country in their manufacture.

Thus in the quinquennium 1924-1928, 389,418 tons of ore were consumed at Tatanagar, Kulti and Burnpur. In the case of Tata Iron and Steel industry, manganese ore is not only used in the manufacture of ferro-manganese to be used in steel making, but also in the manufacture of pig-iron. As pointed out elsewhere, manganese ore is also used in India to colour enamel and pottery ; it is also used in the Kolar Gold Fields in the final smelting of gold in the cyanide process.

THE FUTURE OF MANGANESE INDUSTRY

As has been already pointed out, the resources of India in manganese are far in excess of probable requirements for many years to come. *The present serious fall in the price of manganese ore is* more the result of over-production and lack of demand than of any other cause. We may also note that at present the iron and steel industry of the world has more manganese than it can possibly consume ; this also excludes the possibility of the discovery of some other cheaper substitute for manganese in the iron and steel industry. The chief producers of manganese ore at present in order of importance are : India, Russia, the Gold Coast, South Africa, Brazil, Egypt and Czecho-Slovakia. India, besides being the chief country for the production of manganese in the world, is also the most important in the British Empire ; yet, the position of India is by no means enviable ; for within the British Empire she has to compete with South Africa, the Gold Coast, and Egypt and outside with Russia and Brazil. Hence, India would do well to consider seriously the possibility of the manufacture of ferro-manganese (and manganese steel) which will bring her greater profit besides reducing unemployment in the country. With the development of cheap electric power in several parts of the Madras and Bombay Presidencies, I should think that this must be a paying proposition ; for, the lateritic ores, besides having the advantage of containing less phosphorus than those of Central Provinces, and thus being more suited for the manufacture of ferro-manganese of saleable quality, are also rich in iron which may amount to 20 per cent. Recently in December 1935, the author of this paper was deputed by the Government of Madras to investigate the possibilities of developing the iron ores of the Kanjamalai Hills, Salem, when electricity becomes available from the Mettur Project : the author is of opinion that with very cheap electric power the manufacture of *high grade steel* and ferro-manganese may be possible.

Notes of a Geographical Excursion in and Around Madras

By

Miss H. T. Scudder, M.A.

N.B.—*Please trace out the tour on the map before we follow it as closely as possible on the way.*

1. From St. C.T.C. to the Kirk Bridge. Then a sharp turn to follow the river Cooum. Notice the rate of flow of the river, the winding course of it and especially the difference between two banks. Notice also the *traffic* on the river, and any signs of how it is used by man.

2. Notice the arm of the river which goes to the north. This continues into the *Buckingham Canal.* Also this is the beginning of the island. Continue along the river to Govt. House bridge. Notice on the map that the Government House and the Fort are in a straight line. Why ?

3. Across the bridge and to the island. Notice the development of the island. Can you account for it ? Continue along Wallajah Road.

4. The Fort. Why is it just here and nowhere else ?

5. The Harbour Arm. Notice the direction of the opening. Why is it here ? What is the wall made of ? Why ? What evidence of trade is there to be seen here ? Notice the difference in the water on the outer and the inner side of the wall. Why has the little arm been built.

6. Look at the coast from here. Notice the difference between the north and the south coasts. Make a mental note of the width of the beach here and at all other places where we see it. Notice the position of English Madras and Portuguese Madras, and try to account for their location in these relative positions. (i.e., you can see these positions by looking for the church spires). Why is the harbour north of the Fort ? In what direction is Madras spreading now ?

7. On leaving and entering the harbour notice the trade activities.

8. From the harbour continue along the coast to Napier bridge. Notice here the " mouth " of the Cooum, the islands in the river, the beach vegetation, and classify it as a type of natural vegetation.

9. Along the Marina, notice the width of the beach, the fishing activity (the historical occupation) the modern recreational facilities. Try to find out about the Recreation Ground scheme. Notice the number of little fishing villages which Madras has swallowed in its growth. Notice the typical village development, with palm-trees, a well, and the thatched houses.

10. Near the rifle-range is a very interesting formation of sand dunes. Read up Lake on the formation of sand dunes. Contrast this part of the beach with the more northern portion. Notice the water, the lagoons. On a very small scale this is a type of coastal formation found on a large scale in the S. E. coast of the U.S.A. *i.e.*, sand dune and lagoon.

11. We now come to the Adyar. Compare it with the Cooum. Notice the same points as before.

12. Between here and Saidapet, notice tanks, cultivation and natural vegetation. In regard to the tanks, look for the embankments. See which side they are on, and how they are bound together. Guindy, the Governor's country house.

13. St. Thomas' Mount. What is the height ? Which is the steep slope ? Which the gentle ? Notice the road going between the two peaks. Notice the rocks, and the vegetation on the sides of the hill.

14. From the top, after orienting the map, pick out as many tanks as possible, the race course, the railway, the roads, the coast-land, etc. Notice also the difference between cultivated and uncultivated. Look at the hills to the south and identify as many as possible from the map. The hills to the north are not on the maps we have. We shall look at them on the 1/M map before going.

15. Along the Poonamalle Road to the Adyar (if time) and then back through Mambalam. A purely modern city a " garden " city. At the river, we shall try to get the rate of flow in the centre and at the sides, and see the various actions in miniature, denudation, deposition and transportation, tributaries joining the main stream etc., etc.

The Madras Geographical Association

SUMMER SCHOOL OF GEOGRAPHY, APRIL—MAY, 1936

The Secretary of the Association has the honour to present the following Report to the Working Council regarding the organisation and conduct of the Summer School of Geography held in April-May, 1936 :

In accordance with the resolution of the Working Council, passed on 25th January, 1936, the Secretary prepared a Prospectus of the Summer School which was sent to all the Headmasters of High Schools in the Presidency and published in the local dailies. 36 teachers were selected including 18 ladies. 18 of the teachers were graduates and the remaining were undergraduates.

Mr. R. M. Statham, M.A., C.I.E., Director of Public Instruction, Madras, opened the Summer School at the Teachers' College, Saidapet, on Wednesday, the 15th April, 1936. At 10 a.m., on that day the teachers attending the course and the guests invited for the occasion assembled at the College Hall. Mr. N. Subrahmanyam, the Secretary of the Association, made a statement (Appendix I), tracing the history of the Summer School and explaining the aims and objects of the course.

M.R.Ry. Rao Bahadur R. Krishna Rao Bhonsle, Avl., I.S.O., Vice-President of the Association, then welcomed Mr. Statham and requested him to open the Summer School. Mr. Statham then delivered his Address (Appendix II), after which he formally opened the Sixth Summer School of Geography.

Mrs. P. S. Sundar Raj then delivered her Inaugural Address (published in the April number of the Journal). The meeting then closed with vote of thanks.

The work of the Summer School went on steadily for three weeks. The following Scheme of Work was gone through :—

(a) *The Pedagogy of Geography (including Syllabuses)*. By Mr. N. Subrahmanyam.

(b) *Elementary Surveying.* By Mr. George Kuriyan, assisted by Mr. K. Srinivasaraghavan.

(c) *Map Work.* By Mr. B. M. Thirunarayan.

(d) *Diagrammatic Methods.* By Mr. S. Balakrishna Ayyar.

(e) *Mathematical Geography.* By Mr. S. Muthukrishna Ayyar.

(f) *Land Forms.* By Mr. P. Sridhara Rao.

(g) *Climate and Weather.* By Miss E. D. Birdseye.

(h) *Economic Geography.* By Mr. B. M. Thirunarayanan

As part of the course, the following special lectures were also arranged :—

(a) *Plant Geography.* By Mr. M. S. Sabhesan.

(b) *Animal Geography.* By Mr. R. Gopalan.

(c) *Distribution of Man.* By Mr. George Kuriyan.

(d) *Map Projections.* By Mr. K. Srinivasaraghavan.

Excursions were conducted to the following places: Ennore Backwaters, Pallavaram Hill, Madras Harbour and Red Hills Tank.

At 5 p.m. on Monday, the 4th May, 1936, Miss J. M. Gerrard, M.A., Vice-President of the Association, distributed the certificates to the teachers who attended the course and delivered the Valedictory Address (Appendix III) with which the Summer School was brought to a formal close.

The total collection of fees amounted to Rs. 360, out of which a sum of Rs. 230-4-0 was expended on the travelling and carriage allowances of lecturers. This account will be audited as part of the general account of the Association for the quarter ending 30th June, 1936. The net balance of Rs. 129-12-0 has been carried to the Association Fund.

The thanks of the Association are due to the lecturers for their honorary work in the Summer School as well as to the Director of Public Instruction, Madras, and the Principal, Teachers' College, Saidapet, for permitting the Officers of the Department to work in the Summer School and for allowing the classes to be held in the Geography Department of the Teachers' College, Saidapet.

N. SUBRAHMANYAM,
Secretary.

APPENDIX I

SECRETARY'S STATEMENT

The Madras Geographical Association was founded in 1926 with varied aims and objects; and in pursuance of them it has been carrying on varied activities. The Association journal, which has been a clearing house of geographic thought and original geographical research work done in South India, has just completed its tenth volume. Geographical Conferences have been held in half-a-dozen districts, in each of which the particular district in which it is held has been the subject of study with several papers on various aspects of its Geography prepared by specialists—all the papers being published in the Journal. Excursions have been conducted and popularised in the Presidency.

To meet the sudden demand of the teachers of Geography when the subject was included in the remodelled S.S.L.C. Scheme, a series of Summer Schools have been organised and conducted in 1928, 1929, 1931, 1932 and 1935 at the Teachers' College, Saidapet, and some outside Madras—at Madura, Trichinopoly, Nellore, Gooty, Palaghat and Trichur.

The aim of these Summer Schools has not been for teaching Geography for those who had altogether no touch with it at all, but to catch the actual teacher of Geography who has been doing his work without any kind of technical qualification, and who wishes to get guidance and light in the way of practical work and modern methods of handling the subject. This aim is sought to be achieved by undertaking to provide for the teacher, who has already had grounding in Geography work, the training which would normally require two terms' work, in the course of a short period, by means of intensive effort along a concentrated course of studies, judiciously chosen for their value and importance from the point of view of the teacher. The course consists mainly of practical work, field work and excursions, and presents the salient points in such essential matters as map-making, map-reading and map-correlations, the study of land-forms, climate and weather, use of graphic methods and statistics, and construction of diagrams, models and appliances. A few general lectures, illustrative of geographic method and view-point are also delivered.

In the first three or four Summer Schools, the needs of the High School teacher of Geography were kept in view; but in view of the recent issue of a revised scheme and syllabus for Forms 1 to 3, by the Madras Department of Education, in the last Summer School the needs of the Middle School teacher has also been specially attended to. The same course will be followed in the present one also.

The best way of pulling up the teaching of Geography in the Middle School is to have specialists in Geography among the staff of Secondary Training Schools. But as this is a financial problem which cannot be solved immediately, it is suggested that a Refresher Course in Geography for the teachers in Training Schools who happen to handle the subject there, and explain to them the aim and scope of the new Middle School syllabus in addition to all the other practical work done in the Summer School. Such a course may be organised by the Educational Department itself; or, the Association would be glad to do so with the sympathy and support of the Department. In view of the urgent need for such a training, steps will be taken to run the next Summer School with this aim in view.

Before concluding, I wish to state that the Summer School course is only a compromise that satisfies a real need; but it cannot take the place of a full year's course at the Teachers' College, in which the teacher of Geography gets a knowledge of, and training in the pedagogy of the subject. But even this is not a full qualification for handling Geography in schools. It is a case of putting the cart before the horse—of learning the pedagogy of a subject, whose subject-matter has not been learnt; or it is nearer the truth to say, that it is a case of cart alone without the horse to draw it, for there is no subsequent attempt to take the Diploma or Degree in Geography. A full qualification for one who proposes to become a teacher of Geography is to take first the Degree in it, or until provision is made for it in Colleges, the Diploma in Geography which the University of Madras has already provided for, and then to undergo training in the Teachers' Colleges. It is to be hoped that such fully qualified teachers of the subject will be forthcoming in larger numbers in the years to come.

APPENDIX II

SPEECH OF R. M. STATHAM, ESQ., M.A., C.I.E., DIRECTOR OF PUBLIC INSTRUCTION, MADRAS, OPENING THE SUMMER SCHOOL OF GEOGRAPHY

MR. KRISHNA RAO BHONSLE, LADIES AND GENTLEMEN,

Let me at the outset express my gratefulness to the Madras Geographical Association for having invited me to open the Sixth Summer School of Geography. I need not say how happy I am to be present here and to associate myself with the function of this day.

The Madras Geographical Association is nothing new to me. I have known about its varied work and activities in earlier years; and I appreciate very much the real and valuable propaganda work which it has been doing in this Presidency as well as in other parts of India, in favour of Geography. The journal of the Association is a good production, and can stand comparison with similar productions in other countries. I am very happy to note that the Association and its journal are well known even outside India, in Europe, America and Australia.

By taking up the running of the Summer School course, the Association is serving a very real need indeed. Unfortunately in India there are not many degree courses in Geography; and seeing that the curriculum of schools and the syllabuses have been recently changed, I consider the work of the Association of very great benefit to the Department of Education, particularly at this juncture. Let me congratulate the Association for working on its own resources without expecting Government grant. In this connection, let me also state how much I appreciate the hard work that the Secretary, Mr. N. Subrahmanyam, and his colleagues in the Association, have been doing even in their spare and leisure moments.

In olden days Geography was not taught in the manner in which it ought to be taught; and students were simply asked to remember the names of principal towns, rivers, etc., by mnemonic methods; and the result was that they did not learn Geography in the sense in which it is thought of at the present day. There was a moral from such experience, and that was that they had to go a long way in studying the subject of Geography in the right way. But now partly due to the work of your Association and partly due to other circumstances, the knowledge of Geography in South India is now very much better than what obtained in the days which I can recollect.

Ever since I came to this country, it was my privilege to work with a number of Professors, and I was a teacher in the Teachers' College also. But there were two things which were worrying me. One of these is that those who have gone through high academic courses lacked the power of observation and general knowledge. I do not know if the same state of affairs continues at the present day, for, I have been out of this place for quite a long time. It was very common a few years back to notice that first-class honours graduates were entirely ignorant of what was going on around them, which was passed over as meaning nothing. It was also a common knowledge that when they competed for the Public Service Examination tests, amazing and astounding answers were produced for what may be considered as very simple questions on general knowledge. I sincerely hope and believe that the work of the Summer School of Geography will be aiding a great deal to alter that condition and to teach among all the other aspects, the power of observation, love of Nature and widely extended general knowledge. For that reason, if for no other, I welcome tthe practical training which will be a special feature of the Summer School.

One of the good things that the Association has been doing is its encouragement of travel and excursion. But travel requires a preliminary knowledge of the land you are going to travel through as well as a training in geographical observation. Recently I did a good deal of travel, going home through Australia and New Zealand. I personally feel that if I had done all this travel as a Diploma-holder in Geography or after a training in the Summer School of Geography, I could have come back with a far better knowledge of and understanding of the countries through which I travelled. I am very pleased to know that this Association has popularised school excursions in South India; but let me suggest to you the desirability and usefulness of visiting other parts of India as well outside the Presidency, especially where Geography is taught as a live portion in the Universities. For instance, it will be a source of interest and personal inspiration to the members of the Association if they can see the enthusiasm put into the Geography Degree course in the Aligarh University.

Regarding the note of personal touch in your speech, Mr. Rao Bahadur Krishna Rao Bhonsle, I desire to express my thanks for your kindly references to me. I say that I am really glad to come back to India and be amongst you in Madras to work again in the field of education.

The Association has had a splendid record of achievement; and I wish it still further success in the work of the future. I wish the students undergoing the course in this Summer School a very interesting and happy time. Let me also assure the Association of my best help and co-operation in all its work.

I declare the Sixth Summer School of Geography open.

APPENDIX III

VALEDICTORY ADDRESS TO THE TEACHERS OF THE SUMMER SCHOOL OF GEOGRAPHY

By

Miss J. M. Gerrard.

Ladies and Gentlemen,

This occasion marks the close of a course of concentrated study which reflects great credit, it seems to me, upon all those who have taken part. Sacrificing time and money, teachers have collected from many parts to become students together for a short time; and others have elected to give up of their energy and spare time in preparing and delivering special courses of lectures and practical work, without any gain or profit to themselves. The course seems to have been a very full one indeed; and one of its features is, I think, the number of specialists in different branches who have collaborated together thus affording the students opportunities of coming into contact with many minds.

2. It seemed to me that in sounding the farewell, I ought to emphasize some of the points that the lecturers have been driving home in the course of their lectures and practical classes to you. But, on the other hand, it is possible that you have absorbed as much Geography as you can stand for the present. A dose of 56 lectures and practical classes with 8 sessions of Surveying and 3 after-noon excursions is a pretty strong one when taken in the short period of 17 days. I can recall even now my own state of physical and mental exhaustion after attending a Summer School of Geography at Oxford, 20 years ago. So, probably you too are feeling somewhat limp after this breathless chase after knowledge, and are eager for a rest.

3. The time has come, therefore, for digestion. There is no danger, I feel sure, that you will go from this course in the belief

that you learned all there is about Geography. The aim of the course has been to set you upon the right lines of attacking the formidable mass of knowledge yet to be made your own. I do not doubt but that you are taking away with you lists of references which will be the means of your carrying on the study of Geography to a further stage. I do not think either that you need be warned against the temptation to pass on what you have learned here, in exactly the same form to your pupils. It is not the contents of the subject matter you have learnt that will prove so valuable as the method of approach to Geography. The value it will have for *you* depends upon the insight you have now got into the relation of Geography to human life and experience. The measure of its value will be found in your teaching hereafter, in the extent to which it becomes alive and vivid and the extent to which Geography becomes real and interesting to your pupils.

4. One of the immediate results will be, I hope, the breaking of the shackles that makes your lessons depend upon the text-book. One can understand this dependence when teaching a subject where the foundations are not very secure. The teacher is *afraid* to stray from the text lest he find himself floundering, like a man astray and stumbling in unknown country, full of pitfalls. Will your teaching continue to be nothing but a ré-chauffé of each chapter in the text-book ? This method tends to deaden teaching, and fear prevents the teacher from probing his own deficiencies and at the same time brings boredom and dissatisfaction with one's work. We are all entrapped at times into accepting text-book statements ; and I am reminded of a recent experience in my own teaching. In Form IV we had been discussing in details the crops found growing around Madras, including the explanation of how pulses helped to enrich the soil in which they were grown. In the terminal test the question was asked " Why are pulses grown amongst crops of cereals and cotton ? ". Only two gave the answer expected by the examiner, which was that the pulses helped to enrich the soil. There were a great variety of answers, including statements like the following :—

(a) " Pulses cannot be grown in separate places as it will be too expensive."

(b) " It will be a waste of soil to have only pulses."

(c) " Because pulses are dry crops and they grow between to protect from much sunlight."

(d) " Because they grow quickly, so they plant in between the rows of cotton."

(e) " Because they need little care ".

I realised as I read these answers that my knowledge of the economy of mixed crop farming was far too superficial to be able to deal adequately with these, and that I must set to acquire a far wider and deeper back-ground about crops around Madras than the ordinary text-book treatment demanded.

6. Teaching successive *portions* in the text-book puts the teacher into the position of that guide, which is a figure of fun in Mark Twain's " A Tramp Abroad ". It is all right as long as he can follow the sequence presented and arranged for him; but an unexpected question is apt to put him out completely. So, the teacher needs to digest the chapter portion very thoroughly, he needs to take it to pieces, to re-arrange it and then perhaps he is ready to link up and straighten out where necessary all the queer puzzling notions that arise in 30 or 40 different young minds that are listening to his presentation of the facts.

7. And it is these unexpected questions posed by the pupils that are more important than the text, because they are the ways by which the pupils are learning, and their variety is astounding. No doubt you have heard of " the ships and schools scheme ". It began as an experiment in 4 London schools, each of which adopted a cargo-boat, and by keeping in direct correspondence with the Captain and the Officers and crew, the pupils have been enabled under the guidance of their teachers to follow the course of their adopted ship, to study trade-routes, to learn about ports, countries, climates, customs and peoples, and to obtain direct information regarding trade and the destinations and sources of imports and exports. The children's interest was stimulated by the answers to the questions they had themselves posed :—

1. How do you clean the hold of the ship after carrying a cargo of coal if you have to carry a cargo of wheat ?

2. How long does it take to unload 5000 tons of coal ?

3. To what extent do you rely on wireless reports of the weather ?

4. If a country has a fever, such as malaria, and a boat called at that place and the crew caught it, would they receive compensation ?

5. We often wonder if the ship's crew sing sea-shanties now-a-days, and please how many miles does your ship do on a ton of coal in fair weather ?

How many of these questions could most of us answer straightway ? They are questions which provide evidence of real thinking about things that puzzled the pupils in their learning. And I have quoted these to indicate how various were the ways in which these children were building up their individual concepts of geographical meanings.

8. Such a course as this will help us to enrich the teaching and in so doing helps to give us a deeper satisfaction in our work. Teachers are often assessed wrongly on their capacity to teach. Different judges tend to stress different factors and sometimes the criterion is a superficial one such as the ability to give a lesson in front of a class. To the observer the lesson may seem satisfactory, but who can tell *at that moment* that the exposition was sufficiently linked up with the pupils' experience, and sufficiently stimulating, that it set the thoughts of individual members racing along, to build up concepts and to formulate ideas ?

9. All this then is to point a moral,—how extremely important it is for the Geography teacher of whatever class to lay his foundation both deep and wife.

10. Let me quote from" *an open letter to College Teachers* ": — " The only good way of judging the college or college teaching is by means of the products of the college. We should ask whether the students have grown as a result of their own efforts ; have they come out better educated, better men and women in the broader sense ; have they been better citizens ; have they learned to solve problems ; have they been stimulated to do greater things ? " I think it is on lines such as these that the teaching in the school is to be judged also. And Geography is one of the subjects which when taught properly can lead the pupil to think and to grow, which can awaken in him the consciousness of his own environment and make him aware of other types of human environment.

If this intensive course of Geography will have helped to make Geography real and vital to your pupils, and if it brings you satisfaction in your teaching, then all the time and the effort expended on the course by all concerned will indeed be worth while.

News and Notes

Though this issue of the Journal has been somewhat delayed owing to certain unforeseen circumstances, it is pleasing to note that the varied activities of the Association have been at full swing during the quarter, with regular periodical meetings and with committees functioning in several ways as detailed below.

* * * * * * *

The first meeting of the Association for the quarter was held on 1st August, 1936, in the New University Buildings, when Mr. K. Srinivasaraghavan read a paper on *The Vellar Basin* with Mr. B. M. Thirunarayanan in the chair. (Paper included in this issue).

* * * * * * *

The second meeting for the quarter was held in the Geology Department of the Presidency College, when Mr. P. G. Dowie read a paper on *the Manganese Industry in India* under the presidency of Mr. K. C. Ramakrishnan. (Paper included in this issue).

* * * * * * *

The third meeting for the quarter was held in the History Department of the Presidency College, when Dr. P. S. Loganadhan read a paper on "*Some Recent Trends in the Cotton Industry in India*", with Mr. J. Franco, in the chair. (Also included in this issue).

* * * * * * *

The Standing Committee of the Association examined the replies to the Questionnaire issued in March, 1936, by the Association regarding the conditions of teaching Geography in the Secondary Schools of the Presidency. The Report of their findings has been communicated to the Director of Public Instruction, Madras, in accordance with his Proceedings R. C. No. 231 E-36 dated 20-2-36, for information and necessary action.

* * * * * * *

The Standing Committee continued its deliberations on the preparation of a Syllabus in Geography for Elementary Schools in the Presidency. Owing to the different standards and attainments of the pupils in different localities, it was decided *not to prepare a uniform SYLLABUS* for all localities, but only *to issue a Scheme of Work*, suggesting the main principles and topics, with alternative courses suitable for different types of localities.

* * * * * * *

The Excursion Committee has been preparing a scheme of excursions for the study of the Madras Region. But as the work is still incomplete, it will be published in the next number of the Journal.

* * * * * * *

The Madras Presidency Tamil Sangam had prepared a list of Tamil Equivalents for Geographical Terms as part of their general work. At the time of its recent Conference in Madras, the list was scrutinised and revised by a Committee, presided over by the Secretary of the Association. On his suggestion, this list was sent to the Association for classification, supplementing and further revision, for which purpose the Working Council appointed a Committee consisting of the following members with power to co-opt :— (1) Rao Bahadur R. Krishna Rao Bhonsle ; (2) Mr. S. Balakrishna Ayyar ; (3) Mr. K. C. Veeraraghava Ayyar ; (4) Mr. M. S. Sabhesan ; (5) Miss A. Devadasen ; (6) Sri Krishnaveni Ammal ; (7) Mr. S. Muthukrishna Ayyar ; (8) Mr. B. M. Thirunarayanan ; (9) Mr. K. Srinivasaraghavan ; (10) Mr. K. M. Subramaniam ; (11) Mr. K. Sundaresa Ayyar ; (12) Mr. V. Kalyanasundaram ; (13) Mr. S. S. Krishnaswami ; (14) Mr. Narasimhan ; and Mr. N. Subrahmanyam (Convenor). The Committee already met more than half a dozen times ; and as many more meetings will be required for completing the work, which is expected to be finished by Christmas.

* * * * * * *

The Seventh Conference of the Association will be held at Tanjore in May, 1937, when papers on various aspects of the Geography of Tanjore District will be read and discussed. Members of the Association and others who desire to contribute papers for the Conference are requested to inform the Secretary about it before 15th January, 1937.

* * * * * * *

It is proposed that the next Summer School of Geography may be conducted specially for the benefit of teachers of Geography in Training Schools with reference to the scheme of work in Geography for Forms 1 to 3. Meantime, it has also been suggested that the course may preferably be conducted in a Hill Station. The possibilities of the latter suggestion are being explored ; and the question is expected to be decided by the end of January, 1937.

* * * * * * *

The question of reorganisation of the Secondary School-Leaving Certificate Course will not be undertaken till the expert Committee on Education appointed to study the question in all provinces finishes its work. The existing scheme will in all probability continue in force for some time longer. Meantime, some of the Headmasters are sponsoring a scheme, according to which an extra year's study after completing the School Final Course will be required for entering the University.

* * * * * * *

It is understood that several papers on Geography have been submitted to the newly constituted Geology and Geography Section of the Indian Science Congress, whose next session will be held at Hyderabad in January, 1937. It is hoped that in the course of a short time, owing to the increase in the number of papers on Geography, a separate Geography Section will be constituted in the Congress. Specialists in the subject can help to hasten the time of creation of such a separate Section.

* * * * * * *

The All-India Teachers' Federation will hold its next session at Gwalior during the ensuing Christmas holidays. It has been suggested that a section for Geography may be constituted in it, wherein papers concerning the position and teaching of Geography in the educational systems of the various Provinces and States may be read and discussed.

* * * * * * *

The Seventh World Conference of the World Federation of Educational Associations will be held at Tokyo from 2nd to 7th August, 1937, for which sectional committees are already being constituted. The Committee for Geography consists of 16 members under the Chairmanship of Dr. Takeo Kato, Professor of Geography in the Imperial University, Tokyo.

* * * * * * *

We rejoice to find that railway companies in India are vying with each other, following the example of Western Countries, in the grant of holiday concessions to travellers. It is hoped that teachers, and teachers of Geography especially, will take advantage of them to visit different parts of the country, and thereby enrich their own knowledge and experience for the benefit of their pupils.

Reviews

Europe. By E. M. Sanders. (George Philip & Son, London). 1936.

This is an elementary geography of the Continent of Europe, (excluding the British Isles) for English children of about the Junior School standard. The book is divided into two parts—the first part dealing with the general geography of the Continent as a whole, and the second part with the separate countries. Only central facts of outstanding value have been presented to give the right perspective without burdening the children with unnecessary details. The treatment is descriptive and the language very simple. The volume has been superbly illustrated with typical large-sized pictures, which have been made the basis for a good part of the text, as well as for several of the exercises. Eight simplified coloured maps of Europe make the volume self-contained. Like the other books of Miss Sanders, the book has been made very attractive to children with bold print on glazed paper and fine get-up. In Indian schools, it can be used with great advantage by children of the middle school standard, either as text-book or as supplementary reading book.

Nature Study Reader for fourth year pupils. By Phyllis S. Darling. (Oxford University Press), 1936. Price As. 10.

This is a continuation volume to the author's Nature Study Readers for the second and third year pupils, already reviewed in earlier numbers of the Journal. We appreciate greatly the insistent emphasis on the observational method of study, which forms the basis of the whole series. Most of the chapters in this book, which deal with plant and animal life, may not be directly geography ; but, they inculcate habits and methods, which are invaluable in the study of geography. The first four chapters and the last three, however, deal with what is strictly geography in the characteristic method of the author of insisting on observation and doing. The five charts at the end of the book, together with the description of the figures, will be found highly useful. In this age when mugging up is the usual method of study, a book of this sort is a welcome and healthy corrective.

Longmans' Descriptive Geography; Books I & II (Tamil). By L. D. Stamp. (Longmans, Green & Co., Madras), 1936. Price As. 10 and As. 12.

These are the first two books of a series of three books for forms I to III, prepared in accordance with the syllabus recently issued by the Madras Educational Department. The treatment is direct, clear and simple ; and only facts of outstanding value have been presented. The volumes are copiously illustrated by a large number of good pictures and several diagrams; and exercises have been given at the end of each section. The print, paper and get-up are attractive.

Life of Man on Earth : Books I, II and III. (Tamil). By T. S. Sundaram Ayyar. (Teachers' Publishing House, Madras). 1936.

This is another series of three books for forms I to III, written in accordance with the same syllabus of the Madras Educational Department. The author, who is an experienced teacher of Geography, has taken trouble to present the subject in an interesting manner; and has illustrated the volumes well with pictures, (some of them coloured) maps and diagrams. The treatment, however, appears to be somewhat unequal, being too full in some places and meagre in others.

Descriptive Geography : Books I and II (Tamil and Telugu). By N. Subrahmanyam. (P. Varadachary & Co., Madras). 1936. Price As. 10 and As. 12.

These are the first two books of another middle school series prepared in accordance with same syllabus, written by a specialist on the subject. The instructions and principles, accompanying the syllabus have been closely followed, including the descriptive treatment; and the volumes have been well-illustrated by choice pictures, maps and diagrams. The suggestive exercises given at the end of each chapter not only test the knowledge of the subject-matter but also supplement it in a way. The bold print on glazed paper with the fine get-up make the volumes attractive.

The New Model Pictorial Atlas Geography of the Madras Presidency. By C. S. Subbaratnam. (V. K. Arunachalam, Trichinopoly). 1936. Price As. 8.

This book has been prepared for use in Class V of schools in the Tamil Districts of the Madras Presidency. It has been divided into four parts. Part I deals with certain general features such as winds, rain, sun's position in the sky, etc., together with the practical work connected with them. Parts II and III deal with the Geography of the Presidency—Part II in a general way and Part III regionally. The last part gives a very brief account of the life of man in some important natural regions of the world. The plan is well conceived, and the treatment is clear and interesting, though, we fear, it is above the standard in some places. The book is well illustrated with blocks and diagrams though some of the blocks have not been well printed.

Books and Journals Received

Europe: By E. M. Sanders.

Nature Study Reader for fourth year pupils : By P. S. Darling.

Longmans' Descriptive Geography : Books I & 2 : By L. D. Stamp.

Life of Man on Earth : By T. S. Sundaram Ayyar.

Descriptive Geography : Books 1 & 2 : By N. Subrahmanyam.

Pictorial Atlas Geography of the Madras Presidency : By C. S. Subbaratnam.

The Educational Review : July, August, September and October 1936.

The Scottish Geographical Magazine : July and September 1936.

The Geographical Magazine : August, September and October 1936.

The South Indian Teacher : July, August, September and October 1936.

Akademiya Navk—U. S. S. R. Trudi Instituta Fizicheckoi Geografii : Books 16, 18 and 20.

Problemi Fizicheckoi Geografii : 1936. III.

Journal of Indian History : April and August 1936.

Kalaimagal : August, September and October 1936.

The Geographical Journal : August, September and October 1936.

Foldrajzi Kozlemenyek (Hungary) : 1935, Bk. LXIII, Parts 1 to 8 ; and 1936, Bk. LXIV, Parts 1 to 5.

" " Back Volumes 1926 to 1934.

Educational India : August, September and October 1936.

The Indian Educator : August, September and October 1936.

Mysore Geological Department Records : Volume XXXIV—1935.

Triveni : September 1936.

The Indian Co-operative Review : July 1936.

The Muslim University Journal : April 1936.

The International Observer : Vol. I, No. 1.

Geography : September 1936.

Proceedings and Addresses of the First Indian Cultural Conference : 1936.

Indian Culture : October 1936.

Indian Journal of Economics : July and October 1936.

Geographical Review : October 1936.

Journal of the Manchester Geographical Society : 1935-1936.

Our Home Magazine : October 1936.

The Journal of the Annamalai University : October 1936.

The Journal of
The Madras Geographical Association

Vol. 11 January, 1937 No. 4

*The Human Geography of the Post-Tertiary Alluvial and Sandy Belt of the Madras Coast

BY

MR. N. SUBRAHMANYAM, M.A., L.T., F.R.G.S.

THE POST-TERTIARY BELT OF THE MADRAS COAST

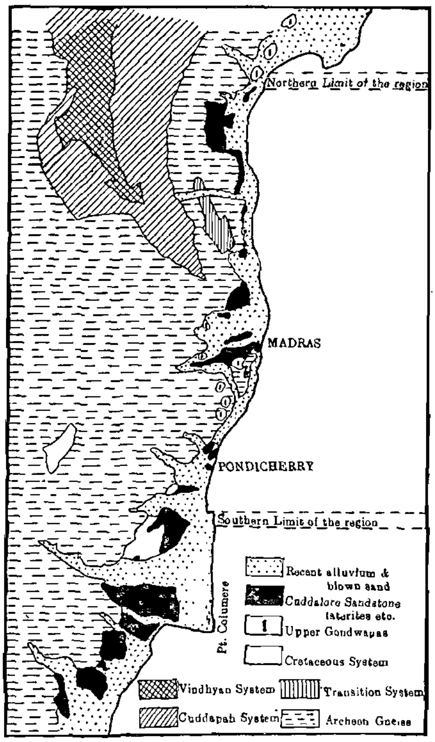
Along the entire length of the eastern coast of South India, as well as beyond this limit, lies a narrow belt of marine beds varying in width from one to four or five miles, though this belt widens into deep bays in certain places extending inland, where they are overlaid by the alluvium of several rivers. The existence of the sea along this belt in post-tertiary times is evidenced by the existence of backwaters and lagoons as at Merkanam, Covelong, Ennore and Pulicat, and the innumerable salt-pans found along the coast. These are, in fact, remnants of the sea, which have persisted in some of the low-lying parts of the plains near the coast even after the coast-line shifted outward to its present position. The islands of Sriharikota, etc., which separate the Pulicat lake from the sea, as well as long stretches along the Buckingham Canal southwards from Adyar, are entirely built of these marine beds. It is well-known that they furnish immense quantities of shells, which form an important article of export, being used in the manufacture of chunam for building purposes. These shells of marine animals are conveyed in boats along the Buckingham Canal to Madras and other places.

This belt of marine alluvium is bordered on the seaward side by the last and the youngest of the geological formations of South India, namely, *blown sand*, which is found forming low hillocks

* A paper read before the Geology and Geography Section of the Indian Science Congress at the 24th Session held in Hyderabad, January 1937.

fringing the beach, and sometimes forming ridges considerably inland. They are entirely due to the action of winds; and their further inroads inland are somewhat checked by vegetation, as is shown presently.

Sketch map of the East Coast between the mouths of the rivers Kistna and Cauvery showing the Geological formations.



NATURAL VEGETATION

The natural vegetation along the sandy beach in this belt is monotonous and distinctly open. The forms of plant life on the sands are perennial prostrate herbs,which send long tap-roots into the soil and carry numerous long trailing shoots in a tuft—the trailing stems often striking roots at the nodes. Some of the forms like Iponea Biloba are efficient sand-binders, since the numerous adventitious roots form a compact net-work through the repeated branching beneath the soil.

On the sand-dunes in several places are found in a dense cluster Spinifex Squarrosus, which possesses big fruits that hop with currents of wind.

On the backwaters and river-mouths is a different type of vegetation, showing xerophytic features. Nearer the water and washed by it all along the bank is to be seen the Avicennia Officialis, which is of the mangrove type. Several seedlings of this plant may be seen stranded on the beach after a storm. A little higher up along the banks grows abundantly Suaeda Maritima, which has short, thick, glaucous leaves with few inter-cellular spaces.

HUMAN GEOGRAPHY

This long narrow belt is apparently a most unpromising region for supporting human life of any kind. The swampy low-lying stretches of saline soil and the shifting sands which nowhere approximate to a loam, are alike incapable of allowing agriculture or animal husbandry to be carried out to any extent. It is interesting to find that, in spite of these natural disadvantages and drawbacks, the region has been developing in a way suited to its peculiar conditions. Over long stretches we find nowadays the ground has been covered with cocoanut and casuarina plantations and occasionally with cashew-nut trees.

True it is that *the cocoanut* has not got the same natural conditions of growth in the east coast as along the backwaters of the *west coast of India, except in the deltas. Still, it is surprising to* find that it has flourished in the coastal tracts of Madurantakam taluk and elsewhere as can be seen by a boat journey along the Buckingham Canal. The sandy saline soil suits it best, and hydrographic conditions decide the rest. Wherever sub-soil water is available, ponds are easily dug in the sand and water baled out by means of piccottahs, as can be seen even in the neighbourhood of Madras City. Boat-loads of ripe cocoanuts, transported on the Buckingham Canal are in frequent evidence on the canal wharves. The topes in the proximity of Madras are, however, utilised not for producing the fruit but for yielding toddy, for which there is an un-ending demand from the thirsty labouring population of the big city. The Edakkainadu of Cheyyur and Chunampet Zamindaris supply the metropolis with large quantities of the ripe cocoanut, required for the growing urban population for religious and culinary purposes, besides what is being supplied from the deltaic tracts by the railway. There is, however, no copra or coir industry developed in the east coast cocoanut plantations as in those of the west coast.

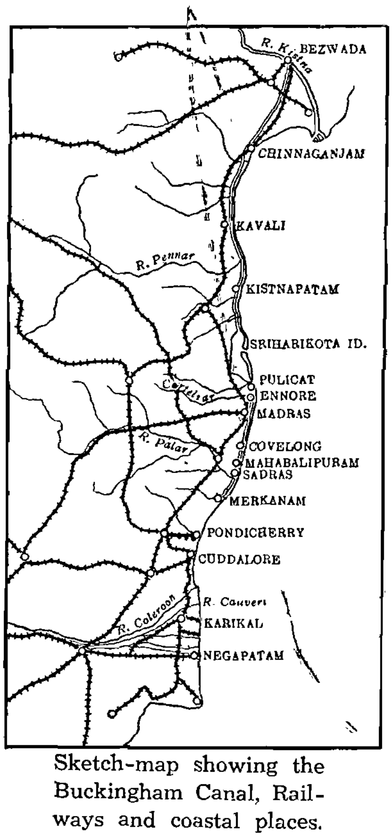
The casuarina, an exotic 'tropical pine', which has gained a naturalised citizenship, finds its ideal conditions in the sandy belt, and has proved itself the ideal type of tree for the region. Any watering or attention is required for just one or two seasons only, after which it flourishes mightily in the dry sandy soil without the need for any further attention.

There is a steady and growing demand for its firewood in the towns of Madras, Pondicherry and Cuddalore on the coast as well as those inland; and the fuel problem of the coastal towns has been solved by the growth of this tree in the sandy belt and by the existence of the Buckingham Canal along it, even in its present neglected condition. So useful and profitable has been this tree as fuel for domestic and other purposes that its plantation has been extended to inland areas, especially near the banks of rivers like the Pennar and the Palar, where the soil is sandy loam. Cuddalore is an important centre, supplying seedlings of casuarina for large areas round about.

More important than its use as fuel is the way that this tree improves the soil permanently. Like the Leguminosae, the root nodules of this tree serve to fix the free nitrogen of the air, thereby improving the soil. Moreover, the fallen leaves, if they are wisely allowed to remain on the ground, turns to humus which mixes with the sand and forms an excellent loam on which good dry crops can be grown as well as grass. Thus after some repeated plantings of casuarina and the conversion of the soil into loam, the land can be turned to pastures which would support animal husbandry as a new industry in the region. Ignorance on this point is responsible for the clean sweeping of the plantations that is unfortunately being allowed in most places, the dried leaves being gathered by the women-folk for 'boiling' rice. One other advantage of the casuarina plantation along the sandy coastal belt is that it acts as a binder for the soil and as wind-screen, preventing the shifting of the sand by the agency of the wind and encroaching on the cultivated areas. This is analagous to the successful planting of the pine tree in the Landes region of south-western France for a similar purpose.

The cashew-nut tree is another important tree of monetary value that has done well in this sandy belt. But so far it is only in Nellore and South Arcot districts that these trees have been planted in any very large numbers and yields a considerable crop. An extension of the cashew-nut plantations is easily possible outside the districts mentioned above also, and will be highly profitable. The superiority of this tree over the casuarina lies in the production of a commodity of small bulk of relatively high value unlike the firewood whose transport would have been a problem but for the canal.

The post-tertiary formation, which comprises our present region, is at the farthest (seaward) end of a peneplain; and it is consequently sure to have a perennial supply of underground water with the water-table not far from the surface. A hydrographic survey of the region and the tapping of the underground water resources by modern methods of boring and pumping will help to extend the several plantations of this region.



Sketch-map showing the Buckingham Canal, Railways and coastal places.

The backwaters and lagoons have afforded facilities for the production of *salt* in several places by baling out the brine on to pans, allowing the water to evaporate, and then scraping out and collecting the salt. The existence of the several factories at Merkanam, Covelong, Ennur and several other places in this region as well as in other parts of the province accounts for the fact that this Presidency has been self-sufficient in the matter of the supply of salt without having to import the mineral at all. The Buckingham Canal has again been useful in the transport of the material to the city markets.

Fishing in the backwaters and in the open sea has been another natural industry of this coastal belt. The existence of hundreds of fishing hamlets, called Kuppams, along the sandy fringe, as can be seen from the one-inch maps of the region, shows how the bulk of the population living in this unpromising tract carry on their livelihood. Venturing in their frail catamarans into the open sea, these fisher-folk return home with their catch of the day. But their chief difficulty is the absence of quick transport from remote places to the city markets. Fresh fish is brought from Sadras everyday to Madras by motor cars. From Thada and Arambakkam stations on the East Coast Railway, the fish caught in Pulicat lake in the neighbourhood of those stations is sent by railway to the city. But elsewhere these facilities are not available, as most places in the region are away from road or rail. Hence much of the catch is converted into dried and salted fish, which is sent by boat along the canal to Madras. If the Buckingham Canal is deepened and widened, fresh fish could be sent to the city markets in quick motor boats. It has to be remembered that fish has its agricultural value as manure; and if it is also remembered that the fisher-folk who can venture in their frail craft far out into the open sea will form the backbone for the future Indian merchantmen and navy, the importance of the fishing industry cannot be sufficiently emphasised. A long stretch of coast-line, even though it may be very regular and unbroken, which is dotted with fishermen's hamlets, is indeed from this point of view an asset for the land.

The existence of the *Buckingham Canal* and its utility have been incidentally touched upon above. But the subject requires a more detailed consideration here. The Canal runs for a distance of about 200 miles northwards from Madras to Pedda Ganjam, linking the metropolis with the Godavery and Kistna Canal systems, and for about 60 miles to the south of Madras to Merkanam in the South Arcot district. Practically, the whole of our region of study is connected by this canal, which links up the several backwaters and lagoons, and runs along or just behind the belt of blown sand. It has already been mentioned how the Canal has been useful for transporting salt, salted fish, firewood, and shells—

all of them products obtained in this region. Wherever feeder roads connect it with the interior, other produce is also carried through the Canal; e.g., from Maipadu and Krishnapatam in the Nellore District, rice is sent to Madras. Even from distant Tenali in the Kistna delta as well as from the Godavery delta rice and cocoanuts used to be sent in large quantities in former years; but the competitive rates have tended to discourage this trade.

It is a well-known fact that *water-transport* is considerably cheaper than land transport of any kind; and if heavy and bulky articles have to be carried over a good distance, the former stands pre-eminent, if no undue artificial advantages are available for the latter.

For the *better development* of the resources of the region under study, it is, therefore, necessary that the Canal should be kept in proper condition—deepened, widened, with the silt removed from time to time, so that it can be used even by motor-boats if necessary. The question is not one of *constructing a new canal, but of improving and keeping in an efficient condition one* already in *existence. The capital expenditure that may be involved in such improvement* is well worth it in view of the several expected advantages. Firstly, there is the increased volume of trade between the productive deltas and the capital city, which is sure to follow with better facilities for cheap and quick transport. Secondly, the industries and occupations of the coastal belt are sure to develop rapidly, leading to increased production; and the region will then be able to support a larger population than it does now.

But more spectacular than either, and certainly more remunerative in the long run, will be the development of a tourist industry. With the growth of quick motor-boat traffic, resort centres might grow at places like Ennore and Pulicat, drawing large crowds of visitors for jolly boat excursions and water sports, and not merely for snipe-shooting and fishing. What is required to popularise it is adequate advertisement. The growth of a tourist industry, as it has developed in western countries, is yet to take place in India; and when that development comes to happen, some of the lagoons and backwaters of the east coast, though inferior to those of Malabar, are sure to attract visitors, at least owing to their proximity to the Capital of the Province. An improved Buckingham Canal in proper condition has its part to play in that consummation.

Good slices of the hinterland of the Port of Madras have been taken away as a result of the development of the new harbours of Vizagapatam and Cochin; and if Madras is to hold her own in the world's trade, and not fall away considerably from the position which she had been holding, all parts of her remaining hinterland have to be properly developed; and the coastal belt discussed about is not without its potentialities, as has been shown in the paper. The tapping of the underground water resources, the extension of the plantations, the construction of feeder roads connecting with the interior, and above all, a proper improvement of the Buckingham Canal will convert this maritime belt so near the Capital into an important, better populated region.

LIST OF REFERENCES

(*N. B.*—Much of the material was gathered first-hand by personal visits to several parts in the region.)

The following are some of the books and Journals that were specially referred:—

Oldham's Geology of India.

Wadia's Geology of India.

Prof. H. Narayana Rao's paper on the Geological Evolution of the Madras Region (Vol. I, No. 2 of the Journal of the Madras Geographical Association—1926-27).

Prof. M. S. Sabhesan's paper on the Plant Geography of the Madras Region (*ibid*, Vol. I, No. 3—1926-27).

Mr. V. K. Sourirajan's paper on the Buckingham Canal (*Ibid*, Vol. III, No. 4—January 1929).

Gazetteers of Nellore and South Arcot Districts.

Manual of Chingleput District.

Statistical Atlas of the Madras Presidency.

District Atlas of the Madras Presidency.

One-inch maps of the coastal belt.

Madras Administration Manual.

*The Industrial Crops of Kerala

BY

MR. GEORGE KURIYAN, B.Sc. (LONDON.),

In Sanskrit literature, from the earliest times, the region lying west of the Western Ghats has been designated 'Kerala'. The Origin of the word is very difficult since the authorities differ considerably on the point; it may, as the Rev. Mr. Foulkes points out, be the same as Chera or the name might have had its origin in the word Keram (a word which denotes the coconut). What ever the origin of the word may be, in popular parlance at the present day, it denotes the region lying to the west of the Western Ghats where Malayalam is the predominant language.

Kerala has a certain peculiarity of its own; it lies on the south-western corner of India and is bounded on the west and south by the Indian Ocean and to the east by the Western Ghats. The northern boundary has not been the same right through. Although the district of South Kanara has much in common with Kerala, both geologically and climatically, yet the language is Canarese, which has little in common with Malayalam, the customs, manners, mode of dress especially of women, the devolution of property etc., are all different. It has therefore been considered advisable to limit the scope of this paper to the cultural region of Kerala rather than to the whole geographic region lying to the west of the Western Ghats. The northern boundary of the region may therefore be taken as the district of S. Kanara. Climatically this region is different from the rest of India with a very high summer rainfall (generally more than 80″, in parts even 150″) and with a moderately heavy rainfall during the season of the retreating monsoon (about 30 to 40″).

Kerala comprises of the three following political units:—

1. The district of Malabar in British India, area 5792 sq. miles; population 3,533,944.

2. The native state of Cochin, area 1480 sq. miles; population 1,205,016.

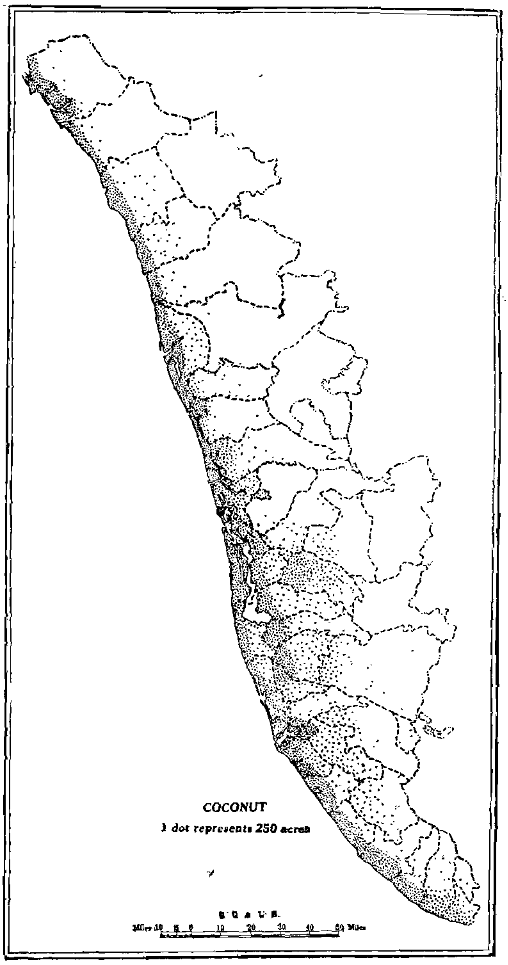
* A paper read before the Geology and Geography Section of the Indian Science Congress at the 24th Session held in Hyderabad, January 1937.

3. The native state of Travancore, area 7625 sq. miles; population 5,095,973.

Total area of Kerala 14,897 sq. miles.

Total population 9, 834, 933.

The density of population in Kerala is 660·9 persons per square mile but it varies very considerably within the three political units, Cochin being the most dense with a density of about 814 persons per square mile, Travancore being the next with a density



of 668 persons per square mile and Malabar having a still lower density of only 609·9 persons per square mile. Nevertheless it should be borne in mind, that these densities are far in excess of the average densities of the other provinces of India. (viz. Madras

Presidency 329 persons; Bengal 646 persons; United Provinces 456 persons; Punjab 236 persons; North West Frontier Province 179 persons; Bombay 176 persons; Central Provinces 155 persons; Assam 148 persons; Burma 63 persons; Baroda 299 persons; Hyderabad 175 persons; Mysore 233 persons, etc.). This indicates very clearly that the region has some natural advantages by which she is able to support such a high density of population. Climatically she is particularly blessed in that there is no season of drought, irrigation invariably is unnecessary (the exception being the Nanjinad rice of south Travancore) the temperature is high, right through the year, so that, agricultural operations are carried on for all the twelve months of the year. Possessed as the region is with a very suitable climate, it is by no means surprising that the most important activity of the population is agriculture. Although agriculture forms by far the most important occupation of the people, (more than ⅔ the working population or nearly ⅕ of the total population is engaged in agriculture) in this paper, I shall attempt to give some idea of the cultivation of, and industries associated with, some of the special crops like coconut, tea, rubber, pepper, cardamom, coffee etc.

COCONUT.

Acreage of Coconuts.

		acres
Malabar	..	335,351
Cochin	..	68,233
Travancore	..	587,464
Total	..	991,048

Number of persons employed in the cultivation of Coconuts.

		persons
*Malabar	..	2,145
Cochin	..	21,284
Travancore	..	166,916
Total	..	190,345

190,345 persons are employed in the cultivation of coconuts.

* The total number of persons employed in the cultivation of coconuts is only 2,145 in Malabar according to the latest census returns. The total area under the crop is 335,351 acres. It is unlikely that 2145 persons could cultivate such a large area, and probably there are several persons who cultivate coconuts, but who are not returned in the census statistics as cultivators of coconuts as it formes only a part of their occupation.

Among the special crops cultivated in the region, coconut is the most important one and it occupies nearly 90% of the total area under these crops. " There is no essential requirement of the people which some part of the tree cannot supply. Apart from the several uses of the chief products, viz., coir, copra, coconut, oil, oil-cake, the hollowed trunk serves as a canoe, the nut forms a staple article of diet and a very wholesome one, the leaves may be used for many of the purposes of paper, are frequently employed as thatch and for the manufacture of brooms, baskets, umbrellas, thattis, and fans and utilised as crude torches in a dried form, or burnt as fuel, either as it is, or in the form of charcoal. In addition, the fresh or fermented juice of the stem is consumed as a beverage, by evaporation it is made into jaggery and by subsequent treatment even sugar is obtainable. When distilled, the toddy becomes arrack and finally vinegar." It is clear that a plant, the produce of which can be put to such wide and varied uses, is bound to play an important role in the economy of any region where it is grown.

CLIMATE AND SOIL.

Good crops are not. obtainable from any region where the climate is characterised by prevailing cloudiness. The lowest tolerable temperature for the tree is 71·6°F (22°C) but in the regions where the temperature is at least not less than 3°C more than this, the production is low, i.e., an average temperature of 77°F (25°C) is the minimum. A temporary fall of even 15°C does not do much harm. Semler suggests 10°C as the lowest tolerable temperature. However the tree thrives best where it is most constantly warm. So long as the heat is not too drying, it is unlikely that coconuts are ever injured by too high temperatures. Latitudinally the limits are about 20°S and 20°N of the equator, but in Madagascar in 25°S they are grown and even in Lucknow (27°N) they are found, but in either case the trees are not very productive.

The limit in altitude depends on latitude; in general it will grow at the greatest altitudes, on, or a little north, or south, of the equator. On a commercial scale however, they are found only up to an elevation of 300 metres (1000′ approximately) and as one proceeds further away from the equator, they are confined more strictly to the lowlands.

Moisture is more important than temperature. Conditions should be such as to permit the most active possible transpiration without the tree suffering from loss of water. In a part of Ceylon where the coconut industry is thriving, the rainfall is 70″ and this is usually considered to be the representative rainfall. In Java where the rainfall is 3 metres i.e., nearly 120″ the tree is found to thrive. On the other hand coconuts also thrive in Puttalam (Ceylon) where the rainfall is only 50″ (127 cms.). Zamboanga in the Philippines has the best coconuts and the rainfall is less than 40″ (1 metre).

High atmospheric humidity is commonly regarded as beneficial to coconuts, but this is justified only in so far as too dry air may result in the trees losing water faster than the roots can replace it. It is perhaps best to state that dryness of air never hurts the coconut except when it is accompanied by the dryness of the soil. Not humidity, but really dryness of air is really favourable for coconuts whose roots are always and adequately supplied with water. Very moist air not only checks transpiration (and therefore poor supply of mineral food) but is an indispensable condition for the spread of at least a part of the pests causing bud rot. Too great humidity (as reported from Deli, Sumatra) causes a premature decay of the fruits.

The wind increases the transpiration and hence as long as enough water can be supplied by the roots, it is beneficial; but beyond this it is injurious to the tree. Where the soil is dry, but little wind is desirable, where the roots are constantly well watered, the atmosphere must be windy.

Coconut roots will not grow into water and they must always have a reasonable supply of water available for absorption. Exceedingly porous soils are usually unsuitable as they are too dry, nevertheless, the most porous soils can be used, if for some reason or other, water is available. This is the condition which actually exists on the beaches. Soils with an impermeable hard pan near the surface are unsuitable for coconut cultivation, because during the rains, they become too full of water and injure the roots. Very stony soils are unsuitable in general as they are sterile and dry.

The best soils perhaps are the soils of the deep alluvial plains, rich in food easily worked, and which permit an excellent root system to develop. It has been observed universally that sandy shores (or shores of backwaters as in Kerala) are very suitable because they have behind them higher country, and the rainfall, which falls in this higher country, sinks into the soil and then moves in the soil towards the sea, carrying with it food which it dissolves as it moves. In times of drought it moves in more limited quantities as the water is scarcer, but the sea shore itself being the place where such water comes close to the surface of the ground, is the last place to suffer from the scarcity of it. So long as there is enough water in the soil any where in the region behind the beach to permit it to move to the ground, the beach itself will contain ample available fresh water and in general the less of this water there is, the richer it is in plant foods. Behind the lagoons or back-waters, coconuts thrive very well as is evidenced by the distribution of the coconuts in Vaikam taluq, Changanacherry taluq, Kottayam taluq, etc. Chirayinkil, Karaunagappally and Quilon are taluqs bordering on the sea and hence one notices the intensity of coconut cultivation.

It is moving water in the ground which is primarily responsible for the high development of the trees on shores and therefore, the country sloping upward from the sea even for great distances make good coconut country so long as there is still higher ground at the back of them from which they can derive a constant supply of soil water. The country around the bases of mountains, whether near the sea or far removed from it, is therefore good coconut country. Kinjirappally and Pathanamthitta are good examples of this in Travancore. The cultivation of coconut has in recent times been carried from the sea board division into the interior, so far as the valleys and hills of the submontane region. Even in the best of times the cost of transport is too heavy for the cultivator in these regions to derive any benefit from the husk. The whole output goes to waste.

In general soils which contain free water are unfit for the cultivation of coconuts, still if the level of the land is such that water is moving in the soil, then coconut will thrive, e.g., in areas bordering paddy fields, the level of the coconut plantations is only 2′ or 3′ higher than the paddy fields, but all the same, the subsoil water is moving into the lower levels of the paddy fields which explains the growth of the coconuts. There is a wide spread belief that the coconut needs salt for its development (probably because they thrive on the sea shore) but, this does not seem to be true. The sea beach even though it be beside the ocean is found to be as free of salt as the land which lies above it. The coconut roots can endure salt, but this does not mean that it either wants it or can make use of it.

Proper physical composition of the soil is more important than chemical composition, if only the coconut plants are able to secure sufficient water.

In Kerala, out of a total cultivated area of 4,060,778, acres, coconut alone occupies 991,048 acres i.e. nearly 20 to 25% of the cultivated area. It is not untrue to say that the rural economy of the whole region of Kerala is dependent upon this tree and as has been suggested before, it is not improbable that the land itself got this name from the tree.

There are many industries associated with the coconuts, the most important however are coir and copra. The chief peculiarity of coir ropes is its elasticity—the coconut fibre will stretch fully 25% without breaking. The exact amount of stretch which ropes made of it will stand depends upon the mode of manufacture, but in all cases, they stretch better than ropes made of any other commercial fibre. It is again less subject to decay. Of the fibres, the most resistant to decay, is Arenga and the next is coir, but Arenga (sugar palm) is not an article of general commerce. The same coconut trees cannot be made to produce coir to the best purposes of oil of the highest quality; one or other of the product must in a measure be sacrificed. As a general condition, Copra or the oil is more valuable.

The first step in the production of the fibre is the removal of the husks from the nuts and is therefore the same as the first step in the production of Copra. The husks are then macerated by soaking them in fresh water, stagnant water, or salt water, until the fibre can be removed easily from the waste matter in which it is embedded. When the fibre is to be cleaned by hand and the retting is done in clean fresh water, the husks are said to be left in it for at least several months and sometimes for as much as a year and a half. In salt water maceration is more rapid and in stagnant water still more so. (The beaten husks require only a period of 2 to 3 weeks in stagnant salt water.) The maceration is hastened by boiling or skinning the husk, and it is a common practice to hasten the decay by opening the husk before soaking begins, so that the water may immediately penetrate the interior. If the soaking stops soon enough, the fibre is hard and clean, but if it continues too long, the fibre becomes dark and loses its value and loses also its strength by decay. The time for cleaning should therefore be as short as possible. The husks after soaking are beaten thoroughly and then scraped and combed. The more thoroughly this is done the better price the product will bring.

To-day however, machinery has become important, the husks are soaked in concrete tanks in fresh water for two or three days, they are taken out and subjected to a mechanical combing and then are hand-combed and are finally graded. (The husk of 100 good nuts will yield 68 to 79 kilograms of coir if the manufacture is by hand and about 89 kilograms in well regulated factories.)

In spite of the diminishing prices of coir in the near past, the quantity of coir yarn produced has not diminished. Matting is manufactured in Alleppey (consumes 40% of the yarn production of Travancore). The chief Indian markets for the Coir yarn are Calcutta and Rangoon. Outside India, United Kingdom is the largest consumer. Exports are made to United Kingdom, Germany, Belgium and Holland. Travancore produces some of the finest types of yarn with a practical monopoly in certain grades of coir yarn. Its chief competitor is the Galle yarn of Ceylon. Calicut yarn also has now begun to compete with Travancore yarn.

Copra is the most important of the products of the coconuts. The best yield of copra will be obtained when the majority of the nuts are slightly beyond their prime (the fibre loses a considerable part of the value when the nuts are beyond the prime). Although there are 3 different methods of drying copra—sun drying, grill drying or smoking, and kiln drying—in Kerala the only prevalent method is the sun drying process which requires good exposure to the sun for 4 to 7 days and produces an article of high quality if the weather is sunny. If however, rain falls while the copra is drying, it is permanently damaged unless it is protected from the rain. Care in drying the copra explains the high quality of the Cochin Oil.

	Number of Workers.			Total Industrial workers.	Approximate percentage of workers of coconut industry to total workers.
	Male.	Female.	Total.		
Malabar	3,669	40,124	43,793	221,058	20%
Travancore	43,642	82,785	126,427	351,076	36%
Cochin	11,570	25,887	37,457	118,546	33%
Total	58,881	148,796	207,677	690,680	33⅓% nearly ⅓

These statistics indicate very clearly the predominant part which women play in this industry; more than ⅔ the workers are women. Preparation of the coconut fibre, and the spinning of the coir yarn are carried on mainly as cottage industries (nearly 95% of the coir made is outside the factories). Most of the work can be carried on in the home and hence the preponderance of the female element. The weaving of mats and mattings out of coir yarn prepared by the cottage workers is done largely in the factories where more men than women are employed.

Negapatam : A Seaport Town of South India

By

Mr. S. R. Pandyan, B.A., L.T., Dip. in Geo.

SITUATION.

Negapatam is a minor port on the East Coast of peninsular India, situated on the seaward side of the delta of the Cauvery, about 170 miles South of Madras, in 10°45'N latitude and 79°5'E longitude.

Negapatam or Nagapattinam must have been a port from time immemorial. According to the ancient Tamils, a town situated on the coast (நெய்தல்) was called a "pattinam," e.g., Sennaipattinam (Madras), Sathurangapattinam (Sadras) and Massulipattinam (Masulipatam). The prefix "Naga" to "pattinam" has led some scholars to conclude that it was the chief town of the Nagas—who came from Lower Bengal and settled somewhere here. The date and cause of their coming is obscure. They are supposed to have been a fierce and hardy people of Turanian descent, and the ancestors of the present Kallars and Maravars.

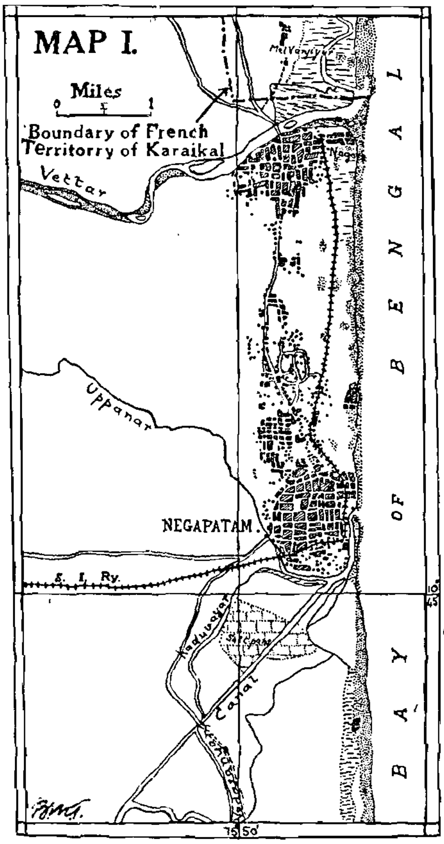
The situation of the original fishing village at the mouth of the river Kaduvaiyar made it possible for boats to go up and down the stream and to carry on a brisk trade with the interior in coastal products like salt and dried fish. Such a situation was of very great advantage in early days. (Map I.)

As the village stood at the confluence of two rivers (Kaduvaiyar and Uppanar) the scope for river traffic was larger in proportion.

The availability of fresh water very near the coast, in fact within 200 yds. from the sea, must have been an additional advantage.

The presence of big sand-hills on the coast gave shelter to the fishing folk in times of bad weather. Even to-day Nambian Kuppam—the fishing village in Negapatam, stands on a huge sand-dune 40-50 ft. above sea-level.

Negapatam lies due east of Tanjore which was the Chola capital for some time. So there must have been a great impetus for its growth in Chola times. Just as Mahabalipuram was the port of the Pallavas, Negapatam served as the port of the Cholas.



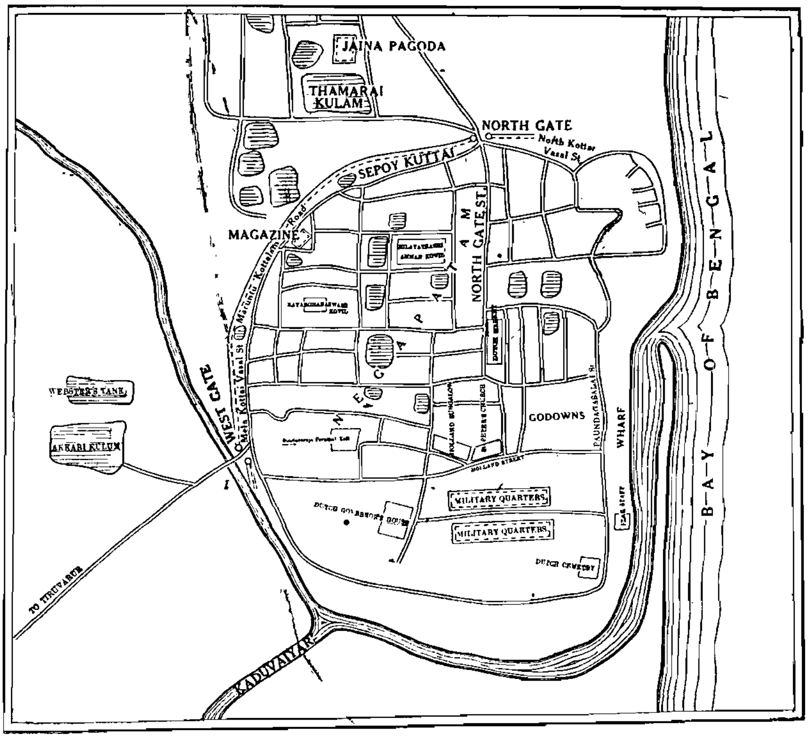
LATER DEVELOPMENT OF THE TOWN.

(*i*) *Under the Cholas.* There are references in the Tamil works like "Periapuranam", and "Thevaram" to Negapatam as the political capital of a Chola province. At this time, it was not only a port and a provincial headquarters, but was also an important seat of Buddhist worship. We learn that the Buddhist temple at Negapatam was endowed by Rajendra Chola I in 1006 A.D. and it was built by Chulamanavaram, king of Kidaram, possibly in South of Burma or Siam."[1] There are also Burmese inscriptions of the 15th Century mentioning the visit of a party of Buddhist priests from Pegu. A remarkable fragment, probably of the famous Buddhist pagoda of the 11th Century survived till 1867, when it was pulled down by Jesuit Missionaries to build their college on the site. Tradition says that a Vaishnavite saint carried away the gold images of Buddha and used it for some other purpose. But we have few historic records as to the growth and development of the town until we come to the advent of the Europeans.

(*ii*) *Under the Portuguese* (1612-1660). The first European settlers in Negapatam were the Portuguese and they called it, " The city of the Coromandal "—perhaps their biggest station on the East Coast. But not much is known about their time.

(*iii*) *Under the Dutch* (1660-1781). In 1660, the Dutch got possession of it and in 1689 made it the seat of their governor. A

II Some Important Buildings of Dutch Times.



Tanks.

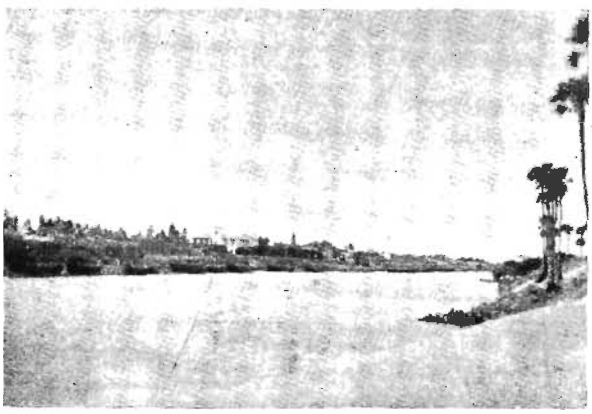
Structures that still exist.

Structures that do not exist.

new castle was built at a cost of 1,600,000 guilders which far surpassed Fort Geldria (Pulicat) in size and strength. At the time of the Austrian Succession War, on the coast lay three important cities—Negapatam under the Dutch. Pondicherry under the French, and Madras under the English. Each was a place of large trade, each was inhabited by some 20.000 to 30.000 Indians, who had gathered themselves round the small group of Europeans 400 to 500 in number, who formed the dominant element: each was a place of reputed strength."[2] The Dutch have left a deep impress on Negapatam. There still remain several structures erected by the Dutch like (1) The Flag Staff. (2) St. Peter's Church. (3) The Holland Bungalow. (4) The Governor's House. (5) The Dutch market, etc. The names of important roads which originted in the Dutch times still continue. e.g. (1) Holland Street. (2) North Gate Road. (3) West Gate Road. (4) Marunthukothalam Road. (5) Pandagasalai Road, etc. (Map. No. II).

(*iv*) *Under the English* (*Since* 1781). During the American War of Independence, England declared war on the Dutch republic (in 1780) and in the following year, the English captured Negapatam and made it their own. Even to-day Negapatam is an important town and the head-quarters of the East Tanjore District.

Geology of the Coast. The soil is fluviatile alluvium of varying composition. The coastline is smooth and unbroken, with the sandy beach and a broad continental shelf. There are huge sand-ridges just near the sea varying in height from 5—50 feet "The greatest elevation is attained by an isolated sand-hill, on which is built *Kuppam* or fishing village of Negapatam. The



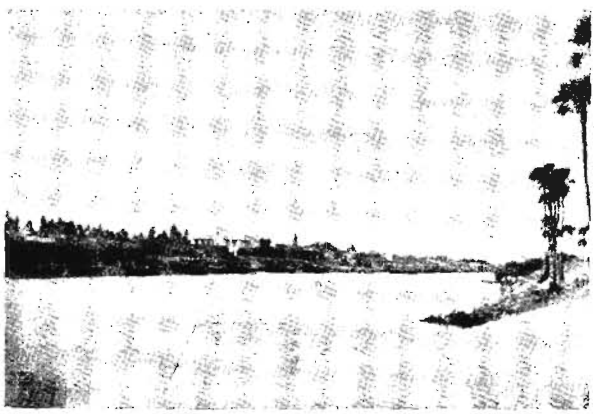
General view

sand-hill in this case is fully 50 ft. above the surrounding beach, and commands a fine view over the level country all round."[3]

of the Austrian Succession War, on the coast lay three important cities—Negapatam under the Dutch. Pondicherry under the French, and Madras under the English. Each was a place of large trade, each was inhabited by some 20.000 to 30,000 Indians, who had gathered themselves round the small group of Europeans 400 to 500 in number, who formed the dominant element; each was a place of reputed strength."[2] The Dutch have left a deep impress on Negapatam. There still remain several structures erected by the Dutch like (1) The Flag Staff. (2) St. Peter's Church. (3) The Holland Bungalow. (4) The Governor's House. (5) The Dutch market, etc. The names of important roads which originted in the Dutch times still continue. e.g. (1) Holland Street. (2) North Gate Road. (3) West Gate Road. (4) Marunthukothalam Road. (5) Pandagasalai Road, etc. (Map. No. II).

(iv) Under the English (Since 1781). During the American War of Independence, England declared war on the Dutch republic (in 1780) and in the following year, the English captured Negapatam and made it their own. Even to-day Negapatam is an important town and the head-quarters of the East Tanjore District.

Geology of the Coast. The soil is fluviatile alluvium of varying composition. The coastline is smooth and unbroken, with the sandy beach and a broad continental shelf. There are huge sand-ridges just near the sea varying in height from 5—50 feet. "The greatest elevation is attained by an isolated sand-hill, on which is built Kuppam or fishing village of Negapatam. The



General view

sand-hill in this case is fully 50 ft. above the surrounding beach, and commands a fine view over the level country all round."[3]

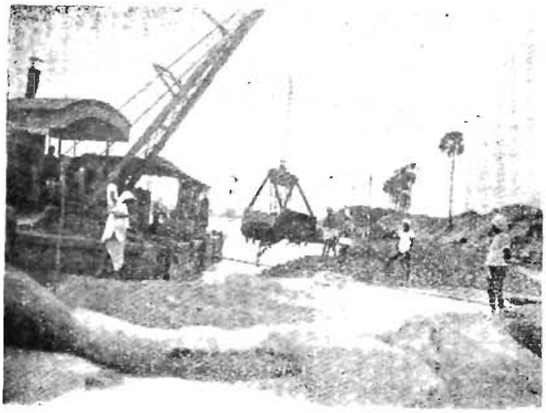
There are no general indications of any tendency on the part of the sand ridges to advance inland. This comparatively stationary condition of the blown sand-hills appears to be caused by the petty effect of the monsoons. Though the North-east monsoon blows on the coast with much greater force than the South-west, its transporting powers are negatived by the heavy rains, which by saturation for a considerable time effectively bind the loose particles of sand. The sand hills have a steep slope facing the sea, and the land-ward side is backed by bushes and palmyra palms.

There is a lateral current near the coast which carries away the silt from the river Kaduvaiyar and retards the formation of a delta. But the river has built up a long sand spit, about half a mile long. The drift to the North is felt even when one is bathing in the sea at Negapatam. Last November (1935) during the cyclonic weather, the river cut across the spit at A and entered the sea.

Landing Cargo

Much money had to be spent on blocking the newly made entrance by sand bags, and again diverting the river *via* the old channel. This step had to be taken because the wharf is built just opposite to the tip of the sand-bar. The river has to be dredged every now and then to keep it deep enough for boats.

When we come inland leaving the sand-hills at the coast, the topography of the land is flat and monotonous for miles, typical of the deltaic tract.



Dredger at work

CLIMATIC STATISTICS.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Mean maximum temp. ° F.	81·8	84·4	88·7	92·5	97·3	97·1	95·9	93·7	92·5	88·4	84·1	81·5	89·0
Mean minimum temp. ° F.	70·8	72·1	75·5	79·0	80·2	79·2	78·2	77·3	76·5	75·9	74·1	72·1	75·[illegible]
Mean monthly temp. ° F.	76·3	78·3	82·1	85·8	88·8	88·2	87·1	85·5	84·5	82·2	79·1	76·8	82·[illegible]
Mean monthly rainfall, inches.	1·60	0·84	0·32	0·72	1·9	1·46	1·89	3·53	3·74	10·15	17·3	10·9	54·[illegible]
Mean No. of rainy days	2·4	0·8	0·5	1·0	2·1	2·7	3·4	5·5	6·0	10·4	13·1	9·1	56·[illegible]
Monthly distribution of cyclones in the Bay of Bengal. 1877-1903.	0	0	0	1	8	4	0	0	6	8	17	6	50

THE CLIMATE OF NEGAPATAM

The daily, monthly and annual ranges of temperature are very low, the annual range being only 12·5 . This is the direct result of the amelioration of the climate by the sea. The hottest month is May (88·8°F) which is not too hot for 10° latitude, and the coolest month is January (76·3°F) which is also not so cool. So we can call the climate equable. The temperature steadily rises from the end of January till the end of May and then begins to fall slowly and steadily.

Negapatam receives on an average 54·37″ of rain per year.

About 70% of the annual rainfall falls in October, November and December.

The heavy winter rainfall is due to the configuration of the coast ; the winds passing over the Bay, absorb moisture which is precipitated as rain on the coast.

Negapatam receives very little rain from the South-west monsoon.

The rain is not well distributed throughout the year, but is concentrated in the last three months of the year.

Irrigation is needed for a second crop in the year.

Negapatam has on an average 60 rainy days, i.e., 1/6 part of the year.

The sky is cloudless for the greater part of the year, and so climatically, the surrounding areas are well suited for the cultivation of tropical crops especially rice.

On some occasions, during the breaking of the monsoons, very heavy falls of rain occur sometimes, in a single day. Between 1891—1920, it rained 14″ to 15″ on one occasion. These heavy rains are due to the passage of cyclones which occur in this part of the Bay of Bengal.

CYCLONE TRACKS

Most of the cyclones visit Negapatam in November or December. There is an interesting old record vividly describing the havoc caused by a cyclone in the " Selections from the consultations of the Agent to the Governor and council of Fort St. George—1681." It says, " In Negapatam happened the storm on the same three days with much great force, demolishing six bulwarks of the fort and the greater part of the houses, whereby was sustained most losses, and the Dutch soldiers those three days and three nights as the storm lasted, went about those fallen houses stealing all they could find and it is like-wise said they stole much goods out of the company's godowns for which they are now doing justice, and those who robbed the houses received many wounds by the owners thereof, who defended the doors from those who would enter by force. It is writ for certain that in Negapatam more than 2000 persons put themselves into a pagoda and it fell and killed all of them. On the sea-side, the fishermen of five towns retired into one which was the highest and the wind and sea carried it away and they all died and they writ it, in the jurisdiction of Negapatam died 14,000 souls and it is to be noted that in Porto-Novo the storm came from North-east and North and in Trangambar from North-east and East and in Negapatam from the South. The distance being 12 leagues and all at one time the same 3 days and three nights."

Winds. The South-west current sets in during April, and is strongest in June i.e., at an average velocity of nearly 200 miles per day. The wind continues till September. In October it dies away. At the beginning of November the North-east monsoon sets in though not with the strength of the other current and continues till the end of January after which it weakens, and by the end of March has veered round through the South-east, to the South-west again.

Humidity. A very high percentage of water-vapour is always present in the atmosphere : More than 50% on summer days, and very near the saturation point on rainy days, due to the coastal situation. The moist heat is considered bad for people with lung troubles.

THE NEGAPATAM TOWN (MUNICIPALITY).

The town of Negapatam occupies an area of 5½ sq. miles, which is divided into six wards for purposes of municipal administration. (The map shows the different wards). The town proper comprises Wards No. I, II and III, while Nagore is divided into two wards (No. V & VI) and the intervening area has been constituted into a separate Ward (No. IV).

1871	1881	1891	1901	1911	1921	1931
52,175	54,745	59,221	57,190	60,168	54,016	48,527

In the year 1866, Negapatam was constituted as a municipality because it had 50,000 persons. From 1866, the population had been growing steadily till 1911. Since 1911, there was a decrease due to the people emigrating to Malaya. There was a further decrease of 10% of the population as a result of the removal of the S. I. Ry. workshop from Negapatam to Golden Rock.

It had employed 2,700 hands and repaired and rebuilt rolling stock of all types. The work-shop was divided into many departments. There was the erecting shop where 320 men were employed. Here the locomotives were repaired and rebuilt ; engines were received in dismantled condition from England, and put together. There were 1,300 men in the carriage and waggon shops, where new carriages and waggon-bodies were built. Besides these, there were the machine shop, the boiler shop, the smith's shop and the foundry.

The removal of the workshop meant a decrease not only of the 2700 people employed in it, who went away to Golden Rock but also of their families and those who depended on them like their servants, the milkmen, the retail shop keepers, etc. It was a great blow to Negapatam.

Out of the 48,527 people (1931 census) 34,340 or 70% are Hindus; 10,958 or 23% are Muhammedans and 3,206 or 7% are Christians.

Communities	1921	Change in 1931.
Hindus	37980	– 3640
Muhammedans.	10759	+ 194
Christians	5381	– 2175

There has been a decrease in the number of Christians and an increase in the number of Muhammedans between the years 1921-31. The decrease in the Christian population is mainly due to the removal of the S. I. Ry. workshop which took away with it many of the Europeans and Eurasians who had been employed in it, as well as their servants, who were also many of them Christians. The exodus of the Europeans meant the exodus of their servants. Most of the Mohammedans of Negapatam are merchants in Malaya, whose business suffered heavily during the recent serious depression of trade, and also as a result of the slump in rubber production; consequently many of them came back to Negapatam, closing their Malayan businesses. So there was an increase in the Mohammedan population.

The distribution of the various communities in Negapatam is typical of an Indian Coastal town. The most striking feature is the relative proportion of Christians to others 10% in 1921, and 7% in 1931. Taking India as a whole, out of 350 million people, there is not even 2½% of Christians. The relatively high proportion of Christians in Negapatam is worth noting. It is due to the following reasons.

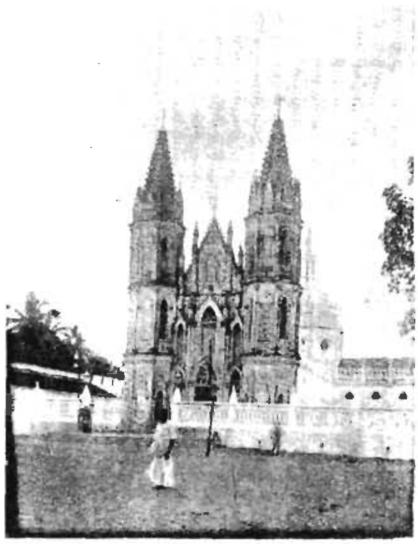
(1) For about 190 years, the town was under the Portuguese and the Dutch who tried their best to convert the people to their faith. That is why we find a high percentage of Christians as in the other Coastal towns.

(2) Many important officials of the Government and officers in the workshop were Europeans and so their servants too, who usually belonged to the depressed classes, became Christians.

(3) The situation of the Velangani Church, five miles South of Negapatam is one of the causes for the high percentage of Christians.

To-day Velangani is an important place of pilgrimage for the Roman Catholics, and Christians from all parts of the country come there during festival occasions. Negapatam is the nearest railway station to Velangani.

(4) We have records to show that Francis Xavier made converts in Negapatam about the middle of the 16th century. Caesar Frederick who came to Negapatam in 1570 says," The citie



Velangani Church

belongeth to a noble man of the kingdom of Bezenegar being a gentile. Nevertheless the Portugals and other Christians are all intreated there, and have their Churches there with a monasterie of Saint Francis' order with great devotion and very well accommodated with houses round about."

Muhammedans too are numerous in Negapatam—20% in 1912, and 23% in 1931, which is a high percentage when compared to South India as a whole.

(1) It is said that they are colonists from Arabia, who emigrated from their native land in the early part of the 18th century in consequence of the tyrannical sway of Hijajben Yasef. On first settlement they took women from among the lowest classes of the natives for their wives, consequently the present day Muhammedan population is of mixed origin. They are Tamil speaking and have the honorific title of "Marakkayar." They are peaceful and industrious in striking contrast to the frequently turbulent Moplas of the West Coast.

(2) Some of the Muhammedans are the descendants of the Hindus who were forcibly converted to Islam by Tippu Sultan.

(3) The tomb of Miran Sahib at Nagore, endowed and built by His Highness Raja Sarabhoji in 1814, became the nucleus of a Muhammedan settlement.

Pilgrims from all parts of the Presidency and Malaya visit this place.

DISTRIBUTION OF THE IMPORTANT COMMUNITIES IN THE VARIOUS PARTS OF THE TOWN (MAP NO. III).

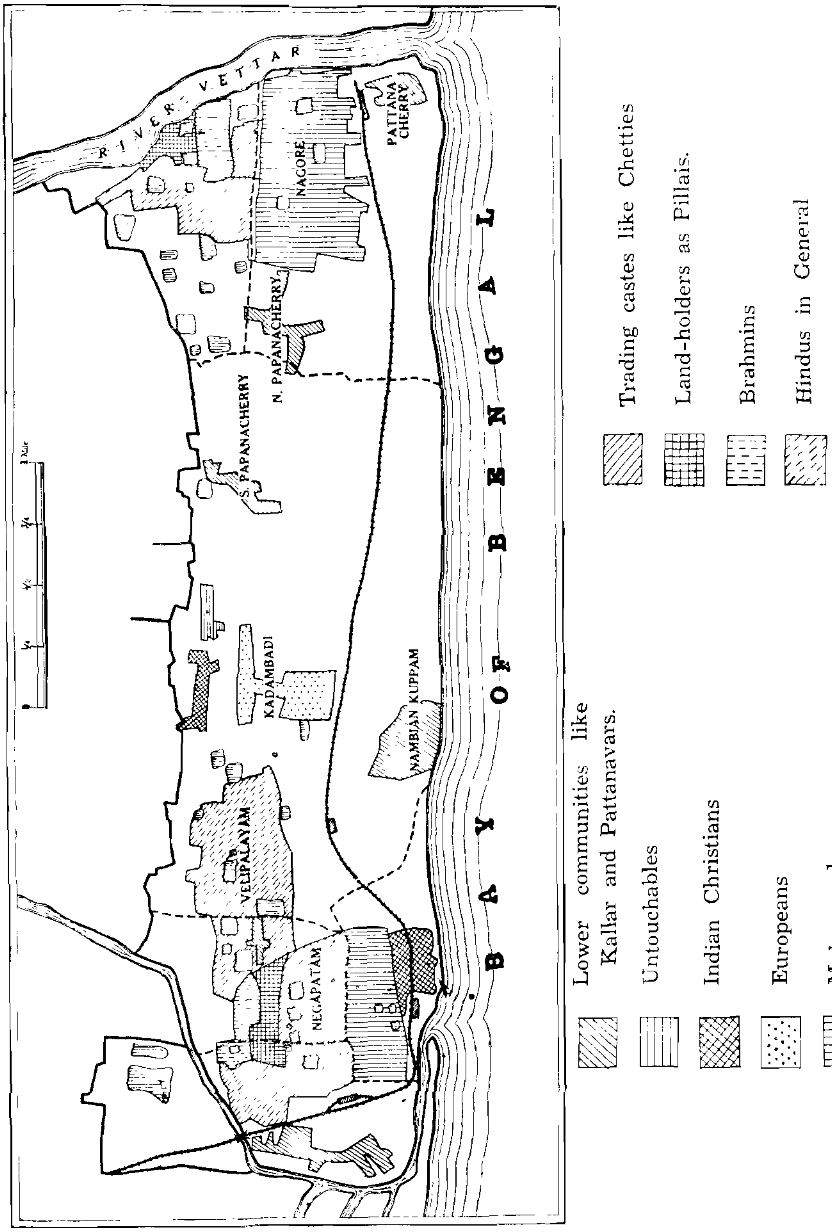
A. *Hindus.* The Hindus mainly fall into two classes namely, (1) The Brahmins, (2) The Non-brahmins. The Non-brahmins are again divided into Sub-classes like, (1) The untouchables, (2) Chetties and other trading castes, (3) land holders and cultivators as Reddies, Pillais, Mudaliars, Naickers, etc. (4) The lower classes like Kallars, Pattanvars, etc., who are mostly labourers.

The Brahmins. The Brahmins belong to the priestly class, and according to Indian tradition, they are supposed to have come out of the head of Brahma the creator. The Aryans were divided into 4 castes, of which the Brahmin came first. Dr. Caldwell thinks that "Brahmins are a perfectly pure, unmixed race." But such a statement is questioned from all quarters. All that we can say is, as the Tanjore Dt. Manual says, "They are the least affected by the occasional taint." As the Brahmins belong to the priestly class, they are always found in the vicinity of temples. We see the same phenomenon in Negapatam. The streets located near Sundaraja Perumal Koil, Sattaiyapper Koil, Naganatha Swami Koil, Maleswaraswami koil, Neelayathashiammon Koil, Venkatachalapathy Swami Koil are all Brahmin Streets.

The Non-brahmins: (*i*) *The Untouchables.* The untouchables or the Adi-dravidas as they are called are few within the Municipal limits. As their name indicates, they live away from the caste Hindus. Their dwellings are found mostly to the West of Kadambadi where only European officials live. They are usually servants of the European officials. Some of them are Christians, while the rest are Hindus.

(*ii*) *Chetties and other trading Castes.* Chetties mostly reside in the business areas where they carry on their various kinds of trading, well illustrating Christ's saying," where your treasure is there will your heart be also." We find their houses in the bazaar streets of Negapatam, Velipalayam and Nagore, and al in streets adjoining it.

III Distribution of Communities.



(*iii*) *Land holders and Cultivators*: (Reddies, Mudali Pillais, Naickers, etc.) The urban population of Negapatam mostly traders, merchants, and people employed in industries and other occupations. Only 17·2% are agriculturists. So this class forms only 17·2% of the population. As the lands that are cultivated lie to the West of the town, they live mostly in the Western part of the town. But an exception is found in the case of North and South Papanacherry where there is much market gardening by the cultivators who live close to their fields in that part of the town.

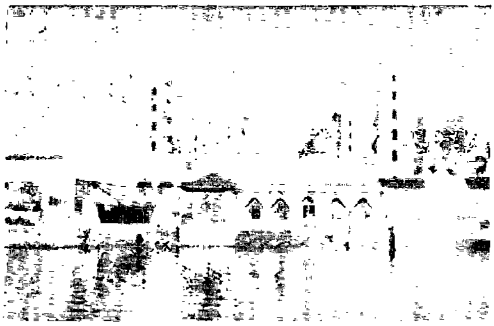
(iv) The Lower classes: (Kallars and Pattanavars). *Kallars.* They belong to the poorer classes who did not originally belong to the town. They came from the surrounding villages with their families and settled here. The men work as coolies in the harbour, railway station, and elsewhere in the town. The women are very energetic and hard working. They go about the town hawking gram, peas, rice, buttermilk, vegetables, etc. This sort of selling in retail is completely monopolised by Kallar women.

The Pattanavars. The Pattanavars are the fishermen of Negapatam. Their calling forces them to live on the coast. In Negapatam there are three small fishing villages.

(1) Pattanacherry in Negapatam.
(2) Pattanacherry in Nagore.
(3) Nambian Kuppam.

The names of all the three villages are self-explanatory. " Kuppam " in Tamil means a fishing village. Also Pattanacheri means a place where fishermen live. The major occupation of the Pattanavars is fishing. To-day many of them are employed as boat-men by the Madura Co., who are the local shipping agents and possess more than a hundred boats. These fishermen are very capable boatmen. The whole village i.e., Pattanacherry in Negapatam proper is Roman Catholic by Religion, while the people of the other two villages are Hindus. Perhaps they became Christians at the time of the Portuguese or the Dutch. They are uneducated, but healthy and hardy people.

The Muhammedans. The Muhammedans of Negapatam are mostly merchants and sailors. But there is also another class—the priestly class who call themselves the " Sahibs." But they are only a few in number, who mostly live near Nagore Darga (Mosque). They are supposed to be the descendants of Mira Sahib who is interred there. Their mother tongue is Hindustani.



Nagore Durga.

The other section of the Muhammedans are all traders and merchants. They call themselves "Marakkayars" and "Malumiyars". Most of their names are like this :—

(1) Packir Malumiyar.
(2) Eesu Malumiyar.

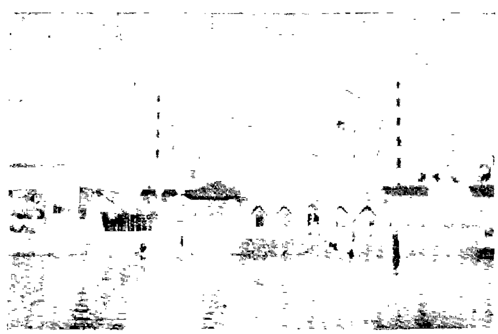
(1) Ahmed Marakkayar.
(2) Ghouse Marakkayar.

In Tamil "Marakkayar", and "Malumiyar" mean the same thing. "Marakalam" (மரக்கலம்) means a ship and "Marakkayar", a sailor. So also in Tamil "Malumi" (மாலுமி) means a sailor. Most of their trade is with the Straits Settlements, and every family has one or two of its members in Malaya. So they live very near the godowns. They do not participate in the local retail trade which is largely carried on by Chetties and other allied classes.

The Christians. The Christians fall into four classes.

(1) The Europeans.
(2) The Roman Catholics converted from Pattanavar community.
(3) The Protestants converted from the Adi-dravida community.
(4) Other Protestants who are petty officials, teachers, clerks, etc.

The Europeans who are mostly protestants are officers in Government, Railway or Madura Co., service. They take very little interest in Church matters. For their benefit, an English service is held once a month in St. Peter's Church which is attended by a few of them.



Nagore Durga.

The other section of the Muhammedans are all traders and merchants. They call themselves "Marakkayars" and "Malumiyars". Most of their names are like this:—

(1) Packir Malumiyar.
(2) Eesu Malumiyar.

(1) Ahmed Marakkayar.
(2) Ghouse Marakkayar.

In Tamil "Marakkayar", and "Malumiyar" mean the same thing. "Marakalam" (மரக்கலம்) means a ship and "Marakkayar", a sailor. So also in Tamil "Malumi" (மாலுமி) means a sailor. Most of their trade is with the Straits Settlements, and every family has one or two of its members in Malaya. So they live very near the godowns. They do not participate in the local retail trade which is largely carried on by Chetties and other allied classes.

The Christians. The Christians fall into four classes.

(1) The Europeans.
(2) The Roman Catholics converted from Pattanavar community.
(3) The Protestants converted from the Adi-dravida community.
(4) Other Protestants who are petty officials, teachers, clerks, etc.

The Europeans who are mostly protestants are officers in Government, Railway or Madura Co., service. They take very little interest in Church matters. For their benefit, an English service is held once a month in St. Peter's Church which is attended by a few of them.

St. Peter's

The majority of the Christians are Roman Catholics and belong to the Pattanavar community. They are very enthusiastic in religious matters, and especially the women-folk are very religious and are regular Church-goers.

The position of the Adi-dravida Christian in Kadambadi is very pitiable. As they are Adi-dravidas they are not able to move freely with the local people. The protestant clergy do not take much interest in their welfare. They do not have the Church nearby and they rarely attend a Church service They are more Christians in name rather than in reality. For the Protestants there are three big Churches. (1) The Lutheran, (2) S. P. G., (3) The Wesleyan. Services are held in all the three Churches and attended by a handful of people. It would be a good thing if the three Churches are united and a single service is held with a big gathering. Of course such combined services are held during festival occasions like the Easter, the Good Friday and the Christmas. The few people who attend the Protestant Church services are teachers, clerks and petty officials.

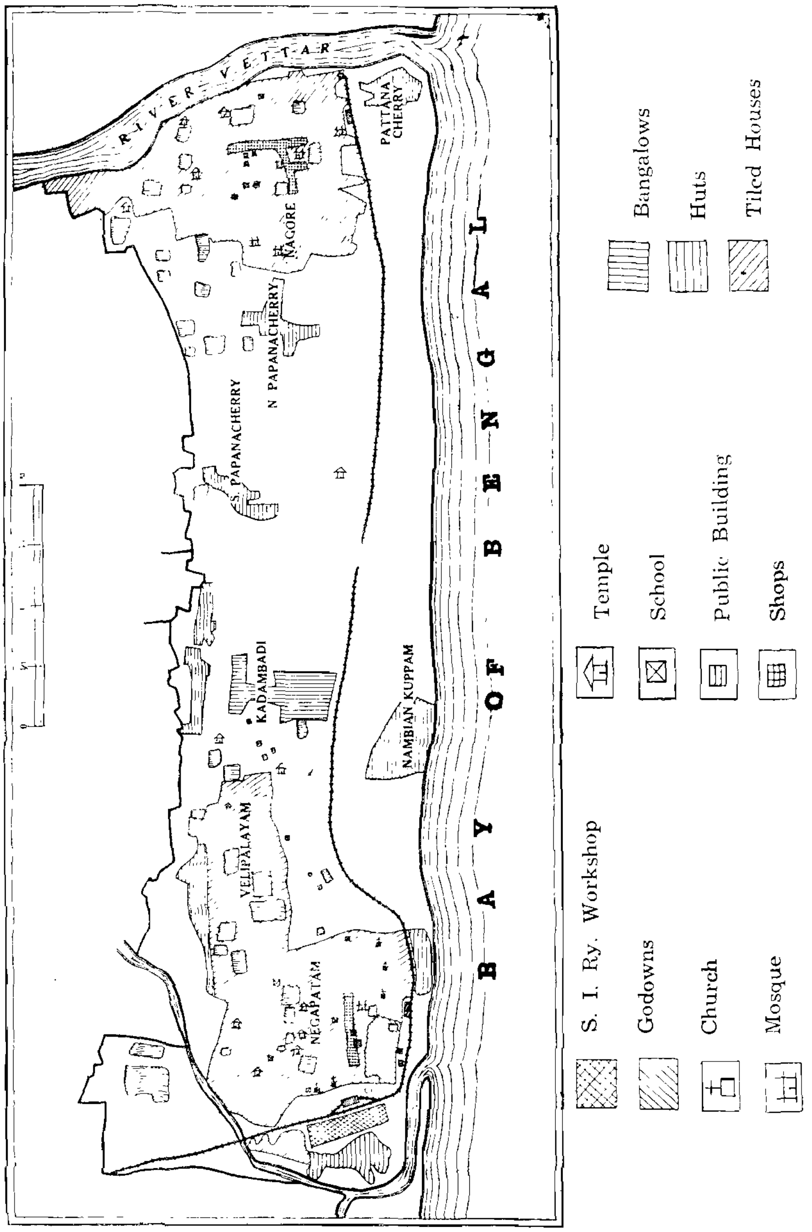
DISTRIBUTION OF HOUSE TYPES : (MAP NO. IV).

It is very interesting to correlate the house-types with the distribution of communities.

The Europeans who live in Kadambadi, live in Bungalows in large compounds with big gardens in front, with garage, kitchen and servant's quarters at the back, quite separate and at some distance from the main house. Most of them are one storeyed buildings. As the European population is diminishing from day to day in Negapatam, no new bungalows are built. The new type of houses that are found in such large numbers in Mambalam

(Madras) and other newly developing areas are conspicuous by their absence. As the town is declining in importance no new

IV Distribution of House types



houses are erected; the few that are built are of old fashioned design and lay-out.

Huts are numerous in Pattanacherry, Nambian Kuppam, North and South Papanacherry and that part of Kadambadi where the untouchables live. There is not much difference between the huts of the fishermen of Nambian Kuppam, or that of the market gardener at Papanacherry or of the untouchables at Kadambadi. The walls are built of mud and roofed by paddy straw. The flooring is of smoothed clay which, when dry, looks black in colour and smooth as cement. Every hut has a sort of pial in front of it, where people sit. The pials are not more than 2½ feet from the ground, and the flooring of the house would be just ½ a foot above the ground. Usually a hut has no rooms, and

A typical hut

no windows. Sometimes a tiny hole in the wall passes for a window. Any crude plank of wood is converted into a door. The huts are simple and dirty. The thatched roof is a veritable home for cobwebs and an excellent breeding ground for the scorpion and the centipede. During summer days scorpions and centipedes fall from the roof and the people don't much mind it.

The majority of the houses in Negapatam are neither bungalows nor huts. They are ordinary brick and tile houses of a single storey. All these houses have rooms round a central courtyard. The courtyard in the centre is very useful in bringing plenty of sunlight and fresh air into the house—the fewness of windows are made up by the open courtyard. All rain that falls on the roof is drained into the central courtyard. The houses of the rich and poor are of this type, but are different in size. The rich people have houses with three or four courtyards of this type, one behind the other in succession while the poor have to be satisfied with just one courtyard.

A typical tiled house

The different public buildings differ in construction and architecture—some are storeyed and others not. As they vary very much it is difficult to discuss in detail about them in this paper.

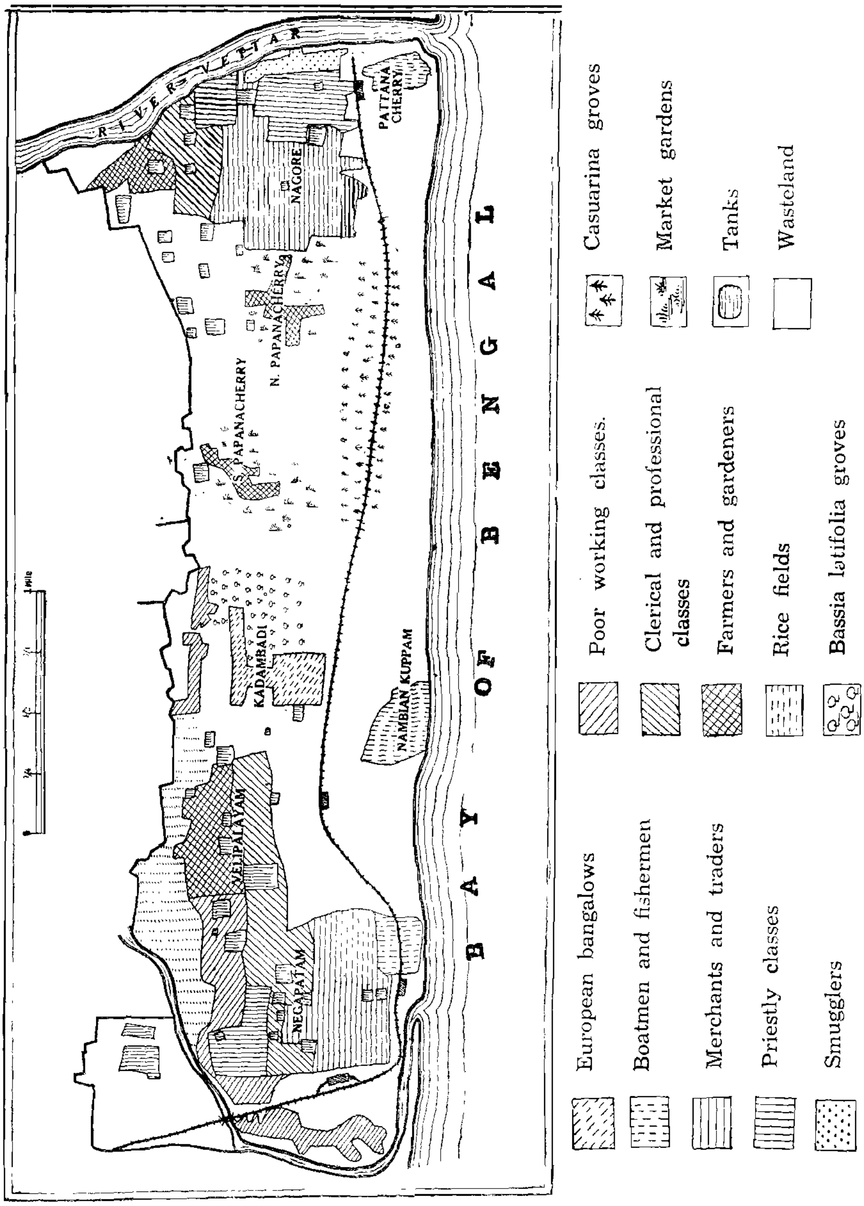
LAND UTILIZATION MAP NO. V

Negapatam is a twin-town, Negapatam proper in the South and Nagore in the North. The town covers an area of 5½ sq. miles and more than 1 sq. mile along the coast is sandy waste. The few houses that are found along the coast are huts belonging to the fishermen.

Another interesting feature of the town is that a large portion of the town is covered by tanks—typical of an ancient town. In the town there are more than 40 tanks. The tanks are not much used in the present day. Most of them have no outlets and the stagnant water is a good breeding ground for mosquitoes. Negapatam is unhealthy because of the tanks and the mosquitoes. Elephantiasis is a very prevalent disease of the place. Just now the Municipality have realised the danger and an oil engine is used for baling out water from stagnant tanks.

About half the area is built up—over which stand the bungalows, houses, huts, public buildings, temples, churches and mosques. The town cannot grow to the East because of the sea, and to the South and West because of the rivers. There is a possibility of expansion to the North of Negapatam proper. In the same way there is expansion possible to the South of Nagore. The future settlements will be most probably along the Nagore-Negapatam main road. There are plenty of sites for buildings which are not utilized because of the declining importance of the town. Many of the sites are not used in any way. A few of them are taken up

V. Occupations and Land Utilization.



by enthusiastic youths and are converted into football fields, badminton and volleyball courts.

Land around North and South Papanacherry is used for market gardening which partially satisfies the local demand, while the remainder comes from Poyur across the river. A few plots of land along the railway line are planted with casuarina trees, which successfully fix the sand on the sea-shore and prevent it from being blown further inland. Rice fields are found to the West of the town, but they are few within the municipal limits. South of the Negapatam railway station there are many big buildings which were once the S. I. Ry. workshops. For many years they remained disused. Recently one of the buildings has been reconstructed into a cinema—" the Universal Talkies "—which is the chief attraction for the people who want some recreation. The other buildings have been taken up by the " Steel Rolling Mills ", which has just begun to function (1936). The officers of the Imperial Air Ways have surveyed the place and have pitched on " Thethi Thedal " as a suitable site for an aerodrome. The future air mails to Malaya will pass through Negapatam.

COMMUNICATIONS

The municipality maintains 61 miles of roads of which 14 are metalled and the rest are mud roads. Being in the Cauvery Delta no stones of any kind are available for road metal. Till recently white coral stones were imported from Jaffna in country boats in particular seasons of the year. As this was not readily available and as it was also costly, blue metal is being bought from Trichinopoly at Rs. 6 per cubic yard. The roads are in bad condition and need urgent attention. There is regular bus traffic from

(1) Negapatam to Nagore,
(2) Negapatam to Tiruthuraipundi,
(3) Negapatam to Tiruvarur,
(4) Negapatam to Karaikal.

RIVER TRAFFIC

The Negapatam—Vedaraniam Canal was constructed in 1863-1867 at a cost of Rs. 55,000 and subsequent improvements brought the outlay to Rs. 1,08,000 in 1874. The total length of the canal is 35½ miles. The canal brings the salt pans of Vedaraniam into touch with Negapatam. The canal is used much for goods and passenger traffic. The journey from Negapatam to Vedaraniam takes 14 hours. The total income earned by the canal is Rs. 1,00 per year.

RAILWAYS

There are six miles of Railway within the municipal limit and four railway stations—(1) Negapatam, (2) Negapatam Beach (3) Velipalayam and (4) Nagore.

WATER-WAYS

There is a fortnightly steamer service to Malaya and many coaling and cargo steamers call here. People who go to Penang Singapore, Batavia, etc., embark here. There are also many native craft which carry on trade with Ceylon, the Andamans and the other islands of the Indian Ocean.

Since 1935, the Negapatam Electric Supply Company Ltd. receives electrical energy from Pykara and supplies power to the town. At present the power is used mostly for domestic purposes and for street lighting. The Steel Rolling Mills consume about 500 units of power per month. As the power is sold cheap for industrial purposes, there is a possibility of greater industrial development.

THE PORT OF NEGAPATAM

Negapatam port is an open roadstead and has an export and import trade in various commodities to the extent of 200 lakhs of rupees. Both the British Indian Steam Navigation Co., and the Asiatic Companies' steamers call regularly, and a large number of country brigs and barques are owned at and sail from the shore and some 160 boats are employed to take the cargo and passengers on board. Cargo is landed and shipped at the wharf, opposite the Customs House. There are two cranes each of three tons lifting capacity. The wharf is maintained at heavy cost. The river gets silted up and constant dredging is necessary. As the wharf is built on the convex side of the river bend, erosion takes place under the stone structure, and much damage is caused to the wharf very often. The trade is mostly between Negapatam and Malaya, Ceylon, Burma and the British Indian ports. The situation of the emigration depot at Negapatam helps a great deal in passenger traffic to Malaya. In the year 1934, no less than 52,143 emigrants went to Malaya to work in the rubber plantations.

THE TRADE OF NEGAPATAM

Year	Exports	Imports
Beginning of the century (1903-1904)	Rs. 73,67,000	Rs. 44,78,000
Pre-war (average for 1908-1913)	Rs. 1,27,55,421	Rs. 79,14,048
Post-war (average for 1929-1933)	Rs. 1,83,29,761	Rs. 21,39,685

The above table shows in general the trend of the trade. Exports have been 64% more than the imports at the beginning of the century. Though there has been a general increase in the exports, the imports were increasing till the beginning of the war and since then decreased considerably. To-day the exports are of the value of 183 lakhs of rupees, while the imports amount only to Rs. 21 lakhs. So the exports are about 8½ times more than the imports.

GROUND-NUT TRADE

As the exports overbalance the imports, let us first consider the exports. The most important single item of export is groundnut. The amount exported has been steadily increasing.

EXPORT OF GROUNDNUT FROM NEGAPATAM

1903-04	2,56,489 cwt.	Rs. 18,92,280
Average for (1908-'13)	6,64,783 cwt.	Rs. 53,10,860
Average for (1928-'33)	14,83,062 cwt.	Rs. 80,29,963

The increase in demand for groundnut is mostly due to its great utility. It yields plenty of vegetable fat, and it is very useful in the preparation of soaps and butter substitutes. Hamburg and Marseilles are the two ports to which 90% of the groundnut of Negapatam is booked. Negapatam looms so large in the groundnut trade because of its position, close to the great groundnut producing area—S. Arcot and parts of Tanjore and N. Arcot districts. We can say Vriddhachalam lies in the heart of the groundnut area. The nearest port is of course Cuddalore. But somehow Negapatam has been thriving much better than Cuddalore in the groundnut trade, perhaps because of better shipping facilities. The groundnut is brought by rail to the godowns of many groundnut companies.

From there it is shipped to various European countries. Some of the most important groundnut companies are the following :—

(1) Ralli Brothers.

(2) Best & Co.

(3) Volkart Bros.

(4) Parry & Co.

(5) Kuppuswami Iyer & Co.

The future of the groundnut trade is quite uncertain. There is always the fear of the Soya-bean or other substitutes taking its place. The increasing competition of the Soya-bean may be minimised if the South Indian farmer is educated and made to use better methods of cultivation and scientific manure and better seeds, and to work on a co-operative basis. Then the production would be made cheaper, and groundnut could be made to compete successfully with the soya-bean. Till now groundnut has been holding the field, and we hope that it would always do so.

GRAIN TRADE

Another important export of Negapatam is grain which includes rice, pulses, wheatflour, gram, etc.

EXPORT IN GRAIN

Year	Quantity	Value
1903-'04	5,48,617 cwt.	Rs. 22,56,000
Average for 1908-1913.	6,27,596 cwt.	Rs. 26,55,604
Average for 1928-1933	2,83,421 cwt.	Rs. 12.76,110

Negapatam is the natural outlet of the Cauvery delta—the garden of South India. The most important crop of the region is rice. So the chief item of export from Negapatam would be rice. In 1913 alone, Negapatam exported rice to the value of 12 lakhs of rupees. But as rice forms the staple food for the people and as the Cauvery delta has the densest population in peninsular India, only a small part of the crop enters into international trade. Most of the rice and other grains are exported to Ceylon. The decrease in the export trade of the grain is caused by the competition of Siamese rice. There is no possibility of a stimulus being given to the rice trade.

TOBACCO TRADE

Trade in tobacco is very important to Negapatam. In 1903-1904, Negapatam exported tobacco to the value of Rs. 4,75,000 which far exceeded the Madras export.

EXPORT OF TOBACCO

Year	Quantity	Value
1903-'04	16,42,621 lbs.	Rs. 4,75,000
Average for 1908-1913	27,61,801 lbs.	Rs. 7,25,858
Average for 1928-1933	32,21,421 lbs.	Rs. 12,70,746

The tobacco trade has been steadily growing and the exports are mainly to the Strait Settlements and Federated Malay States. A part of the tobacco is manufactured into beedies and the rest is sent raw. Beedy manufacture is an important cottage industry among the Muhammedan community.

COTTON TRADE

Another important export of Negapatam is cotton goods. Cotton is not manufactured here, but manufactured cotton goods from England and South Indian cities like Madura are imported and here it is printed and dyed according to the tastes of the people of Strait Settlements, Federated Malay States, Burma and Ceylon. The printing and dyeing is in the hands of the Muhammedans.

Year	*Foreign imports*	*Exports*
1903-'04	Rs. 22.21,000	Rs. 13,26,000
Average for 1908-1913	Rs. 1,09,695	Rs. 9.97,979
Average for 1928-1933	Rs. 1,64,885	Rs. 15,91,696

The above table shows that more Indian manufactured cotton is used for dyeing and printing at present rather than the more costly and better quality English cotton.

Other chief items of export are live animals, ghee, skins and hides, coconuts, onions, vegetables, chillies and spices. They are sent mostly to Malaya, Burma and Ceylon. Except groundnut, other articles of export never leave the Indian Ocean basin.

In the same way most of the import trade of Negapatam is confined to Malaya, Burma, Ceylon and the British Indian ports. Negapatam has a thriving trade in betelnut and the nuts are imported from Ceylon and Malaya.

Betel Nut	Import of Negapatam
1903-1904	Rs. 8,33,000
Average for 1908-1913	Rs. 13,03,688
Average for 1928-1933	Rs. 9,68,144

The trade in betelnut had been steadily increasing till the beginning of the war, and since then diminished a little. There is a big volume of trade in betelnut, because of the chewing habit of the South Indians. Betelnut is an indispensable necessity to every Indian home because betel and nut are offered to all visitors and it is daily used.

Gunny bags to a large extent are imported from Calcutta.

IMPORT OF GUNNY BAGS

1903-1904	Rs. 2,28,000	
Average for 1908-1913	Rs. 3,02,332	12,48,893 bags.
Average for 1928-1933	Rs. 1,70,725	

The total imports have diminished since the war. The gunny bags are very useful in packing grain and sending to other places.

Timber is an import from Burma. There are big timber merchants in Negapatam, mostly Chetties who order teakwood from Rangoon. Usually the big logs are floated from the steamers, and by wind action they are carried to the shore. There are sheds on the beach itself, where they are collected and stored and then despatched to various places in open waggons.

TIMBER IMPORT OF NEGAPATAM

1903-1904	Rs. 5,90,000
Average for 1908-1913	Rs. 10,41,081
Average for 1928-1933	Rs. 25,205

There has been a marked decrease in timber trade due to the depression that followed the war.

Coal is also imported and almost the whole of the coal consumed by the S. I. Railway is landed here.

COAL IMPORT OF NEGAPATAM

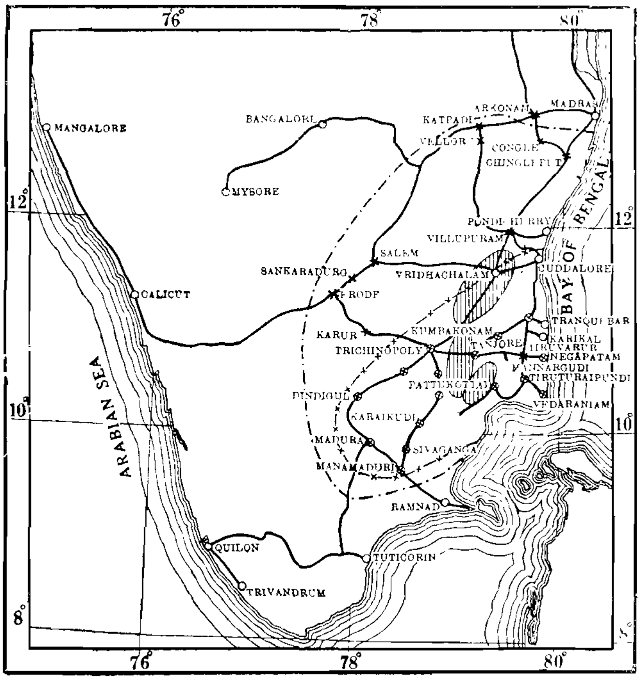
1903-1904	1,21,000
Average for 1908-1913	3,39,386

After the war it has diminished a bit and the actual figures are not available. Other articles of import are seeds of many kinds, gums and resins, railway plant and rolling stock, sugar and patent foods.

THE HINTERLAND OF NEGAPATAM MAP NO. VI

The hinterland of Negapatam includes Tanjore, Trichinopoly, S. Arcot, N. Arcot and Madura districts. Occasionally cotton seeds are received for export from as far as Raichur, Warangal

VI Hinterland of Negapatam



Area receiving commodities from Negapatam.
Area sending commodities to Negapatam.
× Towns sending goods to Negapatam.
o Towns receiving goods from Negapatam.
⊗ Towns sending and receiving.

and Thadapalligudam. Ellangkuruchi and Ottanchatram send the greater part of the tobacco for export to the Strait Settlements.

Negapatam also imports goods like gunny bags, gums and resins, betelnuts, cotton goods and teak and distributes them to various places in the districts of Tanjore, Trichinopoly, Madura and S. Arcot.

THE INDIGENOUS INDUSTRIES OF NEGAPATAM

Chintz Stamping :—This was formerly originated and carried on by 60 Vellalans of Negapatam, but at present it is done by Muhammedans. They chiefly use dark blue and violet colours. Previous to applying any of the stamp-blocks the cloth is dipped in the solution of gall-nut. The printed cloth is sent to Malaya and Burma.

Wax-printing :—It is also carried on in Velipalayam and Nagore. The designs are drawn by hand in wax with a sort of pen, with a ball of aloe or other fibre to act as a reservoir for the wax. Pens of several thicknesses are used for various parts of the pattern.

Trade in gemstones and lapidary work :—The "Marakkayans" (Muhammedans) of Nagore procure pearls from the Gulf of Mannar and rubies from Burma and get them cut and polished by Linga Balijas in Nagore and do some trade both in India and Malaya.

Making of palm-leaf boxes:—At Nagore the Marakkayan women make pretty little boxes for betel and nut out of palymra leaves; they are exported to the Strait Settlements. Baskets and plaited articles too are made.

Shoe making and tanning of leather:—Shoe making and tanning of leather are monopolised by the Muhammedans. The Muhammedans do not do the actual manual labour; the capital is supplied by them, and the labour is from the poorer classes.

Making of Scents :—The making of native scents is an important industry which is entirely in the hands of the Muhammedans.

Manufacture of Steel Trunks:—Negapatam has been famous for steel trunks. The trunks made here are supposed to be the best in S. India—and they are no way inferior to English trunks and they have a longstanding reputation for quality, durability and service. But they are as costly as English trunks.

Smuggling. Though not an occupation in the true sense, smuggling has been developed in Negapatam as a fine art. The Marakkayans of Nagore are famous smugglers. In spite of a very careful watch by the officers of the excise department smuggling is carried on. The main items of commodities smuggled are silver, silks, liquors, scents, watches, sugar and match boxes. As smuggling seems to be a paying concern, many have taken to it, especially all the houses near the river Vettar (Nagore) are houses of smugglers. Karaikal is six miles off from the frontier. As the smugglers find it difficult to carry the goods all the way from Karaikal, the merchants of Karaikal, in order to aid the smugglers have opened branches just on the frontier. Within the last decade a town has grown in the frontier entirely of shops and nothing else. It is the famous Vanchur which is a household word in Negapatam.

The future of Negapatam. It is very difficult to predict anything about the future of Negapatam. Negapatam has declined much. Its prosperity is entirely dependant on the trade conditions prevailing in Malaya. Trade is reviving after the depression and hence we hope for better days.

There is also the newly started Indian Steel Rolling Mills; it will provide occupation for some of the population of the town.

It has been already proposed to build an aerodrome and to connect it with Singapore. So it may also become an important air port.

The Negapatam Electric Supply Co., gets cheap power from Pykara and sells it cheaply especially to bulk consumers. So there is a possibility of starting new industries.

NOTE :—Map I is based on the Survey of India One-Inch maps.

The other five maps are based on personal investigation.

The map of the Hinterland of Negapatam is based on lists of places obtained from the Railway authorities.

REFERENCES

1. Ferguson's "History of Indian and Eastern Architecture." Vol. I.
2. The Cambridge History of India, Vol. V.
3. Memoirs of the Geological Survey of India, Vol. IV.
4. Tanjore District Gazetteer.
5. Scientific Notes of the Indian Meteorological Department.
6. Census Reports.
7. Municipal Administration Reports.
8. Annual Reports of the sea-borne Trade of the Madras Presidency.
9. *Kanakasabai Pillay*: "The Tamils 1800 years ago."

Malta

By

Mr. V. N. S. Rao.

Who is there that does not relish calling at a port after days of continuous sailing ? Water, there had been bluish-green water everywhere. Waves had been dancing about all around. No trees had been visible. No rattling of carriage-wheels, no rap-a-tap of horses' hoofs, no sounds of motor horns had been heard—nothing had existed but the sea, the roaring sea. Now, at last, a port has come into view. There awaits something novel to be seen, watched and heard. Land, firm solid land, is in front, the very sight of which knocks out one's sea-sickness.

We have come to Malta, the little island in the heart of the Mediterranean. Away from the mainland, she exists bereft of company. Her dim coast line draws nearer. The distant haze melts

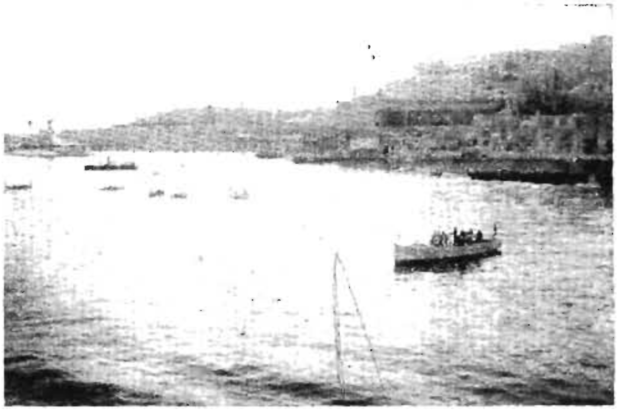
away. Clearer vision strikes the eye. The harbour is not far off. On the left is a jutting piece of land—jutting far into the sea—and, on it are two tall wireless posts. We pass them by. The town comes in sight, a town that is the most fortified in the world. Buildings abound—all on the top of the rugged rocks. No wonder there is an electric lift to carry persons up to the town.

The purple light of the summer eve is playing on the sky. The place looks a fairyland. There, a hundred yards away, on a flat rock are assembled the Maltese—the natives of Malta. How nicely are they clad! How artistic are their tastes! They wave to us, and we wave back. How many a ship would have passed that way like the one that is passing now? How many a ship will pass that way again in times to come? Other groups of Maltese might assemble on that same flat rock to watch and wave to the gliding ship. Thus will it go on, the same scene getting repeated for years to come but with actors changing every time. But, the rocks, the stones, the waters—these will remain as they are, the silent spectators of the march of Time.

Warships! One here, one there, four at that corner, six at this end. What else can one expect of a naval base? They are quiet and calm. Will they be so if something is amiss somewhere? We are running alongside one of them. Cannons show their polished mouths—formidable objects even to insensate observers. The deck is packed to the full with men in military uniform. What dreamy eyes most of them have! To Wales, Scotland, Ireland and England most of them probably belong. Men! born to vegetate in lethargic idleness in the nameless waters of the immeasurable sea. Are they not casting longing looks at our ship, which has just arrived from their home, their sweet home? Does not that delicate man down in that corner look pale? Is he homesick? No wonder if he pines away at the thought of home!

Hark! What is that noise? Who is bawling out at the top of his voice " Laddhy. Laddhy. Have ah loo—ok. Veery sheep. O'ly tree shilli's." The words float to us from the depths at the sides of our ship. There down below is a small boat constantly being tossed about like a child's paper boat on the ruffled waters of a tub.

Standing in the midst of his well spread-out wares is a man with a voice mightier than those of Members of Parliament. How cease-



lessly does his tongue function! Out comes a coil of string from his pocket; up he throws it to us. What a hefty throw! Someone picks it up on board the ship, and lowers one end to him. A basket is tied to it. Ker-chiefs and scarfs, ties and table-cloths, strings and straw-hats, boxes and bags—all come up and go down in quick succession. A lady takes a fancy to a bag, puts a ten shilling note in the basket and sends it down. The man below acknowledges the amount with "Tanks." So it proceeds, a scene worthy to be painted.

It is getting time for us to depart. Death-like silence has taken possession of the place. The ship gives out her usual blast, a dull elongated one. The buildings begin to move away. Off we go again into the open sea. Malta recedes, becomes dim and hazy, and finally goes out of sight. Malta, lovely Malta, becomes a dream.

Geography and Education

NOTES ON AN EXCURSION TO PALLAVARAM HILL

BY

MR. B. M. THIRUNARAYANAN, B.A. (HONS.), LONDON.

(Prepared for the Summer School of Geography, April 1936.)

Geography is " essentially a study of real objects and their relationships ", but topographical maps are used because they provide, by carefully selected symbols, a detailed picture of the country depicted by them. It is important to realise how fully and accurately topographical maps achieve this end, and the opportunity to see a wide stretch of country from an elevated standpoint helps, at the same time, to compare the map with what is actually seen. The views in different directions obtained from the top of Pallavaram hill, which is almost 500 feet high, show various features and patterns or arrangements of detail which are in many ways characteristic of and common in the Tamil region.

The location of the country only a few miles from the coast should be noted, and also that it is quite near the city of Madras. The flatness of the region is varied only towards the south and southwest by numerous scattered groups of small hills, few of them higher than Pallavaram hill itself. These hills lie in a line parallel to the coast, and are composed of intrusive charnockite rocks which have been weathered more slowly. They probably formed a dyke or a series of dykes and stood out as a more or less continuous ridge before being reduced by prolonged weathering and erosion to their present state. The spheroidal weathering characteristic of these rocks can be seen very clearly in many places on the way to the hill-top, particularly in the gullies cut by stream. The region is not, however, quite level. It consists of very shallow and wide valleys merging imperceptibly into one another across very low divides distinguished by their uncultivated, barren or jungle-covered nature. Most of the land over 100 feet above sea-level is jungle, and nearer the coast the land acquires a similar character, as in the case of Guindy Park, even when it rises above 50 feet. A general but gradual rise towards the west is noticeable, more especially towards the south-west. The coast is remarkable for the two sand-dune ridges along and parallel to it, and the two longitudinal depressions behind them, the outer occupied by salt-pans and lagoons and the Buckingham Canal, and the inner by a wider belt of almost barren, uncultivated land.

Speroidal weathering

This coastal lowland is cultivated everywhere, except, as indicated already, in the higher areas and along the sandy coastal belts, where the soil is too dry, stony or infertile for cultivation. Such areas are consequently covered in places by low, sparse, scrub vegetation. Extensive plantations of casuarina trees have been made elsewhere, especially on the dune-ridges, and they are quite valuable as sources of supply of firewood and of materials for scaffolding, etc., especially to the city of Madras. Cultivation is carried on largely under irrigation from tanks, which are numerous and widely scattered. The kinds of crops grown under irrigation depend to some extent on the amount of water available; where the fields are favourably situated near and immediately below the larger tanks, more valuable or profitable crops are produced, such as betel, of which a large area, well over 800 acres in extent, is found under the Chembarambakkam tank, the largest in this region and also in the whole of Chingleput district.

The people are distributed over this region according to their occupations. In the first place, we have a line of fishing hamlets or 'kuppams' along the coast almost totally unconnected with the interior. A similar string of slightly larger villages are found on the other sand ridge also, and these have better and more frequent communication inland. The agricultural population is housed near their fields and tanks, in the numerous inland villages whose size and importance are quite frequently determined by the size of the tanks on which they depend, e.g., Mangadu, Manimangalam and Tirunageswaram.

The scattered hills of this region provide good viewpoints from which a watch could be kept over the surrounding lowland, and Pallavaram hill itself was utilised for such a purpose in the turbulent days of the past. It is said that Shivaji planted one of his outposts on the top of this hill, and that the building erected in his time is the one now used as a mosque. St. Thomas's Mount, Little Mount and San Thome, with their old churches and other relics of the Portuguese and earlier Europeans who had established themselves along this part of the coast, preserve and recall their past. On the other hand, the Pallava rock-cut cave, and perhaps also the name Pallavaram (= Pallava + varam, or Pallava + puram), go back to much earlier times when the Pallava kings ruled over all this area.

The railway and modern conditions have brought new features in their wake. Many places along the railway, such as Saidapet, St. Thomas's Mount and Pallavaram, are developing into suburbs of Madras, where part of the citys' day-time or working population reside, and go to the city daily for their work. Pallavaram hill is also the source of supply of road-metal and stones for building purpose for Madras and roundabout. The large quarries in the hill-sides and the use of mechanical equipment show very clearly how such sources of supply acquire exceptional value and importance when they are scarce but easily accessible, as in this predominantly alluvial coastal plain.

REPORT ON THE RESULTS OF THE QUESTIONNAIRE

Re: The Teaching of Geography in the Secondary Schools of the Presidency

SECTION I: INTRODUCTORY

It was resolved at a meeting of the Standing Committee of the Association held on 27th July, 1935, that the Committee should formulate constructive proposals for the improvement of the teaching of Geography in the Secondary Schools of the Presidency, with particular reference to the requirements as regards staff, equipment and excursions. A preliminary investigation into the existing conditions was considered desirable, and it was decided that this should be made by means of a Questionnaire, to be issued to all the Secondary Schools. The precise form of the Questionnaire was settled at the next meeting on 27th October, 1935. The Questionnaire was distributed to the Schools in March 1936, after the permission of the Director of Public Instruction was obtained for this measure.

The total number of Secondary Schools in the Presidency is over 400 and all of them were addressed. Replies to the Questionnaire have been received from 101 schools, which represents about 25 per cent. of the total. The replies are fairly complete, and only some of the details regarding teachers' qualifications and equipment have been omitted in a few cases. More than half of the replies were received before the end of March, and almost all the others, in April. The last reply came on 25th May, 1936.

SECTION II: ORGANIZATION OF THE WORK IN THE SCHOOLS

All the schools have to teach the subject up to the VIth Form, ever since it was included in the A Group subjects of the S.S.L.C. Examination, according to the revised S.S.L.C. Scheme of 1929. Geography was also one of the C. Group subjects of the same scheme, but only 16 schools in the whole Presidency provide for C. Group teaching, and only 57 pupils have presented themselves in the subject, according to the S.S.L.C. Examination of 1936. Among the 101 schools which have responded to the Questionnaire, only 8 have C. Group Geography and between them they have a total number of 86 pupils.

The number of classes in each school varies much, from a maximum of 28 to a minimum of 3, and the average number for each of the 101 schools is 9.3. A large number of the schools tend to have one section in each of the Forms I to VI, while there is another likewise large group in which there are 2 sections to each Form. The subject is generally taught for two periods every week in all the classes, but in some schools it gets 3 periods a week in certain Forms, with only one period a week in the others. The C. Group students have extra work for 5 more periods in the week during the Vth and VIth Forms.

SECTION III: THE TEACHING STAFF

There are 381 teachers handling Geography in the 101 schools. This gives an average of nearly 4 to every school, but the actual numbers range from 1 to 15. The amount of Geography work done by each teacher also varies widely ; there is one extreme school with a single teacher, doing all the work of the 6 Forms, each having 2 hours weekly, whereas at the other extreme there are schools with 6 classes and an aggregate number of 15 periods a week, divided between 7 teachers. Several schools appear to divide the work of the 6 Forms into lower and higher stages. In some other schools, however, Geography is a part of the work of the class teacher in every Form, which is an arrangement having the obvious disadvantage of discontinuity and lack of co-ordination. It is not quite clear, in the case of the remaining schools, whether they follow any particular scheme of work.

A variety of qualifications is displayed among the 381 teachers. One of them is an M.A. in Geography of Oxford, and another the holder of the Diploma in Geography of the London University, which is equivalent to its Honours Degree. and a third has not yet completed the same Diploma. Only 7 teachers can be described as having studied the subject itself at the collegiate stage, including the three mentioned above ; the other 4 hold the Diploma in Geography of the University of Madras. A hundred teachers distributed between 74 schools, have studied the methods of teaching Geography during their course of training for teaching, and many of these are acquainted with the subject only in its traditional status as the step-brother of History, in the L.T. Course. There are 30 teachers in 22 schools, who have attended the Summer Schools of Geography and Refresher Courses. Many of these are also L.T.'s. Experience in teaching the subject is the sole qualification of a large number. 157 teachers out of the 381 have over 3 years' experience. Many of these also have either the L.T. or the Summer School Certificate. The dearth of qualified teachers is scarcely made up by the number of experienced teachers, and the excessive proportion of inexperienced teachers of Geography is a serious situation with regard to a subject in which experience is most frequently the sole qualification for teaching it. Even if it is assumed that there are a 100 teachers with special training and another 157 with experience, the total number of teachers with any sort of recognizable qualifications is only 264. There is still almost a third without any qualifications whatever. It is hardly necessary to point out that the summer Schools and Refresher Courses are at best merely palliatives, and can never be by themselves adequate training for teaching High School classes. It is not only interesting but significant, in the present state of affairs, that 20 teachers should mention " other qualifications." They are a mixed lot ; one states that he is a member of the Madras Geographical Association ; another that his work has won special mention in the school inspection report ; others state that they have travelled widely ; a few are specialists and authors of text-books ; but the largest number of all (7) are those who have what they severally describe as interest in, or aptitude, love or taste either for the subject or for teaching it.

SECTION IV : EQUIPMENT

Only 15 schools have separate Geography rooms, and one of them boasts of 2 Geography rooms ! A careful comparison with the information given regarding details of equipment and of Geography work of the several schools suggests that many have not fully realised that a Geography room is, in its several aspects, a museum, a laboratory, a workshop and a class-room, all combined into one.

IN REGARD TO THE TOTAL COST OF EQUIPMENT (INCLUDING MAPS, BOOKS, APPARATUS) PROVIDED DURING THE LAST 10 YEARS

Fifteen schools furnish no information regarding their Geographical equipment. The other 86 have together spent amounts for this purpose during the last 10 years, ranging from Rs. 1,000 to Rs. 50.

Fifteen of the 86 schools give only total figures for all equipment, without showing the details separately.

Out of the 86 schools that give any information, 46 schools have spent in a period of 10 years less than Rs. 300, which may be considered the minimum, as estimated by the Standing Committee of the Association.

One school has no maps at all, though it has two Geography-trained L.T.'s and two Summer School Certificate holders. The other 71 schools have spent amounts, varying from Rs. 7-8-0 to Rs. 500, and averaging Rs. 186-3-3 nearly. *As regards books* : Six schools give no information regarding their books only. The others have spent amounts, ranging from Rs. 10 to Rs. 500, and averaging Rs. 104-1-9 nearly. 39 schools give no details about their *Geographical Apparatus*, but the 32 others have spent amounts, ranging from Rs. 6 to Rs. 300. There are 31 schools giving details about other aids for geographical teaching.

SECTION V : EXCURSIONS

Out of the 101 schools supplying information, 42 do not appear to have arranged any excursions, but among the others, excursions have been of varying frequency as is shown by the fact that while one school had organized 14 excursions annually with an average attendance of over 50, another had only one excursion in the last three years. The number of pupils participating also varies between 20 to 25 as minima and 100 to 120 as maxima. While one school has taken 400 boys on excursion during the 3 years, on 3 occasions, another has had 41 excursions during the same period with an average attendance of over 50. The exact duration of the excursions is not always clear from the answers given. A few schools have organized long tours during the Michaelmas and Christmas holidays, while in other cases the school compound seems to have been quite adequate. Local excursions are the most common type ; and also attract the largest numbers. Longer excursions and vacation tours appear to be very exceptional, and restricted to a few schools, some of them doing C. Group Geography. The places visited and things seen vary widely, from such definite and limited objectives as a Swadeshi Exhibition, a light-house " to see its internal arrangements " and " an aeroplane as a means of communication and as a triumph of man's conquest of the air," to others nebulously described as a " study of land forms and water forms!"

Resolutions of the Standing Committee of the Association on the Results of the Questionnaire

I. REGARDING QUALIFICATIONS OF TEACHERS

The Standing Committee considers that the minimum qualification for a teacher of Geography in the High School is an L.T. Degree with either a Diploma in Geography, or Geography in the Intermediate, or in the B.A., and recommends that the Director of Public Instruction be requested (1) to officially recognize this qualification and (2) to give a lead in this matter by ensuring that there will be as early as possible at least one such qualified person in each Government High School.

N.B.—During the interim period, until teachers with the above qualifications are available, the Standing Committee submits that every teacher of Geography in the High School should have taken at least an L.T. or B.Ed. with Geography as his special subject.

II. REGARDING EQUIPMENT

The Standing Committee deprecates the fact that in a majority of schools the amounts spent on equipment within the last 10 years are less than what may be considered the essential expenditure for a High School; and since it is well known that expenditure is not often wisely made, it recommends to the Director of Public Instruction to issue directions regarding the minimum essential equipment for Geography.

III. REGARDING EXCURSIONS

The Standing Committee resolved, in view of the recent appointment of an *ad hoc* committee for organizing excursions, to await its report before considering this matter.

IV. THE C. GROUP GEOGRAPHY

The Standing Committee deplores the fact that only 16 out of a total number of 400 High Schools in the Presidency have provided for the teaching of C. Group Geography. This is no doubt due to the fact that no facilities for continuing the study of the subject in the College classes have been available anywhere in the entire Presidency except in the Queen Mary's College for Women. Even there the subject is taught only in the Intermediate classes. The Standing Committee considers that this state of affairs could be improved if more Colleges would start Geography in the Intermediate and also in the B.A. Course.

SUGGESTIONS FOR A SCHEME OF WORK IN GEOGRAPHY

For Standards I to V of Elementary Schools

(Prepared by the Standing Committee of the Association.)

AIM

To give the children an idea of the world they live in and of their own country in particular, including a more detailed knowledge of their home region.

METHOD

Story telling for Regional Geography of the World and Local Observational Study:

FIRST TWO YEARS, *(Local Observational Study only, and no World Regional Geography)*.

LOCAL OBSERVATIONAL STUDY FOR STANDARDS 1 AND 2

(1) *Observations of the Weather, Position of the Sun.* Sunny and cloudy days ; sunny side of the school at certain hours ; wind, strong or gentle from their effect ; rain, light showers or heavy ; moonlight nights and dark nights ; hot days and cold days.

(2) *Observations of Local Conditions.* Observations of the ground before and after a shower ; conditions of local tank and river at different times. Crops, carts as they go by the road and what is in them, and which way they go ; and whether full or empty. Lorries ; buses and where they go ; and whether full or empty. Railway Station (Goods Yard). Local bazaar. Local occupations and industries such as weaving, etc., and products. Where things are brought from.

N.B.—These observations are not to be made systematically ; but ten minutes a day should be set apart for general conversational work with the children on what they have seen as they come to school ; and they should be recorded on some simple kinds of charts.

STANDARDS 3, 4 AND 5

A. WORLD GEOGRAPHY.—REGIONAL STUDIES.

Stage I (Standards 3 and 4)—Globe to be used.

(*a*) Children of far off lands.

(*b*) People of far off lands.

or

(*a*) Stories of simpler Regions.

(*b*) Stories of more complicated regions.

(*c*) Stories of discoveries. (Winds and currents).

Stage 2. (Standard 5). Regions of the Home Land (India). (Map to be used.)

In the 5th year, during the study of India the Home Region will naturally be included. This can be studied more fully than the rest of India ; and the children's own locality will be studied as a sub-region in greater detail. This sub-region should include the town or village where the children live, and the taluk and district headquarters for administrative purposes ; but the main emphasis should be on the study of the region with which the locality is geographically concerned. This region may be just outside the taluk or district boundry : e.g. Bhavani region may include Kumarapalayam, etc., on the other side of the Cauvery in Salem District, though Bhavani itself lies in Coimbatore District.

B. LOCAL OBSERVATIONAL STUDY :

1. Same observations as in the first two years in a more systematic way, with more accurate and regular recording.

For example : Weather Observations :

Standard 3.

Wind : Weather vane.

Sun's Shadow : Length and direction of it.

Standard 4.

Rain : An improvised rain-gauge. (Making of wind vane).

Standard 5.

Temperature : Using an ordinary thermometer. (Making of wind vane and rain guage.)

Similarly Land Forms and Human Work observed and recorded.

2. Plan and Map.

Standard 3.

Very rough sketch plan of class room, of children going to the desk, etc., sketch of path from home to school.

Standard 4.

Continue the above, bringing in greater area. Need for scale : rough scale.

Standard 5.

Scale systematically explained.

N.B.—This is only one suggested scheme, which may be suitable for rural areas. A scheme for big towns like Madras or Madura may have the approach for World Geography from commodities of daily use and proceed therefrom to the world areas of their production. Such a scheme will be worked out in another sitting of the Committee.

MODEL QUESTION PAPER

By

Miss H. T. Scudder, M.A.,

Form VI. GEOGRAPHY (*Group A*) Time: 1 hour.

(*N.B.—All questions to be answered.*) marks.

1. Write down on your answer paper the numbers 1—20 and opposite each number the name of the rivers, cities, lakes, peninsulas, seas, etc., shown on the accompanying map. (Map omitted). 10

2. On the accompanying map show the following:—Tropic of Cancer, Longitude 0°, a route from London to Yokahama, the air route from Madras to Berlin, the winter monsoon winds. (*Note: the routes should show the most important steps.*) 5

3. Write down the names of 4 countries or regions in the first list, and opposite to each, write one product from the second list which is most characteristic of the region.

1. Ruhr.	1. Rice.	
2. Red Basin of the Yangtse.	2. Cotton goods.	
3. Caucasus.	3. Tin.	
4. Holland.	4. Coffee.	
5. Lancashire.	5. Silk.	
6. Plain of Lombardy.	6. Oil.	
7. Yemen.	7. Cheese.	
8. Malaya.	8. Coal.	4

4. From the towns given below select the best example of (1) a sea-port, (2) a route centre, (3) an industrial town, (4) central town, (5) a river port, (6) a coal-field town. Charleroi, Baghdad, Milan, Rome, Shanghai, Penang, Osaka, Vienna, Madrid, Paris, Cardiff. 3

5. Some of the following statements are true and some are false. Read them carefully. If they are *completely* true, write down true. If they are completely, or partly false, write down false. Do not copy the statements.

   1. Czecho-Slovakia has developed many manufactures such as glass, chemicals and sugar.

2. Danzig is an international port under the League of Nations, located on the North Sea.

3. Iron of very good quality is found in Spain and Sweden.

4. The river valleys of France are great wine-making districts.

5. It is colder in the west of England than the east in winter, and colder in the north than in the south in summer.

6. Athens gets rain in summer, Moscow gets rain in summer, Canton gets rain in summer.

7. Japan has developed her industries, because of her supply of coal and iron, and now is a large exporter of manufactured goods.

8. There is more rice produced in the plains of Siam than is needed, so a great deal is exported.

9. Malacca, Gibraltar, North Borneo, Malta are all British possessions.

10. Maize grows in Hungary and Rumania.

11. The natural regions of Russia are Tundra, Coniferous forest, steppe, desert, mountainous border.

12. Port Arthur is a Japanese possession in Korea.

13. Silk is the largest export and cotton goods the largest import of China.

14. The Pyrenees, the Meseta, the Alps, Balkan Mountains, Apennines are the youngfold mountains of Europe.

15. Wheat grows in Manchuria, the Steppes of Russia, South-East England and the Po Plain and a few other places in Eurasia.

16. The silk worms are grown north of latitude 50° in Eurasia. 8

6. In what parts of Eurasia would you expect the following towns to be situated ?

Extracts from Periodicals

THE INDUSTRIES OF MYSORE

Everything from Gold to Porcelain

BY

MR. ADI K. SETT. F.R.G.S., F.R.S.A.,

When one speaks of Mysore one is inevitably led to think of its gold, chrome and manganese mines, its magnificent forests of teak and sandal, its coffee and mulberry plantations and above all its Soap, Sandal, Silk and Sugar—the four big S's with which the name of Mysore has become associated.

Mysore was the first in India to foresee the possibilities of developing its natural resources by the application of modern science and in more industries than one it is leading the way. The progressive administration of the State has happily always encouraged the investing of capital in industrial enterprises.

SOAP

The Soap Factory, which is located in Bangalore City proves to be a star feature in a tourist's programme. It is one of the few State enterprises which has proved profitable from its very inception. Last year a profit of about Rs. 90,000 was made. The products, which consist of toilet and washing soaps, brilliantine, vanishing cream, tooth paste, mouth wash and gum, are thrown open to All-India markets and also exported to foreign countries but mostly to England, due to the Trade Commissioner's efforts. The Factory employs 150 labourers.

SILK

Due to the very favourable conditions obtaining in the State for the cultivation of mulberry, the sericulture industry has been highly developed and about half the total raw silk produced in India comes from Mysore. Owing to the competition from cheap Japanese and Italian silks, the sericulture industry of this State has suffered much and has caused alarm as about one-sixth of Mysore's population depends on this industry. Mysore silks are famous in India and elsewhere for their durability. The Silk Factory produces shirtings, suitings, saris, socks, neckties and handkerchiefs (which are a speciality). This is a lucrative concern and affords bread to over two hundred souls. The breeding and the rearing of the silk cocoons has become a cottage industry throughout the State. Each cocoon yields a silk filament of 300 to 400 yards.

Small industries, such as cotton, silk and wool weaving, have always existed in the State. Mysore has devoted much attention to the weaving industry which provides employment to over 150,000 people. The Government Weaving Factory, started twenty-four years ago, proved to be very valuable and is now converted into an institution for training youths in weaving cotton and silk. We must remember one great factor in favour of the industrial enterprises of Mysore : electricity is cheap throughout the State and almost all the factories are electrically worked.

SANDAL OIL

Near the Silk Factory stands another factory, the products of which have made the name of Mysore famous all the world over. It is the Government Sandal Oil Factory.

Sandalwood trees are found in all parts of Mysore and wherever they may grow they belong to the State. Huge blocks of sandalwood are collected in the factory and it is interesting to see how they are chipped off within a few minutes by means of the electrically-run machines. Oil is extracted from the wood by steam distillation. Vapours carrying oil and steam are condensed in tubular condensers. Crude oil, which is extracted, is refined in the laboratory and stored in a cool room. The oil is much used for perfumes and medicines and is mostly exported to Russia for medicinal purposes. The perfume is locally sold. Mysore sandal oil accounts for about three-fourths of the world's output of this commodity. The factory, which was started by Government as far back as 1916, has moved from strength to strength and now carries on a flourishing trade with Europe, America and Japan.

SUGAR

The Sugar Factory of Mysore is perhaps the largest in India, employing over three hundred and fifty people. It is piloted by a Dutch expert. Government own 60 per cent. of the shares which have now more than doubled. The factory works for only seven months in the year. The initial capacity of the plant was 600 tons per day and though the factory is only three years old, its capacity has been increased to 1,400 tons a day.

The molasses, which are obtained during the manufacture of sugar, are used for coating the road surface in the moffussil in place of the more costly tar—this is a new venture. Roads which are thus "molassed" are much better for heavy traffic than tarred roads; this process is much cheaper than the usual tarring. The molasses are also much used in the Distillery, which adjoins the factory and here arrack, whisky and brandy are turned out; all extremely cheap. They are however not exported much. The Krishnarajasagar Dam irrigates sugar-cane plantations to a distance of over 40 miles.

GOLD

There are four principal gold mines in the State and they are leased to Messrs. John Taylor and Sons who give a royalty of about Rs. 40 lakhs per annum. Nearly 13,000 coolies are employed. Besides gold, there are chrome mines, iron ores (at Bhadravati), manganese ores; also copper, lead, antimony and asbestos can be found in considerable quantities in the State. A great many concerns are privately-owned, yielding a good amount of royalty to the Government.

The Mysore Iron Works of Bhadravati, entirely State-aided, has been causing anxiety to Government. From its inception in 1923, except for the present year, it has not been running profitably, mainly due to the depression in the iron market. It has, however, given training to a good many and afforded employment on a large scale. Recently a steel plant has been installed and great things are expected of it. The concern provides employment for 5,000 people. A small cement factory is to be very shortly installed here as the slag obtained at Bhadravati is said to be excellent. Plans are also afoot for a paper mill which will also be erected here, due to favourable local resources.

This article would be incomplete without a mention of the stone quarries which are scattered all over the State. The local granite is excellent and is exported to Europe and America to be used as kerbstones. Recently, at the Empire Exhibition in London, Mysore kerbstones were much appreciated and lauded. This granite is excellent for building purposes; all the important public buildings in the State are entirely built of granite.

ELECTRIC GOODS

The Government Electric Factory, situated in Bangalore, is under the charge of an enthusiastic and clever Polish expert.

Switches, metal lamp-shades and floodlights are chiefly turned out as well as a most attractive collection of bakelite articles which are well received by the public. Employment is given mostly to a large number of well-educated young men.

The Porcelain Factory of Bangalore is another Government concern which is receiving much attention and support from the public and is running well financially. The raw materials constituting a porcelain ware—china clay, felspar and quartz—are locally found. It is interesting to watch china clay being washed in the levigation plant and then being mixed with felspar and quartz. Chiefly insulators are manufactured and these find a ready sale all over the country; everyone of them is subjected to a severe test before being placed on the market. Some ornamental articles are also turned out here.

MEDICINES

Opposite the Porcelain Factory is the Government Industrial Laboratory where various kinds of patent medicines, liniments and tinctures are manufactured. These are chiefly used in the State Hospitals. Latest records show that 66 different kinds of medicines were manufactured during the past year. Only those raw materials which cannot be obtained in India are imported from Europe. The total value of medicine manufactured during the last year amounted to Rs. 65,000. This is a most praiseworthy Swadeshi venture and excellently run. An interesting feature here is to watch ointments being churned in big vats and to see hundreds of tablets being turned out by a small machine.

SANDAL

Adjacent to this Laboratory are the Sandal Kothi and the Lac Factory. The Kothi stores about twenty lakhs worth of wood. The billets, which are obtained after the wood is chipped, are mostly sent to Bombay for the Parsi Fire Temples. A good amount of sandalwood is exported to the United States, and Russia and France take a very fair amount of oil for medical purposes. There is a small Lac Factory, where liquid polishes for various woods and sealing wax are manufactured.

TECHNICAL SCHOOL

The Chamarajendra Technical Institute of Mysore provides practical training to students in various arts and crafts. Over three hundred of them work here and each is paid for piece work. The various articles and furniture which are manufactured are indeed very beautiful and can easily stand competition with similar articles made anywhere in India. Inlaid work of ivory and crinoid are a speciality. Carved ivory and sandal pieces from Mysore are receiving world-wide fame. The sandalwood carvers have practised their trade for generations. A sandalwood casket presented by the Maharajah to King Edward the Seventh was exhibited at the Wembley Exhibition and created a sensation there.

SIR MIRZA'S DREAM

Mysore is indeed passing through an industrial revolution. In spite of the existence of all these various factories and industrial concerns already noticed, various important factories are to be set up shortly in the State, of which mention may be made of a biscuit factory and one for manufacturing electric light bulbs, a factory for the making of ammonium sulphate and other sulphates (estimated to cost about Rs. 18 lakhs and to be piloted by distinguished scientists). The curing of tobacco is also given serious attention to by the Government. It is the great dream of Sir Mirza Ismail, the Dewan, to make his State industrially the greatest in India, thereby bringing about employment and prosperity to the subjects. It is entirely due to his initiative, far-sightedness and shrewd business acumen that all these important factories have flourished in the past and will do so in the future.—*The Hindu.*

BADRINATH

By

Mr. K. Venkataswami. Naidu

Once we cross Haridwar, the place where the Ganges enters the plains, we find ourselves in some of the wonderful fairy lands in the world.

Perhaps no other district in the Himalayan region combines rugged grandeur with delicate beauties of nature to such an extent as Gharwal. For the traveller, the mountaineer and the sportsman, it has a charm and fascination of its own. One sees stretched out for miles and miles the unchanging snow-capped peaks of the Himalayas from Trisul in the east to Kedarnath in the west.

My journey was confined to the district of Gariwal where the chief temples of Utharakand are located. There is Jamnotri which is the birthplace of the river Jumna, Gangothri, the birthplace of the Ganges and Kedarnath and Badrinath, the two famous sacred shrines. The ravine from which the Ganges emerges into a mighty stream is commonly known as Gangothri and, the hills and mountains over which it flows are so charming and refreshing that a man finds himself transported into regions of bliss. One who has seen the course of the Ganges from its source along the 300 miles of its magnificent descent to the plains, the hundreds of tributaries dedicating their waters to the holy river cannot fail to be fascinated.

THE FIVE PRAYAGS

The places at which important rivers join the Ganges are beauty spots. Invariably, there is a beautiful temple and a nice little hamlet. Devaprayag is a place where the river Alaknanda meets Bhagirati. From Devaprayag, the river is called the Ganges. The source of the river Bhagirati is called the Gangothri. It is only by following the course of Alaknanda we reach Badrinath.

The next place is Rudraprayag where Alaknanda meets Mandakini. It is on the banks of Mandakini at a height of 14,000 feet above the sea level, the magnificent temple of Kedarnath stands. The river Alaknanda meets Pindari Ganga at Karna Prayag and Nandakini at Nanda Prayag and Vishnu Ganga at Vishnu Prayag.

At Haridwar, the Ganges emerges from the mountains to the plains in all its grandeur and magnificence. Here the people offer prayers to the river as the embodiment of the sacred goddess, Ganga. The beautiful town of Haridwar is studded with dharmasalas which look like so many palaces. There people gather in thousands every day throughout the year to offer prayers to the river.

KALI KAMLIWALA

Along the upper course of the river in Gharwal, we have got beautiful little hamlets where sages and great souls are living in renunciation and peace. A few miles above Haridwar there is a place called Hrishikesh. Viswanandaji, otherwise called Kali Kamliwala, (because of his black blanket) who saw the miseries the pilgrims were put to in those early days started a great institution which provides dharmasalas, pyoos, arrangements for feeding the pilgrims throughout the route and also for giving them medical aid.

As we get near Badrinath, we come across snowy-peaks. They look very beautiful in bright sunshine. Some mountains are bare and covered with snow. Beautiful landscapes, snowy peaks, waterfalls and caves, abodes of the rishis of ancient times, are some of the wonders which we can see only in the Himalayas.

The journey to Badrinath Puri is, with certain precautions, absolutely safe, and it is a journey which every one ought to make during his lifetime. There are some places on the route where one has to be cautious ; Government have taken sufficient precautions to see that no danger to life is caused. Usually it takes 20 to 25 days to go to Badrinath and return. We have to cover over 183 miles out of which we do 60 by bus. From Haridwar to Devaprayag there is a bus service and the distance of 60 miles can be covered in a few hours. Thence we have to go by a bridle path which is generally five to six feet wide. The route is straight except in the higher regions where there are very steep ascents. During the whole route, there are 'chutties' or halting places at every second or third mile. A chutty is a place where a number of bazaarmen erect their sheds under licence ; they give shelter to the pilgrims on the understanding that the pilgrims buy their requirement from them. Invariably at every chutty we have pipes from mountain springs and it is safe to drink that water. One must avoid drinking water from the Ganges or its tributaries because the water is very impure.

CHANGES IN CLIMATE

Travelling in the Himalayan region, one will often find himself as high as 15,000 feet and as low as 1,500 ft. He must therefore make necessary arrangements for changes of climate. Suddenly a heavy downpour of rain may come. There must be warm clothing. Vegetables are difficult to get, but at some important towns, we get vegetables, biscuits, nuts and other requirements. There are also dispensaries and hospitals at every 10th mile. The pilgrims are seen on the route all hours in the day and sometimes in the night also. There is absolutely no fear of wild animals, or dacoits.

There are various methods of conveyance, one of which is the 'Dandi,' which is carried by four people. We have the "Japan," which is just like the "Dohli" at Tirupathi ; horses and mules. "Kandi" is another, just like a basket carried by one man on his back. But conveyance is not quite indispensable. Usually one can walk 20 miles in that salubrious climate without any difficulty whatsoever. If necessary, one can employ a Bhoj or a cooly to take our luggage for a small remuneration.

Most of the people who travel in this route,are all pilgrims. We see people, from all parts of India. They become friends easily and spend time in religious discussions and render mutual help. I have met several "sadhus." Some of them are bare and naked, without even a shred of cloth on their body sitting in the open exposing their bodies to the biting chill and snow. As pilgrims meet each other, the cry, "Jai Badri Bishal," rends the air.

BADRINATH PURI

On a site which is 11,400 feet above sea level, stands the little village of Badrinath Puri and around it we see snowy peaks. The mighty Alaknanda is flowing by the side of this hamlet. There is a thermal spring (122 deg. F.) known as Tapat Kund which is said to contain valuable healing properties. In that water one enjoys a hot bath, amidst the cold surroundings.

The beautiful little temple enshrines the famous idol of Badrinath. The Lord is seated in the Yoga posture. It is stated that Lord Sri Vishnu, when He created the world, Himself first performed 'tapas' and then taught the great 'manthra' to the people. This sacred manthra is the source of the Vedas. This temple is considered to be the most sacred in India and every Hindu is ordained to worship Lord Badrinath at least once in his lifetime.—*The Hindu.*

News and Notes

An ordinary meeting of the Association was held on 16-10-'36 at the Presidency College, when Mr. K. M. Subrahmanyam, M.A., L.T., Dip in Geo., read a paper on *the Agricultural Geography of North Arcot District*, with Mr. K. C. Ramakrishnan M.A., in the chair.

* * * * *

Another meeting of the Association was held in the last quarter, on 9-12-'36, at the Teachers' College, Saidapet, when Mr. B. M. Thirunarayanan, B.A. (Hons.), London, delivered a lecture on *Air Routes in India*, with Capt. Abdul Hamid, M.A., in the chair.

* * * * *

At its last terminal meeting held on 13-11-37, the Standing Committee of the Association prepared an outline scheme in Geography, suitable for Elementary Schools in rural areas, which is published in this issue.

* * * * *

Though the Excursion Committee of the Association could not complete its work in the last quarter, the Tamil Geographical Terms Committee has been carrying on its work with frequent meetings, classifying and supplementing the geographical terms, and revising the Tamil equivalents, already prepared by the Madras Presidency Tamil Sangam. It has been an arduous undertaking; and the work is nearing completion.

* * * * *

A meeting of the Coimbatore branch of the Association was held in November 1936 under the Presidency of Mr. T. K. Duraiswami Iyer, when Mr. T. S. Venkatesa Iyer, B.A., B.L., gave a talk on *the Hogainakal Falls*.

* * * * *

Another meeting of the same branch took place on 28-1-'37 under the Presidency of Mr. K. R. Ramakrishna Iyer, B.A., B.L., when Mr. Rao Saheb C. M. R. Chettiar, delivered a lecture on *My Tour in the Deccan Plateau*, illustrated by slides.

* * * * *

We congratulate Mr. Chettiar on his election as Fellow of the Royal Geographical Society. He has been the enthusiastic President of the Coimbatore branch of the Association, whose activities are mainly due to his earnestness and enthusiasm. He has contributed several papers on the Historical Geography of South India, especially for the Conferences of the Association; and these have been published in back numbers of the Journal.

The next Summer School of Geography has been arranged to be held at the Geography Department of the Teachers' College, Saidapet, from the 7th to 30th April 1937 for the benefit of teachers of Geography in Secondary Schools. Details regarding the course will be notified in due course.

* * * * *

The Working Committee of the Association has resolved at its last meeting held on 6-2-'37 that in view of several difficulties of having the Association year and consequently the Journal year different from the calendar year, the latter be adopted as the Association and the Journal year.

* * * * *

Nothing is yet known definitely about the reorganisation of the Secondary School-Leaving Certificate Scheme; and it is expected that the existing scheme will continue to be in force for some time longer. Meantime, the Madras Teachers' Guild has prepared a well-considered scheme, which will be made the basis of discussion at the S.I.T.U. Conference to be held at Tanjore in May next.

* * * * *

We are glad to note that Sarah Tucker College, Palamcottah has introduced Geography in the Intermediate Course; and this is the second Women's College in the Presidency to have Intermediate Geography.

* * * * *

Even in these two Colleges, the subject is only a blind alley. It is hoped that at least at the Queen Mary's College which has been having Geography taught at the Intermediate stage for a fairly long period without any break, early steps will be taken to continue it in the B.A. course.

* * * * *

It is, however, deplorable that no Men's College in the Presidency has made provision for teaching the subject even in the Intermediate stage. The Presidency College, as the premier Government College in the Province, should normally give a lead in the matter of introducing new subjects of importance. There is a special reason why this College should find it advantageous to do so. Students taking up Geology in the B.Sc. course will find in Intermediate Geography the necessary preliminary training which the Botany and Zoology students of the same course find in Intermediate Natural Science. It is surprising that the College Authorities have not yet realised this simple and obvious fact; and it is hoped that early steps will be taken to start Intermediate Geography in that institution.

* * * * *

In the absence of provision for teaching Geography in the B.A. Degree Course in any of the Colleges in the Presidency, the University of Madras has with considerable forethought instituted the Diploma Course in Geography, a training in which ought to be sought by all prospective teachers of the subject. The Training Colleges give preference in the matter of admission to the Geography section to persons with such qualifications, irrespective of other considerations. Yet, it is regrettable that the need for taking this Diploma before seeking admission in the Geography section of Training Colleges has not yet been generally realised.

* * * * *

The proposal to permit *bona fide* teachers who have passed the Intermediate Examination and taken the Diploma in Geography to appear privately for the B.A. Degree Examination is before the University authorities; and its approval should facilitate people who are keen about it getting the Degree in Geography without waiting indefinitely for Colleges being affiliated in that subject.

* * * * *

It is understood that the Osmania University is proposing to introduce Geography in the Intermediate Course, and to provide for its teaching in the City College at Hyderabad (Deccan). It is hoped that the Annamalai and the Mysore Universities also will take up the question at an early date.

* * * * *

Two of the papers on Geography, submitted to the *Geology and Geography Section* of the Indian Science Congress at its 24th Session held at Hyderabad in January last, namely, *the Human Geography of the Post-tertiary Alluvial and Sandy Belt of the East Coast* by Mr. N. Subrahmanyam and the *Industrial Crops of Kerala* by Mr. George Kuriyan—are published elsewhere in this number of the Journal.

* * * * *

The next session of the Science Congress to be held at Calcutta in January 1938 is its Silver Jubilee session, which will be attended by representatives of the British Association among whom are some well-known Geographers. Mr. D. N. Wadia, Assistant Director of Geological Survey, has been elected President of the Geology and Geography Section for that Session.

* * * * *

It has been proposed at Hyderabad that a federation of the several Geographical Associations and Societies in India may be brought about, whose representatives may meet annually along with the Science Congress, and discuss matters of common interest, and compare notes regarding their work, activities and achievments. The suggestion has also been made that the Madras Geographical Association as the oldest Geographical Association in India should take the lead in the matter.

* * * * *

The All-India Federation of Teachers' Associations will hold its next session at Calcutta in the Christmas week of 1937. The meeting of the Science Congress will take place in the following week in the same place.

* * * * *

For the Geography Section of the Seventh World Conference of the World Federation of Educational Associations to be held at Tokyo from 2nd to 7th August 1937, the following general theme has been decided upon :—*Promotion of International Goodwill Through Geographical Education.* The following three papers will be among those presented by the Japanese Geographers and Educationists :—

1. How to Realize International Exchange of Geographical Teaching Materials,
2. Recent Development of Geographical Education in Japan.
3. Changes in the Distribution of Population in Japan since 1870.

Additional papers from prominent geographers of other countries are of course expected.

Reviews

Map Making. By Frank Debenham. (Blackie & Son, Ltd., London) 1936. Price 5sh. - net.

It is a matter for joy that a master of the subject has chosen to write a simple book on Surveying for the amateur. Most books on the subject are meant for the professional, and leave the impression that the making of maps is a sort of mystery, involving the use of strange and expensive instruments, acquaintance with higher mathematics and a high degree of perfection with the pen. Prof. Debenham has shown in this volume under review that reasonable maps can be made with the simplest of instruments, mathematics of the middle school standard, and a moderate ability only with the drawing pen.

After explaining certain important general principles and scales in the first two chapters, surveying by means of the chain, the compass and the plane-table, and with the help of photographs and the methods of determining heights—are treated clearly in the next 8 chapters. The last chapter, which discusses the choice of instruments is followed by appendices explaining the use of lettering, conventional signs and traverse tables.

We can strongly recommend the use of this book by the upper form school boy, the first year university student, or the field scientist, who will find that the mapping of small areas is a simple, interesting and inexpensive hobby, in which a reasonable degree of accuracy can be easily attained.

Longmans' Descriptive Geography: Books I & II (Telugu) and Book III (Tamil). By L. D. Stamp. (Longmans, Green & Co., Ltd., Madras). 1936. Price As. 10, As. 12, and As. 12.

Books I and II of Mr. Stamp's middle school Geographies are the Telugu versions of the Tamil books reviewed in the previous number of the Journal. As in those books, the treatment is direct, clear and simple ; and only facts of outstanding value have been presented to produce the right perspective of the regions in the several continents. The books are well illustrated with a number of good pictures and diagrams ; and useful exercises are given at the end of each section. The print, paper and get-up have made the volume attractive.

Descriptive Geography: Book III (Tamil and Telugu). By N. Subrahmanyam. (P. Varadachary & Co., Madras). 1936. Price As. 12.

This third book in Tamil and Telugu completes the middle school series by the same author, reviewed in the previous number of the Journal. As in those earlier books, the instructions and principles accompanying the syllabus have been closely followed, including descriptive treatment; and the volumes have been well-illustrated by choice pictures, maps and diagrams. The suggestive exercises given at the end of each chapter not only test the knowledge of the subject-matter but also supplement it in a way. The bold print on glazed paper with a fine get-up make the volumes attractive.

The Story of Indian Civilisation. By C. E. M. Joad. (Macmillan & Co., Ltd., London). 1936. Price 2sh/6d.

In this interesting little book the author has not attempted to give any connected political History of India, not even in outline. On the other hand, he has selected those aspects of Indian History, which have appeared to him to be significant or distinctive of Indian thought and culture, and has tried to present some account of them. Avowedly, the book which does not pretend to be an original contribution is not an objective record of Indian civilisation, but is "an account of the reactions produced by that story in a highly interested spectator, a product of the very different civilisation of the West, whose primary purpose in writing has been to make clear to himself what it is that India has or has not which marks off her civilisation from that of all other peoples, and how much of this 'something,' which romantic writers call 'the spirit of India,' may be discovered and applied for the benefit of the West." The volume may be recommended for study by university under-graduates, who will find in it the salient features of their own country's culture, as presented by a sympathetic foreigner.

The Oxford Geographical Note-Book for Secondary Schools: Books I to VI. By Jasper H. Stembridge. (Oxford University Press). 1936. Price: Book I—1sh/-. Books II to VI—10d. each.

This is a series of six geographical exercise-books, intended for individual use during a four or five-year school course. The exercises are for the most part based on sketch-maps, which attempt to show the effect of relevant factors on particular aspects of Geography. A number of photographs of general interest are included; and exercises based on them will no doubt serve to stimulate observation. A number of questions, selected from various standard examination papers have also been included. Each book closes with an examination paper which can be answered, after the rest of the exercises have been completed.

Book I deals with the British Isles—the Home Country of the English children for whom it is intended; and Books II to VI each deal with the following continents in order: North America, South America, Africa, Australia and Asia. But they may be taken, of course, in any order. A similar volume on India, as an alternative to Book I, would help the use of the series in Indian schools.

Exercises in Modern Geography: Book I—The World; Book II—The British Isles. By A. W. Coysh and D. M. Hunt. (University Tutorial Press, London). Price 1sh. each.

These two exercise books are intended to encourage atlas study and examination of pictorial material; and may be used as basis for individual work. The exercises contained in Book I are intended for use by pupils who have completed the regional study of the continents and who need to co-ordinate and extend their knowledge of world geography before leaving school or prior to school certificate examination. Those in Book II provide a detailed survey of the Home Country (British Isles), and are intended primarily for pupils preparing for public examinations. An alterrative Book II on India will prove very useful for Indian pupils.

Problem-Maps (World Series). By H. Alnwick. (George G. Harrap & Co., Ltd., London).

This book is not a course, but the presentation of a collection of 43 maps in such a form as to suggest problems and arguments. They are intended not as topographical tests, but as the subject of geographical discussions, while part of the accompanying text suggests also the converse process by asking the pupil to turn a given argument into map form and thence to make his own deductions. In an appendix are given the statistics required for working out the problems, which mainly refer to world commodities that have been made the link between the Regional Study and the World Whole.

Bulletin of the Madras Government Museum: Volume III, Part II —An Outline of Indian Temple Architecture. By F. H. Gravely. (Superintendent, Government Press, Madras). 1936. Price As. 12.

This little brochure is highly interesting and elucidatory to the student of Indian Archaeology, who will find in it a clear presentation of the type characteristics of the different styles of Indian Temple Architecture, northern and southern as well as the independent styles of restricted range such as those of Malabar, Bengal, Nepal and Kashmir. It will be still more interesting if it were possible to correlate the characteristics of the different styles with possible influences of environment or with the available structural raw materials in the several regions. As a matter of fact, in one or two places geographical influences have been shown to have been at work as at page 9: "In a West Coast or Malabar temple, the walls resemble a wooden railing in structure, and are as a rule still made of wood to-day." And this in a region where wood is plentiful and cheap is quite natural. The presence of a series of pitched roofs one above the other in Malabar and Nepalese temples has been traced to Chinese influence, the result of proximity in Nepal and of sea-contact in Malabar—the latter evidenced by the Chinese fishing nets of Cochin and Travancore backwaters.

The Calcutta Geographical Review: Volume I, Part I—September 1936.

We have much pleasure in welcoming the first number of the Calcutta Geographical Review, the organ of the Calcutta Geographical Society, Geological Department, Presidency College, Calcutta. The Society has been in existence since July 1933, doing silent spade work; and the Review has been undertaken recently, in September 1936. This first number contains several useful articles of varied interest; and with such a good start the Review is sure to prove a valuable clearing house of Geographical thought and activities in Bengal and North-eastern India. We wish the venture all success that it deserves.

Books and Journals Received

Map Making : By Frank Debenham.
The Story of Indian Civilisation : By C. E. M. Joad.
Longmans' Descriptive Geography : Books I & II (Telug Book III (Tamil) : By L. D. Stamp.
Descriptive Geography : Book III (Tamil and Telugu) : Subrahmanyam.
Geography of Madras City : By K. R. Rajam.
Problem-Maps (World Series) : By H. Alnwick.
Exercises in Modern Geography : Books I and II : By A. W & D. M. Dent.
The Oxford Geographical Note Books : By Jasper H. Sten
Report of the Department of Agriculture, Madras for tl 1935-36.
The Geographical Magazine : November, December (Xma ber 1936) & January 1937.
Kalaimagal : November & December 1936, and January 19
The Educational Review : November, & December 1936, a uary 1937.
The Scottish Geographical Magazine : November 1936 anc ary 1937.
The Indian Educator : November & December 1936, and 1937.
The Geographical Journal : November & December 19 January 1937.
The South Indian Teacher : November and December 193
The Quarterly Journal of the Mythic Society : July-Oct
Geography : December 1936.
The Indian Co-operative Review : October 1936.
Educational India : December 1936, and January 1937.
The Geographical Review : Index for 1936, and Januar
Indian Culture : January 1937.
An Outline of the Indian Temple Architectur (Bulletin of the Madras Government Mu
The Indian Journal of Economics : January 1937.
The Calcutta Geographical Review : Vol. I, Part I, Sept