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NOTICE

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— Editor

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THE COAST PLAINS OF KERALA

A reconnaissance

By

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The creation of the new state of Kerala in 1956 brought together for the first time a people and a country whose distinctiveness is one of the most remarkable features of Southern India. The new state, by combining the district of Malabar, formerly under the control of Madras, and the one-time princely state of Travancore and Cochin, less the southernmost taluks of Travancore, now covers some 15,000 square miles, and in 1951, a population of approximately 14,000,000 persons. It is in area therefore the smallest of all the fourteen states of the Union, although in size of population not much smaller than Orissa with 15,000,000 and 60,000 sq. mls., Punjab with 16,000,000 and 47,000 sq. mls., and Rajashtan with 16,000,000 and 132,000 sq. mls. Its population is considerably greater than the states of Assam with 9,000,000 persons, and Kashmir with 4,500,000; each with an area in excess of 85,000 sq. mls.

In density of population Kerala, with an average of 907 to the square mile, is the highest in the Union; only four other states possess mean densities in excess of 500 to the square mile: West Bengal with 780, Madras with 600, Bihar with 580, and Uttar Pradesh with 560 persons to the square mile. In all, the density of population in Kerala is nearly three times the national average figure of 312.

The simple population comparisons highlight in many ways the essential problems of this area which relate, for the most part, to causes which either stem from, or can be related to, demographic factors.

However, to begin by posing a problem, which though obvious, is not fully understood, would lead us eventually into difficulties, and it will be my intention therefore to consider Kerala, and in particular its coastal areas

as it was in the past and as it is now. By doing so I hope that some light will be thrown upon the real nature of the problems within this area as they would appear in a geographical setting.

Kerala owes its present existence as a political entity to a common language, Malayalam, spoken nowhere else in India, and perhaps one of the most closely regionalized major languages in the whole of the Peninsula. Yet this has not always been so, and the slow evolution of Malayalam as a language separate from Tamil is only one element in the pattern of Keralan identity; for although Malayalam came of age during the seventeenth century, when one man boldly set about making an alphabet and used it to render some of the chief Sanskrit poems in the vernacular, the real beginnings are as much geographical as historical.

The contrasts in environment between Kerala and its neighbours to the east, Mysore (Karnataka) and Madras (Tamilnad), are as near complete as one could wish for. Madras, with its wide coastal plain, open landscape, and an agriculture dependent either upon irrigation by tank or well, or upon the cultivation of dry crops, is a country of towns and villages; while Mysore, with its rolling plateaus, broad rivers, and almost semi-arid, but bracing climate, is the natural home of the cattle breeder. Few of the skills learnt here and in Madras would be of use in Kerala, where with high rainfall and high humidity, the landscape proliferates under an almost equatorial climate. Kerala is a land of trees and its whole economy has long been dominated by them; trees tempted traders to cross the Arabian Sea to Kerala for spices, ships, coir and nuts; Europeans came to manage tea, coffee, and even rubber estates; many varieties of trees in Kerala came from Ceylon and give to Kerala one of its lowliest but numerically most important castes, the toddy tappers. And even today, the dense forest clothing the western face of the Ghats are the real barrier to the rest of India. Thus did the tree long isolate Kerala from the rest of India and yet closely connect it with nations thousands of miles away across the seas.

Yet, one must not press this distinctiveness too far, for it might lead to the assumption that Kerala should extend along the whole length of the west coast. The problem has always been one of communication and the northern limit of Kerala has been defined as a compromise between the extent to which she can maintain north-south lines of communication along her coasts, and the extent to which neighbours on the plateau above, despite environmental differences, can afford a better means of control and organisation. Thus, in northern Kerala, Malayalam begins to give way to Kanarese as soon as swift-flowing east to west streams make it easier to move up to the plateaus of Mysore, than along the coast. Even so, the differences between the Mysore plateau and the coasts are strong enough to bring forth dialects of Kanarese, as an indication of a degree of isolation in these northern tracts.

However, such an argument to account for Kerala would have had little value but for the presence of an area within which the core of a Keralan ethos could develop. This heartland lies between Calicut and Trivandrum, where the coastal plain and the Ghat low foothills zone widen considerably. The importance of this area to the regional consciousness at the present time will be fully discussed in due course, but that the Keralans themselves have always been aware of it is clearly indicated by the way in which local folklore accounts, not only for the peoples of Kerala, but for the very soil on which they live.

THE MYTHICAL ORIGINS OF KERALA:—

The story in its essentials is that Parasu Raman, the macebearing incarnation of Vishnu, having killed his mother, tried to expiate his sin by killing all the Kshatriyas, who were counted to be the enemies of the Brahmins; he also gave away all of his land within the four seas. Having done these things, he was turned out of his land by the Brahmins. This left him nowhere to go, but the god of the seas, Varuna, taking pity on him, offered him as much land as he could span by a throw of his mace. Parasu Raman accepted, and throwing his mace from Gokarnam to Cape Comorin, caused the sea god, so the legend goes, to retreat from all this land.

The story then tells of how Parasu Raman populated his new lands with Brahmins brought from the Cauvery, Krishna, Mysore, Maharashtra, and Madura, and with members of the important castes to serve and protect them. He also brought to the country all kinds of agricultural plants; in particular the coconut, the plantain, and the jack fruit. Finally, he had to contend with an indigenous race of warlike people, who could not be entirely subjugated; so to specify them he gave them special privileges.

The story is nothing more than a legend, but it does hold a grain of truth; first, it clearly indicates what is, after all, the real heartland of Kerala—the coastal plain from Mangalore to the Cape; secondly, it points to its origin as a plain of emergence, as in fact it is; thirdly, it stresses the colonial character of its earliest settlements; fourthly, it takes into account the existence of an indigenous people; fifthly, the story gives at least legendary reasons why the Brahmins should as a class be so powerful in this part of India. And finally, it refers to a number of agricultural plants as being foreign to Kerala.

The story has one other interesting facet. It goes on to describe how the country was first governed, and tells how, in order to deprive the king of despotic power, the country was divided into seventeen parts; and it refers to the separation of the north from the south in the matter of certain religious beliefs. Finally it tells how the Muhammadans came to Kerala by sea, and converted the royal house, only to lose influence when the last of the Muhammadan kings left by the sea to make the pilgrimage to Mecca, never to return.

The real history of Kerala is not known but these traditions do give a general idea as to what went on.

KERALA AND ITS EARLY OVERSEAS CONNECTIONS:—

It is clear from other sources that Kerala was an important area even before the time of Christ; some claim on fairly good evidence, that much of the material used in Jewish ritual could only have come from Kerala—cinnamon, peacocks, and perhaps even the gold of Ophir. Some point to the long existence of Jewish settlements in Kerala, of which the one in Cochin still survives and counts among its members both black and white Jews.

The connection between Kerala and the Middle East at this time are full of possibilities. The trade seems to have been in the hands of the Arabs, and later, the Greeks, who, though aware of Kerala's produce, do not say much about the country. However, the Roman conquest of Egypt, the country to which most of the trade was destined for onward distri-

122, N 268, N 61.36

bution in the eastern Mediterranean, soon brought direct knowledge of the sources of this trade to Europe, and we have the now familiar account of the Greek, Hippalus, boldly striking out across the Arabian Sea to reach Kerala at the time of the southwest monsoon. This was accomplished early in the first century A.D. About this time too, the first Hindu from Kerala to visit Europe, reached the Roman court of Emperor Augustus. The Periplus of the Erythrean Sea gives a very good description of the Kerala coast, and described it as a source of pepper in great quantity, pearls, ivory, and fine silks. The chief mart was given as a place called Mouziris (Muyirikodu) now identified as Cranganore at the mouth of the Periyar River, and a little to the north of present-day Cochin; a former capital of the Chera Empire, and now deserted as a port because of silting.

The Periplus mentions gold as one of Kerala's leading imports, the truth of which is well evidenced by the very large number of gold coins of Roman origin which have been unearthed in Kerala as well as in other parts of south India; especially along a line between Cranganore and Pondicherry through the Palghat Gap. Ptolemy and Pliny, among others, all make reference to Kerala and its trade, and it is possible that there were in fact well-established Roman settlement in this area; the Peutingerian tables compiled during the third century A.D., specifically mentions one at Cranganore. The Pondicherry settlement, at the eastern end of the trans-peninsula route, has, in fact, been found and excavated.

References are also made during this early period to Christian settlements in Malabar. Cosmos Indicopleustes, for example, mentions a Persian Bishop being settled here in the sixth century A.D. From deeds of privileges granted between 700 A.D. and 625 A.D. we are certain that there were both Jewish and Christian communities of some size in the country.

In this early period there was warfare between the Malayali and Sinhalese and for a time each occupied part of the other's territory. The Sinhalese occupation would account for the introduction of the coconut tree among other things. The Malayalam word for coconut calls it the 'southern tree'.

The deeds already referred to are of interest because they give some of the earliest accounts of the duties of the Nayars. These people are clearly not the earliest indigenous inhabitants, but coming early, they secured for themselves a remarkable role; that of protection and supervision. They were the guardians of rights and of caste duties, and collectors of taxes, and by spreading themselves through the country, gave a remarkable degree of stability to the community. The last of the Brahman incursions took place after the seventh century, when Vedic Brahmans coming from the north, along the coast from Kanara, penetrated the country.

From then on Arab influence increased steadily, and close links were established between them and the west coast rajas. Chief among them was the Zamorin of Calicut, who gained considerably from the trade brought by the Arabs. Kerala's importance at this time must have been great. Marco Polo visited it once in 1290, and again in 1292 or 1293, and Ibn Batuta left a fine account of his visits during 1342 to 1347. Batuta described Kerala as;

" . . . not having a span free from cultivation. For everybody has here a garden, and his house is placed in the middle of it; and around the whole of this there is a fence of wood, up to which the ground of each inhabitant comes. No one travels in these parts upon beasts

of burden; nor is there any horse found, except with the king, who is therefore the only person who rides. When, however, any merchant has to sell or buy goods, they are carried upon the backs of men, who are ready to do so for hire."

Ibn Batuta refers to annual trade with China. Marco Polo's own voyage is a testimony to the Chinese connection, and this it seems was conducted at that time in very large vessels. Ibn Batuta had difficulty however in finding a large enough cabin for both himself and his slave girls, and to this he owed his life as the ship in which he intended to sail was wrecked.

THE PORTUGUESE:—

The Chinese trade, great as it was, withered away under competition from the Arabs, and had disappeared by the end of the fourteenth century, and, but for the arrival of the Portuguese in 1498 and their subsequent intervention, there is little doubt that the Arabs would have won political control. They had already much influence at the court of the Zamorin of Calicut; which da Gama—discovered very much to his cost.

The Portuguese struggle for supremacy was, to say the least of it, bloody, and might not have succeeded without the help of petty Indian rulers lying to the north and south of Calicut, who either wished to free themselves from the Zamorin's power, or were threatened by his expansionist plans. The Arabs were allied to the Zamorin, and through religion and control of the spice trade, with the rulers of Egypt. Thus, in the years following da Gama's first voyage, the Portuguese took advantage of their Indian allies by building up ports and factories at Anjedive, Cannanore, Cochin, and Quilon and from them despatching spices to Europe and sending fleets to harry the combined Arab and Zamorin ships. The control of the Arabian Sea was secured in a series of moves aimed at the nerve centres of the Arab sea routes, Malacca, Aden and Hormuz, after a great naval victory in 1506 off Cannanore, over an Arab-Turkish fleet, sent to succour the Zamorin of Calicut.

One of the most important moves in this struggle was the conquest of Goa by Albuquerque in 1510, and the acquisition of a base entirely free from interference. Within a few months Goa had become the focal point for all Portuguese activities.

The Portuguese continued their struggle and might eventually have won complete control, but for the appearance of other European powers. They had captured most of the key places, fortified them, and exercised a general, if at times uneven, control of the sea and they possessed all the benefits of a monopoly trade in spice to Europe.

THE INTERVENTION OF THE WEST-EUROPEAN NATIONS:—

The British tried unsuccessfully to reach India in 1591, and again in 1594-95 and in 1596. The Dutch had reached it in 1597, but their vessels were lost. They did however establish a factory at Baroda in 1598. In 1607 the British reached Surat, and in 1610 the Dutch settled at Pulicat, a few miles north of Madras, where they established fort Geldrie. The British established a factory at Surat in 1612, and in 1615 concluded a treaty with the Zamorin of Calicut, who saw in this move a possible ally in his struggle

against the Portuguese. The first British shipment of Malabar pepper was made from Cochin in 1635, five years before the British settled in Madras.

But for the moment it was the Dutch who were to matter most in Kerala. In 1660 they made a second unsuccessful attack on Goa, and they were similarly repulsed at Cochin a year later. A second attack on Cochin in 1663 brought them success, and from that day on the struggle for the spice trade was to be between European powers. With the capture of Cochin the Portuguese lost all of their Malabar possessions and were left only with Goa. A loss which can in large measure be attributed to their brutality toward the indigenous peoples and costly wars into which they were led. The Dutch followed in the Portuguese footsteps and although they controlled all the key points, Quilon, Cochin, Cannanore, and Cranganore, they too suffered from heavy military expenditures.

The British for their part did not resort to arms, and very much aware of the follies of their competitors, sought to use the velvet glove whenever possible. The British, having already a small settlement at Anjeno, about twenty miles to the north of Trivandrum, now secured a place for themselves at Tellicherry, a few miles south of Cannanore. This was chosen entirely because of its proximity to the best cardamoms to be found anywhere, and to the fine peppers of Kottayam (N. Malabar). As a port it had little to commend itself. This dates some time before 1699. The establishment of a French factory at Mahe in 1725, only a few miles away, threatened from time to time the fortunes of Tellicherry whenever the two countries were at war.

The real demise of the Dutch relates to the growth in the power of Travancore at the expense of the Raja of Cochin, who had always supported them; so that when Cochin fell to Travancore in 1750 the Dutch as a power were finished.

The French threat to the English was effectively silenced with the very active support of the local people; a support achieved through the good diplomacy of the British at Tellicherry. And thus by 1761 Britain alone controlled the spice trade.

The historical period from then on concerns only the British and Indians and was to be the third stage of European intervention.

Looking back to the two periods already considered, first to the short period of Portuguese supremacy, and secondly to the struggle for the spice trade between 1663 and 1761, we should note that to all intents and purposes European influence was confined to isolated spots along the coast. Europeans did not penetrate inland, Europeans did not engage in any form of cultivation or manufacture, nor did they have any hand in actual government. The factories and forts which they established were mainly to be found in the north from Cochin to Cannanore. In the south only the British factory and Angengo survived this period, but there had been others, notably at Tangaserri and at Quilon. Both had been captured in 1742 by the Travancoreans.

The reason for this concentration towards the north is in conformity with the distribution of pepper cultivation which falls off as we approach Quilon. And, as we have seen, reaches its finest quality in the region of Kottayam not far from Cannanore.

The factories established by the Europeans were shared among four petty chieftaincies; the Kolattiri family to the north around Tellicherry and Cannanore; The Zamorin's possession around Calicut; the Raja's possession around Cochin and lastly that of Travancore. The success of the British relates in part at least to their better relations with the local rajas; the failure of the Portuguese, French and Dutch to their inability to strike up good relations, and in the case of the Dutch and Portuguese actually to antagonise the local inhabitants.

The factory sites, while linked to the inland distribution of the much sought after peppers, cardamoms, and gingelly seeds and of cocoa and areca nuts, were of various kinds; Cannanore, Tellicherry, and Mahe were open roadsteads without inland access by waterways; Calicut, Tangaserri and Anjengo, while open roadsteads, had access, inland Calicut via the Kallayi and Beypur Rivers, and Angengo and Tangaserri via the extensive backwaters.

Cochin in particular was the most favourably sited in this respect, since it had access to the greatest of all the backwater network, the Vembanad Lake system. But, as we have seen, its full geographical potential was not realised during either of the two periods, because the Raja of Cochin, to whom it belonged was never strong—being in the first period very much subject to attack from the Zamorin, and in the later falling foul of the Trancoreans.

THE STRUGGLE WITH MYSORE AND CONSOLIDATION OF BRITISH RULE:—

By the middle of the 18th century Britain was master of the sea trade and the dominant trader ashore. But her trading posts were like beads on a string. She had no control of the surrounding country, and her fortunes were very much dependent upon events within the coastal tract. Travancore's expansion northwards has been referred to, and her conquests were completed in 1762 when, by building a land rampart from Cranganore to the foot of the Ghats she secured a defended right flank, and ejected the Zamorin from Cochin.

Petty difficulties between other rajas and rulers continued, but the most outstanding event was the spilling over into Malabar of the Mysoreans under Hyder Ali, and after him his son, Tippu Sultan. This was marked for the British by the capture of Mangalore and the use of this place as a base for Hyder Ali's infant navy, and by a series of reverses which at time seriously threatened their hold of the coastal settlements.

The course of the first and second Mysorean wars are matters for the historian, but we should note that the district of Canara and its capital, Mangalore, was to be a base for the southward movement of the Mysorean army and navy. This plan would have overcome the lack of real communication along the coastal tracts. In his first attempt Hyder Ali got as far south as Cranganore, the last remnant of the Dutch possessions in Cochin.

The wars with the Mysoreans, first with Hyder Ali, and then against his son Tippu Sultan, had two important results; first, it secured British control over all the districts of Canara and Malabar; that is, the most affected northern parts of the Malayalam speaking coast. Second, it brought home to the British the true nature of the country lying inland, and in particular the very rudimentary nature of its communications.

The question of inland communications is a feature which to this day is of considerable importance. The backwaters from Quilon in the south to Calicut in the north, though not continuous had been joined by short stretches of canal, and boat communication was possible all along. If we remember that during the Monsoon, traffic by small boats along the sea side of the coast is impossible, and that at all times inland-waterway craft can be more deeply laden than those of the open sea, some measure of the importance of these backwaters can be estimated. In fact at this time the great bulk of moment went on by water, either along the short streams that came off the Ghats, or along the backwaters or *Kayals*.

There were no roads, and land travel along narrow winding paths was either by animal or on foot. Kerala's modern system of roads begins with Tipu Sultan's 'gun roads', built largely during the second Mysore War to facilitate the rapid movement of large bodies of men, as well as Tipu's heavy guns. These gun roads, which were all linked originally to the old capital of Mysore, Seringapatnam, were developed by the British into a coastal plain system.

THE PHYSICAL BASIS FOR CONTRASTS BETWEEN NORTHERN AND SOUTHERN KERALA :—

The period which followed, the nineteenth and twentieth centuries, was one of consolidation by the British in Malabar, and of the continuance of the old forms of management in the two southern states of Travancore and Cochin. The most recent political event was the creation of the state of Kerala already referred to, and this has, to a certain extent acknowledged the distinctive character of the area. Nonetheless, as this short description of the region has shown, there are strong grounds for supposing a contrast between north and south, which encouraged, at least until 1947, an important degree of difference in political and economic development.

These distinctions are not without a physical basis and although it is true to say that there is an even stronger series of physical divisions running north-south, there are important variations between the northern and southern components of each of these parallel tracts. Basically these contrasts relate to the frequency and extent of backwaters, which in the north are confined to a disconnected series of almost ria-like lagoons at the mouths of the larger rivers; as well as to the more broken nature of the topography in the northern coastal plains, a brokenness which is emphasised by the difficulties of river crossings.

Of the three north-south divisions it is the sea-girt coastal plain and dunes zone which shows the greatest variation in extent. It is at its widest between Calicut and Trivandrum, and narrowest in the region of Mahe, Tellicherry and Cannanore—all situated on rocky promontories. Although the coast may be broadly described as an emergent shore line, with on the seaward side a very gently shelving sea bottom, and to landward, evidence of raised beaches, and in the laterite hills what may be platforms of marine abrasion, the wider extent of the alluvial coast plain in Travancore-Cochin must be related to a gentle but well marked inward curve of the Ghats at this point, and to the formation of a continuous system of spits and bars joining the two ends of the embayment. The lagoons so formed are now in the process of either natural infilling by river action or reclamation by man. In detail there are however a number of interesting features, not least of which is the large amount of deposition in all river

valleys draining into lake Vembanad, and the pronounced ria shape of the estuary of the River Kallada near to Quilon. But these and other problems must await a fuller examination before any final conclusion can be reached. What is certain, however, is the existence of strong alongshore currents, which at least as far north as Cochin, sweep from south to north. These are most in evidence during the southwest monsoon and to these must be attributed much of what we see in the present-day coast.

THE CULTURAL LANDSCAPE TODAY :—

The core of Kerala is therefore its coastal plain, and important as may be the Ghats or high ranges with their forests and plantations, and the foothills as a zone of expansion for the peasant population, events will in the end depend upon this narrow coastal strip.

Coastal Kerala enjoys what is perhaps India's nearest equivalent to an equatorial climate. The average annual temperature at around 80 deg. F. has a range of only 5 deg. F. on either side. Diurnal ranges of temperature are only a little lower than the annual range, and the extreme ranges, and the extreme maxima and minima for all months are almost exactly the same. A slight seasonal swing can be detected in higher day, and lower night temperatures during the early part of the year. Rainfall, cloud and humidity are in fact the only true seasonal elements, and their regional variations lead to climatic contrasts between northern and southern coastal Kerala. To the north the rainfall regime becomes increasingly monsoonal, with, as at Mangalore, over 80 per cent of the total rainfall in the months June to September; while to the south the monsoonal pattern is increasingly affected by extra monsoonal rainstorms, so that stations such as Trivandrum receive less than 50 per cent of their rainfall during the same period. Rainfall is in all cases high, and increases steadily northwards from Trivandrum with 66" to Mangalore with 129", with the majority of the coastal stations receiving more than 100".

The vegetation which accompanies this climate is luxuriant, but so great is the impact of man that very little of an almost continuous canopy of green from Trivandrum to Mangalore is natural. To the south of Trivandrum the country changes as the rainfall decreases further, and the importance of the southwest monsoon is now second to that of the so-called northeast monsoon. Nagercoil, some ten miles from Cape Comorin, receives only 40" per annum. The effect on the landscape of this change is most marked; Trivandrum is unmistakably Keralan with its high humidities, luxuriant vegetation, and uniform temperatures; Nagercoil, on the other hand, is an anomalous extension of the Tamilnad dry zone type. The boundary between the two areas corresponds to the 50" isohyet, and with the separation of this southern extremity from the old state of Travancore, and hence from the new one of Kerala, roughly along this line, the cultural individuality of Nanjanad with its capital, Nagercoil, has been recognised.

Yet at the same time, one is well advised to begin with Nanjanad in any examination of Kerala's cultural landscape, since its contrasts highlight the distinctiveness of Kerala proper. This study will therefore begin with Nanjanad and will continue northwards from Cape Comorin to Cannanore, a distance of some 350 miles.

NANJANAD :—

Backed by the steeply rising southern extremities of the Western Ghats, the open rolling coastal plain of Nanjanad is watered by a

system of irrigation, begun probably a thousand years ago, based upon three rivers; the Paralar, the Pazhayar and the Kothayar. Elsewhere, beyond the area commanded by these rivers, tanks are used to eke out the meagre rainfall and everywhere the Tamils have given to this particular part of the west coast their distinctive cultural elements. Villages are compact, small towns an integral part of the landscape, and everywhere is grown the floral emblem of the Tamil; the palmyra palm. With its straight trunk soaring to perhaps 80 ft., and stiff radiating head of fan-shaped leaves it grows either around the villages, or in long lines or singly. Unlike the coconut, it does not seem to require the sound of human voices to encourage it, nor is it so demanding as to soils or water. Yet, like the coconut it enters into every aspect of village life. Every eight or so years its leaves may be cut for thatching and basketmaking, and not so long ago, for use as writing material. The straight trunk may be used as building material, and serves well for house construction, provided it is kept away from damp. The palmyra palm was, until the passing of prohibition laws, the main source of alcoholic beverages for the hardworking Tamil cultivator, and the toddy tapper with his collection of knives and pots, and the palm itself adorned with pots to collect the juices from the base of the spadix, were common sights until only a few years ago.*

Northwards the palmyra is, at first gradually then suddenly, replaced by the coconut palm, the sure sign of a transition from 40" to 60" of rainfall. This takes place a few miles to the north of the now silent and ruined fortress town of Padmanabhapuram, once the capital of the Travancore kings, and a sign that the original power of the Travancoreans began in the more open dry areas of Nanjanad, and only later moved into the wet zone.

TRIVANDRUM :—

The modern capital of Kerala and formerly of Travancore is Trivandrum; a city of more than 200,000 inhabitants, owing its present position largely to the decision to find it as a centre of Travancore power in the eighteenth century. The old city lies within walls of mud, and with its fort and great temple, dedicated as was the old state of Travancore to the deity of Padmanabhaswamy, is in great contrast to the modern town which surrounds it. With its colleges, schools, administrative buildings and big modern hospital, it takes on the character of a typical Indian city, but its hilly site gives it an air of an eastern suburbia, with about as much coherence to its layout. Yet one cannot help thinking that, with spacious views over coconut groves, white painted bungalows, green lawns and the noiseless tread of people about their duties, suburbia is more at home here than it is in England.

Trivandrum is a political, administrative and cultural centre, and while it is now the capital for a much expanded area, still reflects its closer cultural ties with southern Kerala than with the northern districts. It has little industry, but is well connected by a railway eastwards through the Shencottah Gap to Madras and another, recently constructed via Quilon, to Cochin and Palghat and the northern districts. A little used canal also connects it to the backwater system but pride of place must now go to air and road transport. The road, a late comer to Kerala, is giving a mobility hitherto undreamed of to the ordinary person, and the red and cream buses

* Even now tapping is permitted, either for conversion into *Jaggery* (indigenous sugar) or for consumption as a beverage to be effected fresh before fermentation.

—Editor.

of the Kerala Government transport system on trunk and local routes now play a vital role in the life of the country. Air transport, although very far from being a mass medium, is bringing Kerala into the All-India orbit. Trivandrum is the southern terminus of an air network which embraces Cochin, Coimbatore, Madurai and Trichinopoly, and has Madras as its northern terminus. Where it once took 36 hours to travel from Madras to Trivandrum by rail, it now takes four or five, and Delhi is within one days travel. For the executive, administrator and their like, this ease of movement is bound to play an important part in breaking down old isolation philosophies.

A traveller with some recent knowledge of the Vale of Kathmandu cannot help but agree with Fergusson's views, expressed nearly eighty years ago in his classic work *An History of Indian and Eastern Architecture* as to the remarkable and perhaps not accidental similarities between the architectural forms of these two widely separated parts of India. Temple architecture in both places seems to have been derived from some common source, and the use of wood and the pagoda-like shapes so frequently employed, are unlike more conventional forms of Hindu architecture. It is true that in both places the more conventional forms are to be found, for example in Trivandrum, the great *gopuram* of Padmanabhaswamy, but these appear almost alien in a country where fine woods abound and skills in wood-working and carving are a national heritage. It is unfortunate however that one's curiosity cannot be satisfied; temples are forbidden to the *malecha*.

THE ENVIRONS OF TRIVANDRUM AS A TYPE STUDY FOR SOUTHERN KERALA :—

Southern Kerala, old Travancore State, has preserved many of the older ways; its comparative freedom from the old spice trade influences its freedom from British control and its comparative isolation all helped to give it this distinctinctive atmosphere. Nonetheless, at least part of the credit must go to the landscape itself; for as green and as lush as it appears from the air and the ground, it is not in practice an easy area to develop. It presents a fragmented pattern of low laterite hill and narrow flat-floored valley; and an alternation of fertility and agricultural possibilities perhaps ideal for the peasant working for a narrow market, but not something which would encourage large scale development of commercial agriculture. The laterite hills, flat-topped where the low coastal platform has not been fully dissected, are everywhere steeply sloped, which can give rise to a pyramidal shape. The alluvial valleys, narrow and winding, are in marked contrast. Their soils are brown to black, and their floors represent a sharp break of slope at their junction with the hills which fall down to them; a sharpness and flatness no doubt increased by the cultivator in working over the land for paddy cultivation.

These two elements, hill and valley, represent two basic environments to the human cultivator and inhabitant of southern Kerala. The hill with its freely draining soils, steep slopes and outcrops of country rock, is used for cultivation of tree and root crops. The hills are perennially green, and beneath their canopy twist and turn the roads and tracks connecting houses and small settlements scattered about the hill-sides. The alluvial valleys are by contrast, deserted; except for the workers with their bullocks and ploughs in the paddy fields. Here too the seasons are much more in evidence; the rice as it grows passes through its distinctive hues of green to the stubble yellow of the aftermath; The fields pass through their phases of flooding

and irrigation, and at night are zones of quiet stillness and darkness, ringed around with pin-points of light from houses, and the gentle murmur of insect and animal life.

The Trivandrum area exhibits many typical examples of these two contrasted but complementary landscapes of open paddy lands and shaded gardens, but before giving a description of them it is necessary to refer to the Keralan house; the focal point for all these activities, and so closely connected in all manner of ways to the country side that it would be difficult to imagine a more characteristic landscape element.

THE KERALAN HOUSE - THE TRAVANCORE TYPE:—

There are many variations in the basic type of Travancore house, but the description which follows is intended to cover the basic elements of an ideal house situated on the edge of a laterite hill, close to the paddy field for surveillance over it, near to the valley stream for bathing and washing, and on a site with a good water supply from a shallow well. The valley stream, if it is not already flowing close to the outer edges of the alluvial floor, will in all probability have been diverted to one or both sides of the valley; a measure which not only increases household comforts, but which also provides some flood control for the paddy fields against excess water draining off the hills during the monsoon, and a system of irrigation during dry spells.

The house itself will be protected by a mud wall, topped in the traditional manner by a palm thatch roof set above the wall on a simple wooden frame to protect it from the damaging effects of rain. Formerly, when protection against marauders was an important consideration, the wall may have been protected by a thorn hedge. The entrance through the wall to the house consists of a gate with over it a triangular roof; very similar in style to the lich-gate of an English church. A path, or even a ladder, will lead down to the stream. The house roof is hipped, and the ridge pole and main roof slopes are continued out over the upper part of the two hipped ends, giving an almost South Sea Island look.

This distinctive device is used for ventilation and the triangular opening so left is commonly filled by a delicately carved screen. The main house wall is deeply recessed to form a verandah and with its wide eaves the house is protected from the effects of sun and rain. Shade seems to be an important consideration, and planted as they are deep within the garden zone, houses are difficult to see from more than a few yards off. The yard, which forms an integral part of the house, is however an exception, for on it are dried the produce of field and garden. The noonday sun strikes down upon it through a clearing and its carefully smoothed mud and dung floor provides a clean insect-free surface upon which to produce and to work at removing fibres from coconut husks.

The room within the house are various, but most will include a guest room, a kitchen and a general room; lean-to additions are also a common feature. In close proximity to the yard and within sight of the house will be a small cattle-shed, open at the sides and thatched; a capstan oil press with its own palm thatch roof; haystacks built around palm trunks, perhaps a frame for firewood and a well. Northwards toward and beyond Calicut, houses are more commonly of two storeys and tiles are more generally used. The use of tiles was in fact at one time restricted to Brahman landowners,

whose houses were (and still are) somewhat grand affairs; especially if the joint family happened to be a large one.

The poorer class houses of course will lack many of these amenities and the simplest house will be entirely of palm thatch. It will nonetheless still reflect its Keralan origin.

THE GARDEN CROPS OF THE LATERITE HILLS:—

The key garden crop is the coconut, but its cultivation on any scale is limited to well watered coastal areas; the best moisture coming from ground water in gentle movement. Hence, water collected on high ground and percolating downwards, or water which is passing into the sea through sand dunes, or through alluvium on the side of river valleys, is ideal.

The great bulk of the coconuts in Kerala lie within about fifteen miles of the sea, and an average acre should support about a hundred trees. They live for about sixty or more years, and begin to bear nuts at the sixth to tenth year after planting and will continue to fruit up to the sixtieth year, giving greatest returns between ten to thirty years of age. The yield generally lies between sixty and one hundred nuts per annum, and these are taken during the months January to June. The tree is a cultivated one, and during its formative years in particular requires constant attention if good yields are to be expected, which some think explains the scattered nature of the Malayali settlements.

The uses to which the products of the coconut palm may be put are well known; the tender or young coconut provides a refreshing drink, the kernel of the mature fruit can be eaten or may be crushed to provide oil; the hard shell may be used for making drinking cups, oil lamps and the like, and when burnt gives a high grade charcoal which may be used for paints or for manure; the fibrous rind of the nuts, known as coir, issued for the making of matting, ropes, stuffing and brushes; the outer pith (all that remains after the nuts have been husked of their coir) forms a useful manure for the fields; the leaves can be split for a thatching material which is claimed by many to be superior to tiles, both from the points of view of waterproofness and as an insulator against sunshine; the leaves provide fodder for elephants and from the mid-rib of each leaf are made brooms, brushes, etc.

The trunk of the young tree, because its heart is soft and spongy, can be used for making water pipes; the wood of old trees is used as a building material; finally, like the palmyra, the coconut palm can be made to produce toddy which can either be drunk or converted into sugar.

In the laterite zone in particular, large numbers of areca palms are grown and these will thrive at greater altitude than the coconut palm. The areca requires even less attention. The main product of this graceful palm is the nut from which is obtained the main constituent of *paan* - the areca nut being the nutty part of this concoction. The areca leaves are burnt and provide manure, and the sheath which covers the flower can be used for making vessels to hold water, and for cups, dishes, and even small umbrellas.

An important source of food is the plantain, and although it grows best in alluvial soils, it can be grown in most places. The plantain, which belongs to the banana family, is planted in shallow pits in the laterite, and can be made to fruit for up to twenty years, providing each year's growth is cut back. The fruits are ripened during the cool weather season. About five hundred plantains can be set to the acre, and each plant can yield as many as

two hundred to three hundred fruits. The leaves of this plant make a useful disposable and hygienic plate for eating purposes, and parts of the stem can be woven into a cloth. The plantain garden is frequently enclosed by either a fence or a low wall.

Another common tree is the jack fruit, which apart from its timber, provides a source of food in its fruit which hangs, like the cocoa pod, from the main stem.

Northward from Trivandrum the pepper vine is found, growing ivylike round the lower parts of tree trunks.

Among the remaining trees which must receive attention is the cashew nut tree. It is not indigenous to Kerala, but was brought in by the Portuguese from Brazil. The plant is ideally suited to the local climate, and has become almost a weed in some parts; greatly impoverishing the soil and discouraging the growth of better plants. It is also the haunt of a particularly active biting ant.

In recent years the cashew nut has become an important item of international trade, and around Alleppey, Quilon and Calicut factories have been established for shelling the nuts and grading the kernels. So cheap is the labour and so expert the workers that a large tonnage of unshelled cashew nuts are imported each year from Africa for shelling and grading, and then re-exported. However, in the last five years or so African labour costs have risen much less than those of Kerala and this trade is tending to diminish.

Various other crops are grown in and around the laterite hills; grams, pulses and edible roots. The most important of all, and still rapidly increasing in acreage, is the tapioca plant. The root was brought into the country within the last hundred years, and it is of special importance to the laterite zone, in which it thrives better than anywhere else. It is in fact a substitute for rice, and offsets the lack of paddy in areas without, or far from, alluvial valleys, and is used especially by the poor people. Sweet potatoes are also grown in the laterite areas, but thrive best in the better class soils.

This provides some idea of the character of the laterite hills, and as one can see, it provides a pattern of stimulus and response, which is perhaps the most characteristic feature of Kerala.

THE PADDY LANDS:—

The paddy lands within the laterite hill zone are part and parcel of the economy; that is, while in Nanjanad one finds paddy cultivators and paddy villages, here paddy forms only one part of the agricultural system. The most striking difference between paddy, and tree and root crop cultivation is in the use of the plough and bullock in the former. The laterite hill is the scene of land labour with hoe-like instruments, whether for tree cultivation, root-crops, or for the grain. The next contrast is that the paddy lands of the alluvial valleys, indeed paddy grown everywhere, has a much stronger seasonal basis. The rhythm of tree and root cropping, while possessing a certain seasonal tendency, is much more spread out, and labour demands for cropping and planting, etc., are not squeezed into a few somewhat hectic weeks. The agricultural tenor of the alluvial valleys, on the other hand, is more in line with the normal pattern of activity to be found elsewhere in India; except of course that there is much higher proportion of double cropping.

The agricultural year so far as the paddy is concerned relates basically to the rainfall pattern. After the harvest, sometime in December or January, the lands are usually ploughed and left thus until about the middle of March, when they are ploughed again, to be ready for planting towards the end of April when light rains begin to occur. The fields in this case will not be flooded until the rice is about one foot high; that is, the crop is well developed before the main monsoon rain occurs, and not after, as many parts of India, where there are no preparatory showers before the burst. The crop is harvested in September, but the harvest may continue until November. The second crop is sown almost immediately after the first and is much less dependent upon rainfall for its development. Hence in the lands one finds the field channels serving a dual purpose—drainage and water control during the main monsoon season, and irrigation in the second. The crop is more likely to be transplanted from nurseries and sown before the first crop is harvested. In addition the land for the second crop is first puddled, and then levelled by means of a levelling board drawn by water buffaloes or bullocks the peasants standing on the board to increase its efficiency where necessary.

Transplanting takes place when the shoots are about one foot high, and thus, while the first crop is not flooded until the rice is one foot high, and for the second crop the field is flooded from the first, effectively there is no difference. In both cases manure is used, and here we note an important relationship between the laterite lands and the valleys. The laterite hill provides large quantities of leaf manure and ashes, and thus the amount available depends to a large extent upon the existence of woods and trees; increasing population and deforestation for the making of gardens therefore leads to a decrease in the amount of manures available.

In these agricultural operations there is, as usual, a division of labour between men and women—the men in general being responsible for ploughing, weeding and sowing, while the women undertake transplanting, weeding and much of the harvesting.

A third crop may be obtained from the field, and will usually consist of either gingelly (from which oil is obtained,) or a root crop. The amount of labour expended upon this crop is very little. The system of double and treble cropping in the laterite hill area is known as *Nilamkrishi*.

Much less frequent than either garden, or, as it is called, *Purayidam*, and valley paddy, or *Nilamkrishi*, is *Malamkrishi*, the cultivation of laterite hills; the land so cultivated being called *Cherikals*. Basically this system seems to be a remnant of shifting cultivation, and even today when the period between sowings is seldom more than six years, the shifting system has become a long fallow system, and is still partly dependent upon burning of the cover. The ground is seldom cultivated for more than two years in succession. Grams, pulses, and dry paddy are sown and on the flat hill tops the plough may be used, but frequently the work is done with the hoe. The method of cultivation and its general pattern is similar to the *chena* cultivation of the dry zone of Ceylon.

Certain of the lower parts of the alluvial valleys within the Trivandrum area and along the laterite zone, are in fact flooded from June onwards, but in certain areas not until January are they clear. These areas are best considered as being separate problems and since they are far better developed to the north, these will be treated in detail later.

THE FISHING COMMUNITIES:—

Near to Trivandrum and indeed along all the coast of Kerala there are small fishing communities, which are today very frequently Moslem in religion.* Not a lot is known about the seasonal activities of these people, but from a simple inspection the following items are of importance. The fishermen are usually without land and sell their fish to others through middlemen. The fishermen are usually indebted to one man who provides both nets and gear, and who gives them a share of the catch in return for their work. The method of catching the fish is from the shore by means of seine nets, which are laid into the sea from small craft. The nets are dragged ashore by all who can be mustered. The numbers of boats must run into many hundreds, since at certain spots on the sandy beach they stretch as far as the eye can see. The fishermen are most frequent near to large settlements; the village of Kovalam, for example, supplies Trivandrum market. The fish is rushed, as it were, to market, in baskets on the heads of porters.

The nets are made locally, though the boats themselves are the work of specialists; fishing slackens off during the monsoon when the seas are too rough, and most of the fishing is done during the early morning.

It should be mentioned here that the methods of making nets is the one practiced the world over. The fish may also be used for manure, and further north some of it is dried and preserved. Attempts are being made to mechanise, and modernise fishing in these areas; either by improved fishing methods, or by better distribution and preservation including the introduction of refrigeration.

Travelling northwards from Trivandrum along the main road to Kottayam, some ninety miles journey, the landscape consists essentially of a repetition of what has already been described; the road following the lower platform of the laterite hills. The succession of embryo villages, social service clusters and isolated roadside houses, and everywhere people walking, standing or sitting beside the road mile after mile, is the order of the day. The road twists and turns, and the clear view is the exception.

KOTTAYAM AND KUTTANAD:—

Kottayam itself is a large centre, at one time a capital of a petty rajah, and has for long been a centre for what are known as Syrian Christians, a sect who were converted to Christianity prior to the coming of the Portuguese, perhaps as early as the second century. Kottayam is a district centre, but it derives a great deal of its importance from its position as the meeting place for transport moving along backwaters and a road which leads up the Ghats in the direction of Peermade; a town which lies near to the Periyar Reservoir in the Cardamom Hills. Peermade is a centre for the tea industry and is of some historical importance because it was here at the Government Gardens that tea was first grown as an experiment in 1864. Coffee estates had already been established near here in 1862. The road which leads up from Kottayam to this place was built to serve the tea plantations which have grown up since. At present in this district there are about 10,000 acres of tea.

Within a mile or two to the west of Kottayam, one strikes the alluvial and sand tract of the Kerala backwaters. If the laterite hills are

* Also Christians, mostly Roman Catholics—Editor.

the backbone, the alluvial and sand tract forms the flesh and arteries of true Kerala. Some general remarks concerning them have already been made, but here, within a four-sided figure, narrowing to the north and bounded by the towns of Kottayam to the southeast, Alleppey to the southwest, and ending in the north at about the position of the old fort of Cranganore, first established by the Portuguese, lies the most extensive tract of backwaters, dunes and alluvium anywhere in Kerala.

The whole area is of considerable geomorphological interest, and while no proper study has been made of them, the following notes might be of interest.

The Keralan coast consists essentially of a coastal sand dune belt of varying thickness, behind which lies a zone of lagoons and alluvial flats. Here, in this particular area, the zone reaches its maximum width of about 22 miles and is large enough to be considered a separate region, with its own morphological and human problems. Elsewhere the width of the belt, defined as being that part between the shore and the seaward edge of the laterite hills, varies from zero on headland, such as those at Trivandrum, to two or three miles. In these areas the lagoons are long and narrow, and while they are comparatively shallow, as are all of the lagoons or *kayals*, the amount of active infilling by fresh water streams appears to be little. This type is best seen between Trivandrum and Quilon.

In the next section, partly owing to the gentle seaward swing of the dunes and a pronounced inland swing of the laterite hills the lagoon zone, assuming that originally the whole area was once a continuous stretch of water, reaches its maximum. At present roughly half its length is occupied by a lagoon, Lake Vembanad, while its southern extremity has been infilled by river alluvium.

The rivers which enter this southern half enter the lagoon through what can only be described as an active delta, and in such a way as to make a sudden turn towards the north so that the southern shore of Lake Vembanad consists of a number of minor estuaries. It is noticeable that these southern streams are the most important of all the streams flowing into the *kayal*. During the monsoon season the height of the water within the *kayal*, especially to the south can be as much as four feet above level. Thus there is ample scope for the creation of new land lying above sea level, and, apart from the monsoon season, high enough for reclamation. The monsoon high water level within this *kayal*, and to a greater or lesser extent in all backwaters in Kerala, accounts for the flooding of much of the lower stretches of the alluvial valleys between the months June to September.

The Vembanad is notable not only for the extent of alluvium now occupying its southern end, but for the width of the dune belt along the coast, reaching nearly ten miles at its widest, and for the existence of relict dunes on the landward side of the lake. The latter, especially in the central part, reproduce in micro-form, the normal features, that is, a dune line and within it an alluvial zone. In view of the pronounced evidence of the dune coast from Quilon northwards being a compound spit with a series of gently inward curving laterals, it appears that this inner line of dunes may have been left stranded, as it were, by the northward prolongation of the present dune line. The northern extremity of this dune area is itself divided into an alternation of sand and alluvium.

Today, especially with regard to human activity, one can roughly divide the area according to whether it is dune or alluvium. One should note however, that the term dune should not be taken to indicate a series of anything more than gentle swells of only a few feet. Interconnecting the whole, both within itself and to the laterite areas, are the *kayals* and rivers.

Thus, on a run from Kottayam to Alleppey one is able to see in sequence the various stages of development of the alluvial lands, and from Alleppey to Cochin the contrasted scenery of the sand spit zone. Once again there is a complete contrast between two areas.

There is between Kottayam and Alleppey a water boat service, and at both termini there is a well-established landing stage. Barge transport plies between both places. The barges are of traditional construction, and their double ends and curved prows are most graceful. They are either poled along, or they may be helped along by means of rudimentary sails of woven palm. Like all the boats plying within the backwaters, they are of sewn constructions which, though it may seem primitive, provides a carvel built boat not subject to wood rot in the places usually occupied by nails, that can, most conveniently, be dismantled periodically and re-sewn and recaulked. Fairly large boats are made, up to sixty to eighty feet in length; these are true barges and are only found in and around the ports.

The first stages of the journey run through alluvial lands long since reclaimed and put into service, and like the old reclaimed areas in Europe, are criss-crossed by an irregular pattern of dikes and channels. Seen from above, the landscape shows a ribbon effect; the streams and artificial cuts wind through the alluvium, with on either dike a narrow band of settlement, palm trees and very small gardens. Between these bands of green are the paddy fields.

The system of paddy cultivation here is very distinctive, and probably found in very few other places in India. It is not found in the Ganges Delta of Bengal where one would expect to see it; since here too there is the problem of annual inundation and of alluvial growth.

The Vembanad alluvial area forms a distinctive sub-region of "pays" known as the Kuttanad, and the rice lands in this district are called Punja Padams. The system of cultivation depends on people who either live on the dikes, or who can get at the lands from nearby patches of dry ground, and both groups lead a semi-aquatic life. Movement can take place along the dikes, for example, but it is restricted. For purely local and personal movement, and carriage of small items the canoe is used. At scattered intervals, there are what could be termed canalside shops and tea houses, the latter since the advent of prohibition becoming more and more of a social centre and meeting place.

Returning to the question of Kuttanad cultivation one may summarise the problems of land use here under four heads; excess water, weeds, soil exhaustion, and water deficiency. In the older portions of Kuttanad, the lands drain naturally after the end of the monsoon, and from September onwards the land can be worked. The level is controlled by that in the lake and canals, and as one progresses down toward Alleppey, the ease with which the paddy lands can be drained off naturally and the period during which it is free from flooding diminishes. Formerly the extent to which these lands could be properly controlled was related to the area which was either

drained naturally, or which could be drained by Persian wheels. Early in the twentieth century the steam pump was brought into use, followed by the diesel, and of recent years, the electric pump, linked to the grid system, has taken over most of the work.

Hence one finds nowadays that there are extensive areas of new settlement, which stand out from the older areas by their comparative newness and lack of trees and settlement. The whole aspect is one of a tropical Fenland.

The flooded fields become the haunts of fish during the monsoon, and it is a common sight to see men and women, waist deep in water, netting fish, and one seldom sees a pump outfall without its attendant net on the canalside. The organisation of draining depends also upon the creation of main and sub-dikes. The main dikes line the main channels, while the sub-dikes divide the area so enclosed into smaller units or fields. The dikes are constructed of wattle fencing and from mud taken from the channel or nearby field. The fields, especially in the newer reclamations, are very large, often more than thirty acres in extent, and this is in great contrast to what is seen elsewhere.

Weeds, which grow during the flood period, must be removed, although after the first reclamation these are much less troublesome. Nonetheless, they are a constant menace.

The soils are almost entirely derived from the fine silt drawn from the laterite country, and while they will give excellent crops for a few years, fallowing must be practised to maintain fertility. However, since each field is bounded by its own dike, the fallow fields serve a double purpose since they can be used as storage tanks for water which is released into neighbouring paddy fields for irrigation.

The salinity of the water in the Vembanad lake varies with the seasons and soon after the end of the monsoon, the water of the lake tends to become brackish. Hence, it has been obvious in recent years that a weir to stop the inward movement of salt water would considerably reduce the risk of salination and increase the area of potential paddy lands. A scheme recently approved and now in the course of construction, is intended to provide for this. The parallels between this and the Dutch schemes in Holland are clear.

A regularisation of this form of cultivation would enable this kind of activity to go on without as many dangers as in the past; a more certain start could be made, salination could be guarded against, and above all, sudden rises in the water level either within the fields, due to sudden rain showers in October or November, or flash floods in the canals and water courses can be guarded against. Still, the gamble remains and the cultivator is liable to have to harvest his paddy from boats.

The bottoms of the canals and backwaters are in places floored by fine silts and the shells of animals. The local people dive for both, and the shells are used in large quantities by a modern cement factory recently installed not far from Alleppey.

ALLEPPEY:—

Alleppey is not naturally connected to the backwater system, but the existence of calm water in the lee of an offshore mud bank, by encouraging the use of this particular section of the coast, stimulated the

construction of a canal through the sand belt to the backwaters beyond. The local explanation for this calm water is that oil released from the mud bank flattens the swell. The oil, if such it is, could be a decomposition product from buried lagoon vegetation, forced seawards by hydraulic pressure during the course of the monsoon when the level of Lake Vembanad rises above sea level. Whatever the cause, the slack water opposite to Alleppey offers the only year-round anchorage for ships between Quilon and Cochin. The mud banks migrate from year to year and it is a part of the duties of the harbour-master at Alleppey to indicate, by means of signals displayed on a tall flag pole, its exact position.

The canal linking the town to the backwaters bifurcates and its two arms form the axes about which the town is orientated. The port itself consists of a short iron pier, and goods are moved out to ships standing offshore via hand-pushed railway wagons and lighters. A walk along the banks of Alleppey's canals makes one aware, perhaps for the first time, of the industrial character of Kerala, and of the dependence of its industries upon tree crops, hand labour and overseas markets. Alleppey itself first opened for trade in 1762, has many European owned warehouses, and besides boat repair and similar activities is a centre for the manufacture of coir matting and oil pressing with tile manufacture found in the south in the vicinity of Quilon and in the north, near Calicut and Tellicherry. Bails of coir yarn, and batches of freshly dyed coir mats are a common sight along the canal banks.

THE AGRO-INDUSTRIES OF KERALA :—

The industrial character of Kerala stems from its agricultural products, and until recently could be grouped under two heads. First, the indigenous native crafts supplying the local market, and second European enterprises utilising local materials, labour and skills in the manufacture of products for the world market. A third stage, the introduction capitalistic enterprises for home consumption goods may be traced to the Basel Mission which, during the 19th century, established in Malabar and especially at Calicut, tile factories, weaving mills, and printing presses. The influence these have had upon local capitalists, especially in tile manufacture, partly accounts for a tendency for the power-driven industries to be concentrated in northern rather than southern Kerala.

The characteristic feature of all local industries today is, however, its dependence upon hand labour. Even in such European owned and managed factories as deal with cashew nut, coir spinning, etc., most of the work is done by hand or by simple hand driven machines. The accent upon hand labour partly accounts therefore for the very heavy concentration of population along the coastal tracts. Thus, mechanisation could, under certain circumstances, represent a very real threat to the local population.

The types of industries found cover a wide range of activities, carpentry, pottery, basket-making and weaving, *bidi* making, woodworking, shipbuilding, net-making, mat-making and so on. Northwards from Alleppey the most outstanding is the coir industry. Whole families are engaged in extracting coir, a process involving steeping the whole husk in water for up to two months, stripping the husk from the kernel, beating the husks with short sticks to remove the fibre, and finally twisting the fibres into yarn. The last stages are done by women at home and in factories. The sight of a hundred or so women under one roof working simple hand twisting machines to produce coir yarn for export, recalls to mind the early days of the Lancashire cotton industry.

ALLEPPEY TO COCHIN - THE SANDY LITTORAL :—

The main north-south road and the railway to Cochin from Trivandrum swing away from the coast to follow the laterite hill zone and the eastern shores of Lake Vembanad. In doing so they isolate the shoreward sandy littoral at the point where it assumes its greatest width and geographic individuality. This little known area with its verdant canopy of coconut palms, is an area of considerable difficulty, with most of its surface covered by a gleaming white sand, and with only a few strips of alluvial soil between parallel sand bars. On the other hand the local peasantry have shown much ingenuity in overcoming these difficulties by making full use of a water table which, during the monsoon at least, is never more than a few feet below the surface.

The sub-surface water in slow movement toward the sea provides an almost ideal environment for the cultivation of the coconut, and this area is one of the most important sources of coir in the region. Provided the plants are set in hollows filled with compost, a mixture of cow dung, coir waste, ashes and rotting vegetable matter, the effects of the sterile soil can be offset by ample water and high temperatures. Thus without achieving high yields, this area produces a wide variety of crops; among them sago palm, jack fruit and even tapioca. The cultivation of rice poses greater problems, but has been achieved, with effort.

The method involves digging shallow but extensive pits so as to reach the water table, and piling up the spoil into great mounds of sand. Since the water within these depressions fluctuates with the seasons and salinity is a problem at the low water stage, the rice is planted on small mounds within the depression at the beginning of the rains and transplanted as the rising water table and surface rains freshen the water.

The population of this area is surprisingly high, but its standard of living does not appear to be as high as elsewhere in Kerala: houses are not as well made, and the economy appears to be very dependent upon coir making. The provision of a good road along this strip, which with the coming abolition of the ferry north of Shertalay, will provide an unbroken through route from Alleppey to Cochin, should help to rescue an area which must be one of the worst in India affected by elephantiasis. The seaward edge of this dune coastal area is marked by a series of small fishing communities, while on the landward side run the backwaters and intra-coastal canal to Cochin. At one or two places the canal has given rise to small villages, and it continues to be a cheap outlet for locally produced coir.

COCHIN :—

Cochin has already been mentioned in connection with its Syrian-christians, and one of the features of Kerala, striking to those familiar with the rest of India, is the frequency with which one sees Christian churches and the peculiarity of their architectural forms. The designs were either originally Portuguese or are recent copies of Portuguese models. They are almost universally white painted and as a consequence stand out as a characteristic feature of the landscape. Some, principally those dating from the 16th and 17th centuries, are architectural gems, still possessing the original, and sometimes almost horrifying, relics and statuary, and a profusion of brightly coloured images of saints and the Virgin Mary make it easy to understand why da Gama and the Malabarese each thought the other to be members of their own faith.

Cochin marks the present outlet of Lake Vembanad, and its position on the south bank of the narrows through which the lake drains into the sea, and the access which this lake allows to central Kerala, gives Cochin its importance. It is, furthermore, the only land-locked harbour anywhere between Cape Comorin and Goa. But even a site must have an origin, and hence Cochin really owes its beginnings to a cyclonic storm in 1341, which cut a way through the sand bar at this point; previous to this Lake Vembanad had its outlet further to the north in a joint mouth with the Periyar River—where is now sited the old and dead port of Cranganore.

The term Cochin is very loosely used to describe what are in fact four connected settlements. Cochin, at the passage through the sand-spit; inside the spit, round the corner, as it were, the Indian port of Mattancheri; across on the other side of the backwater lies the historical capital of Cochin State, Ernakulam, and between it and Cochin-Mattancheri, the new settlement of Willingdon Island; each possess distinctive characters and functions. In addition, a fishing community lies close by on the northern side of the passage at Veypan.

Cochin is the European quarter, and in it are found most of the shipping offices and European-owned warehouses, but from the time when European ships increased in size and were unable to enter backwater until the construction of the new Cochin harbour in the nineteen twenties and thirties, large boats had to stand off and were discharged and loaded by lighters.

The old town is today laid out round an old square. Within its vicinity are many well-preserved seventeenth and eighteenth century Dutch houses built with only two concessions to the new environment; thick walls and simple wooden awnings over the windows. The square encloses a tree-lined green, to one side of which is a church of Portuguese foundation in which da Gama's body is said to have found its first resting place.

Mattancheri still functions as a port for country craft sailing up and down the west coast and here also country boats are repaired. Here settled the remnants of the Jewish community already mentioned. Ernakulam is to a certain extent a port, but its main functions are still those of administration and education. Willingdon is situated on an artificial island; the product of a long mooted scheme to turn Cochin into a modern port, which required the cutting of a deep channel through into the backwater across the bar, the bringing of the railhead from Ernakulam to the newly created Willingdon Island to give direct access to the berths and wharves on the island, and the conversion of the Ernakulam railway to broad gauge, thus connecting Cochin to the rail net.

The scheme, started in 1928, was completed soon after the outbreak of the last war, and by bringing modern ships to the backwater proper, a new lease of life was given to the town of Cochin. The port, it must be remembered, was created by the breaching of the Veypan spit; further breaches in the neighbourhood of Cochin could now be disastrous. The risk is there, and a breach made not long ago was only sealed with difficulty. To understand the reasons for these breaches we must recall that during the monsoon the level of Lake Vembanad can be higher than sea level. Consequently the outflow of water through the Cochin passage is frequently

strong enough to overcome the flood tide, and breaches can thus be made as a result of inward as well as outward pressures.

The backwaters near to Cochin, and in particular in and around the passage, are noted for a peculiar method of fishing, often referred to as being Chinese. In fact the raising and lowering of nets into the sea by means of a jib does resemble a Chinese method, and the introduction of such an apparatus would not be hard to explain, since there was, until the fifteenth century, a regular trade between Cochin and China. It has been suggested, however, that in fact this method was introduced by the Portuguese, and its existence solely around Cochin confirms this view. An exactly similar method is also found in use to this day on the Danube in Austria, and on the west coast of France, as well as in Portugal itself.

TRICHUR LAKE AND MALABAR:—

Northwards from Cochin the Vembanad backwaters narrow and terminate near Cranganore at the mouth of the Periyar River. Backwaters are found north of this, but none can be compared to Vembanad. Trichur Lake, which has only a small river draining into it, is perhaps the nearest comparison; it lies a few miles north of the Periyar and its local inhabitants have developed a form of paddy cultivation very similar to that already described as Kuttanad cultivation. The method here was perhaps even more advanced because of a masonry dam which was built during the eighteenth century to bar the ingress of sea water. Disaster came to the area very early in the nineteenth century when a British administrator thinking thereby to improve agricultural output, had the dam breached. Quite the reverse happened of course, and the whole thing was rebuilt a few years later. It is hoped that a similar dam will at some time be constructed on Lake Vembanad.

The last section of the coast, from about Calicut northwards, is in many ways akin to the area south of Quilon; a succession of headlands, between which lie long stretches of sand bars and elongated backwaters. The river mouths may either be found inland on a backwater, or on the coast itself, depending upon the volume of water coming down. Even the biggest rivers have sand bars at their mouths, and there is increasing evidence that the predominant drift of the current is now from north to south; that is the reverse of what was the case in Travancore.

The forms of agriculture already described with regard to laterite hills and sand belts persist, with of course local variations, and therefore the northern part of Kerala will be considered in relation to its own peculiarities. The area was one of the earliest to fall under British rule; it has for long and had connections with Arabia, and it lies at the foot of the extensive Mysore Plateau, with whose people it has considerable intercourse. Consequently, outside influences have tended to mark Malabar off from southern Kerala, while Cochin district, at least in its coastal tracts, enjoys the role of a buffer or transition zone between Malabar and Travancore.

THE WESTERN GHATS AND THE MALABAR ECONOMY:—

In Malabar one becomes more aware of the grandeur of the evergreen forests which clothe the Ghats, and, through the trade which passes up and down the ghat face, of the dry Mysore plateau. The forest products

of Malabar lie for all to see at the mouths of its important rivers and are most conspicuous at Calicut, where, on the Kallayi river just outside the town, enormous rafts of timber float beside modern saw mills. The logs are floated down the Beypore river, and thence by a short canal into the Kallayi. Thus, Calicut turns out to comprise three parts; Calicut proper, the Kallayi river sawmill zone, and lastly the Beypore river estuary.

The timber from which Calicut gets so much of its wealth is derived in the main from a zone of evergreen forest which lies on the Ghats between about 1,500 feet and 4,000 feet. Below this zone lies the remnants of a belt of deciduous trees, which, once reaching almost down to the coast, has been for centuries attacked by sedentary and shifting agriculturists. Here the trees are now of little commercial value, and such woods as remain receive little or no attention. This belt is, however, traditionally the source of local lumber, firewood and green manure.

The ghat forests, partly because of their inaccessibility, have remained, but even they would have been decimated but for conservation methods adopted with varying degrees of success during the nineteenth century. Above the evergreen belt and just beyond the crest of the scarp lies a narrow belt of bamboos, and beyond that again, deciduous forests under state management. Calicut's timber trade was particularly fortunate owing to the efforts of an Englishman who, in the 1840's, leased large tracts of land in the upper Beypore river area, and laid them down to teak, the most valuable of all timbers. The Beypore river, leading down to the Kallayi river, is therefore a timber artery, and while Calicut is undoubtedly the largest timber market in India, local inhabitants also claim it to be one of the world's largest, at least in terms of value of timber.

CALICUT AND THE BEYPORE RIVER :—

Traditionally one of the biggest users of timber was the shipbuilding industry, and to this day it is carried out in very much the traditional manner by the local people in the Beypore estuary. This place is, indeed perhaps one of the few comparatively untouched remnants of the old style of anchorages and shipyards. In it are Arab *dhows*, Indian coasting vessels, and country boats of all kinds, brought here for shelter and refits during the monsoon, and in the sailing season to load locally manufactured tiles and bricks for shipments all over the Indian Ocean.

The city of Calicut is not on a river and like Alleppey, depends for its traffic upon the lighterage of goods from shore to ship. The town also owes its importance today to a number of local industries and its position as district headquarters. Its site is in some way difficult to explain. One would have expected a prosperous hinterland to have encouraged a port hereabouts, but even a cursory examination would show that the angle between the north bank of the Beypore river and the coast is preferable to the one now occupied. Indeed, Tipu Sultan, after his conquest forcibly took the inhabitants of Calicut to this alternative site with the intention of founding Calicut anew. The citizens of Calicut obviously thought better of their old haunts, for they returned to the original site as soon as Tipu was ejected from Malabar.

The modern tile-making industry, started originally by the Basel Mission as long ago as 1874, has become an important employer of labour.

The staple product is an extremely heavy red tile of considerable strength called the Mangalore tile. The clay for its manufacture is dug up from the river bed by men driving from boats. The Basel Mission also inaugurated spinning. In addition there are oil presses, cashew nut firms, coir factories, printing presses and the like. An interesting activity is rope-making on the local beach. Access to the north as far as Mangalore, and to the south and with Madras, gives Calicut some additional importance, but the incorporation of Malabar district into the new state of Kerala may eventually alter the pattern of trade.

CANNANORE :—

To conclude this short description of north Kerala, there follow a few references to Cannanore. This town, one of the earliest English settlements, and one with which da Gama had relations on his first journey, is in some respects similar to Calicut. Here, too, modern industries have sprung up; since the war, a spinning mill, and a plywood factory. Its site is perhaps a little more explicable than Calicut, since it occupies a bay and is guarded by a headland on which the old fort and Cannore cantonment were sited. As with the remaining towns along this part of the coast, Mahe, Tellicherry, Calicut, there is significant proportion of moslems, most of them converts.

Such then is the coastal tract of Kerala, an area which, by languages, has come to be separate state, (and by politics, a little trouble some). To the north of Kerala, the physical environment continues very much the same, except that communications are less effective along the coast. Above the Ghats lies Mysore which, with its wide horizons and bare plains, bright sunshine and low rainfall, is in complete contrast. However, the juxtaposition of two states of such differing natural abilities has encouraged trade between the two. Perhaps the most significant of the items moved is cattle. These are bred and reared just to the east of the ghat crest in the dry grasslands. The cattle are exported annually to the Malabar coast where they are sold to the agriculturists for work animals. No worthwhile breeding takes place in Malabar itself; the high monsoon rainfall and the lack of pasture at other seasons count against this. Thus it is that the paddy lands of Malabar depend to a large extent upon annual importations of a type of bullock made famous by two great generals; Tipu Sultan and the Duke of Wellington.

CONCLUSION :—

If in conclusion we might return to the initial question raised, the one of population pressure, it will by now be obvious that, compared with the rest of India, the amount of employment offered per square mile is probably higher than elsewhere. The high percentage of persons not directly concerned with agriculture is indicative of this. Modern industry accounts for only a small proportion of the total employed, and we still see today in Kerala a pattern production of handicraft goods which has changed little over the past hundred years or more. Descriptions of Kerala in most of its aspects written at any time during the last hundred years still, in many instances hold good. Photographs taken fifty years ago in Kerala are often indistinguishable from those taken recently.

Population pressure in Malabar in the sense of population pressure elsewhere, because of the large percentage employed in handicrafts, is therefore different, and it is not so much a question of an agricultural popula-

tion pressing upon land resources as the inability of non-agricultural workers to secure for themselves livelihood. However, the problem is complex; even a short study leaves one with the feeling that a great deal more must be discovered before generalisations could be made. Here in Kerala industrialisation is liable to hit at handicraft workers in the traditional pattern, rather than take people off an overcrowded land, as it would do in many other parts of India. Further, each of Kerala's traditional industries is peculiarly liable to depression. Coir yarns and matting are affected by increased standards of living in the West; for example, the vacuum-cleaner replacing the brush, the carpet replacing the coir mat, and so on. Synthetic oils and competition from other areas, are affecting coconut oil production; improvements in shipping are having an adverse effect upon the shipbuilding trade. The declining wage differential between Africa and India is liable to offset Kerala's previous entrepot trade in cashew nuts, and so on. Tile manufacture seems to have been less affected, but economic nationalism around the shores of the Indian Ocean is bound to affect Kerala.

The tea and coffee industries, a fuller explanation of which has not been given, are in the hands of the Europeans, and while plantations run in the old way are perhaps an anachronism today, tea and coffee production never will be. These two crops are among India's most important earners of foreign exchange, and disruption of production is liable to cause difficulties.

The dispersed nature of Kerala's population makes organisation difficult, and furthermore, it may hide for a longer period the real condition of the people. Hence, a great deal of so-called industrial employment in Kerala may only exist because of low wages. The mere attempt to improve conditions by legislation and other methods of wage increase may, in the short run at least, do more harm than good, by putting out of employment those who are only taken on because rates are low and something can be found for them to do. On the other hand, with such a high proportion of the population skilled in some form of handicraft work, and literate to a higher degree than anywhere else in India, there are considerable possibilities for industrial advances in fields requiring intelligence and skilful finger-work. The development of hydro-electric power from stations along the western Ghats will no doubt do a great deal to encourage this development.

The development of the port of Cochin will definitely aid the general improvement of Kerala, but if experience in Europe and elsewhere is anything to base one's opinions upon, mere port development leads only to the employment of large numbers of unskilled labourers. Cochin port could be the focal point for a well balanced industrial network, but restrictions of site may count against this. The lack of nodal centres and the dispersal of the population of Kerala is being made good but largely in an unplanned manner; roadside service centres along the lines of main bus and motor routes are growing space, but too many have that anonymous all-Indian look about them. The provision of a denser road net will, to some extent, reduce the present attractions of the main north-south Comorin—Calicut—Cannanore road and spread the possible benefits from an increasing tempo of economic activity. On the other hand, there is the risk that they might simply act as routes of migration into towns. Rural standards may be low, but there are compensations, perhaps more observable to the visitor than to the local inhabitant, and it would be wrong to surrender them for a rootless life in the town.

The Keralan landscape is one of the most distinctive in southern India, and it is matched by equally characteristic social and cultural customs and beliefs. Changes are already apparent; it is to be hoped that they will fit into the landscape as well as does traditional Kerala. A de-ruralised European may be forgiven for looking at such a landscape with nostalgia, for it recalls to his mind a pattern of life which may all too easily be brushed aside, without regard for its inner virtues, in an unheeding desire for 'improvements'.

ACKNOWLEDGMENTS:—

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SEA TRANSPORT AMONG THE INDIANS OF SOUTH AMERICA

By

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INTRODUCTION :—

Literature on the sea-transport of the Indians in South America is ample but scattered. Much of the data are in the Spanish language. A study however of the available literature brings out very clearly the significance of sea-transport in the culture of Indians. It has not always been accepted that amongst the Indians some tribes were and some are even now experts in sea-transport. Some have suggested that these people have never been marine-minded and hence they could neither have built the vessels nor accomplished sea journeys successfully (Means, 1942). However, another body of culture historians and anthropologists agree unanimously on the point that Indians were expert seamen and their contribution to sea-navigation in general and to types of vessels in particular have been of sufficient significance as to deserve a special study (Heyerdahl, 1955).

The study of the sea-transport of Indians can be conveniently divided into two parts dealing with the two coasts, west and east. As compared to that of the former, the literature available for the latter is rather scanty. One of the reasons is obviously the continental nature of the culture (as opposed to oceanic) of the people inhabiting the eastern area. Not that they did not have the water transport, but more or less it was restricted to inland river journeys and transport on lakes. Hence the varieties of the boats are very much restricted and instances of long sea-journeys are lacking.

I. WESTERN COAST :—

From the view-point of anthropology sea-transport on the western coast has been of immense significance, much as it throws a flood of light on the most controversial problem of trans-Pacific contacts between the Polynesian people and South American Indians. Directly basing on his experiences on a balsa long raft one anthropologist has even suggested that Polynesians are none else than Indians themselves (Heyerdahl, 1952). Be that as it may, the types of boats used along this coast and their seaworthiness have been of supreme significance for the study of anthropological processes like invention, parallelism and diffusion.

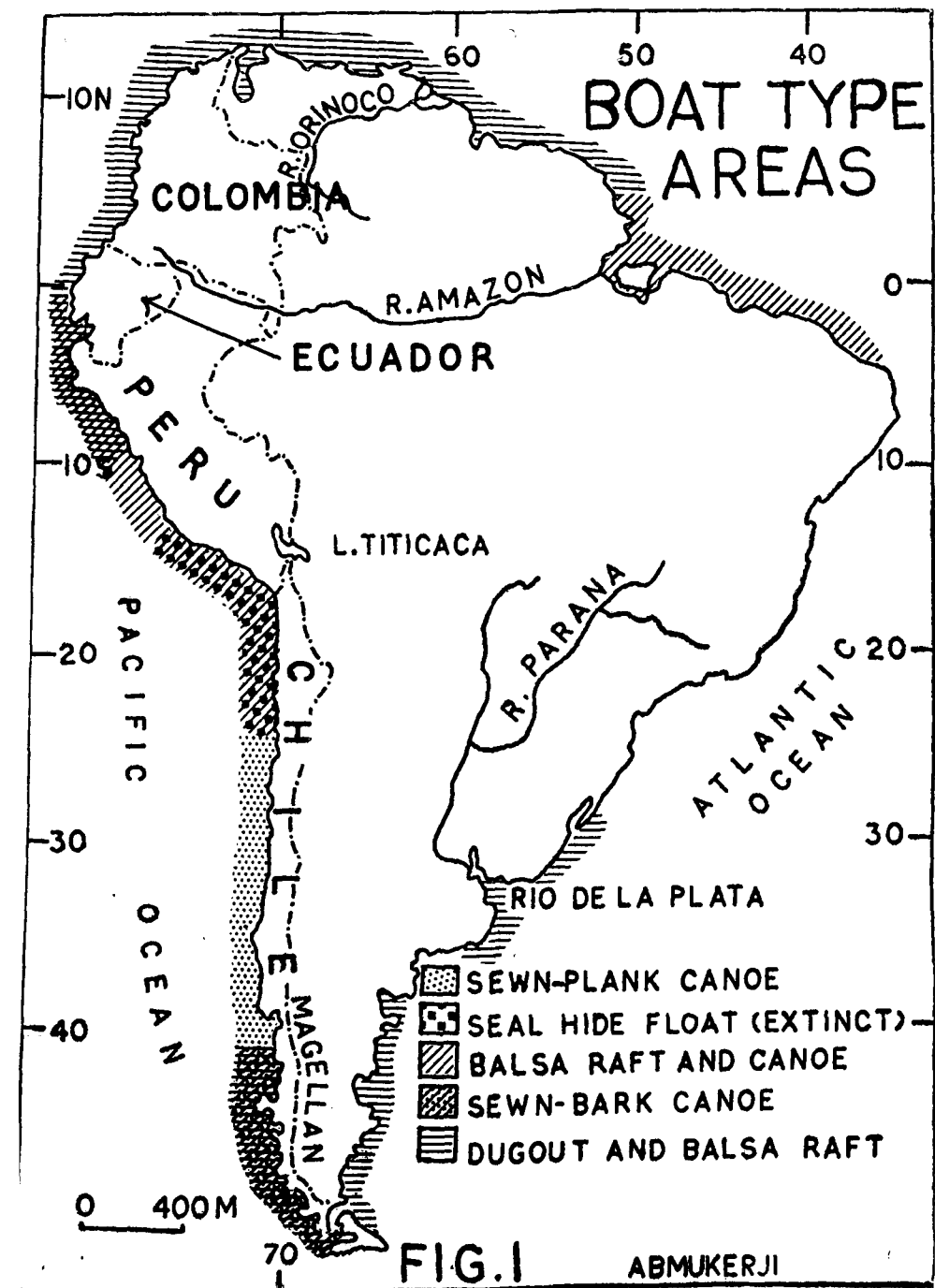
TYPE AREAS (Fig. 1) :—

Physically as well as culturally the western coast can be divided into four parts included in the following countries :—

- Colombia and Ecuador
- Peru and northern third of Chile
- Araucanian Chile
- Magellanic Region.

COLOMBIA AND ECUADOR :—

Physical Setting :—For most of its length the coastal plain here is only five to fifteen miles wide. In some places as near Tumaco tertiary material

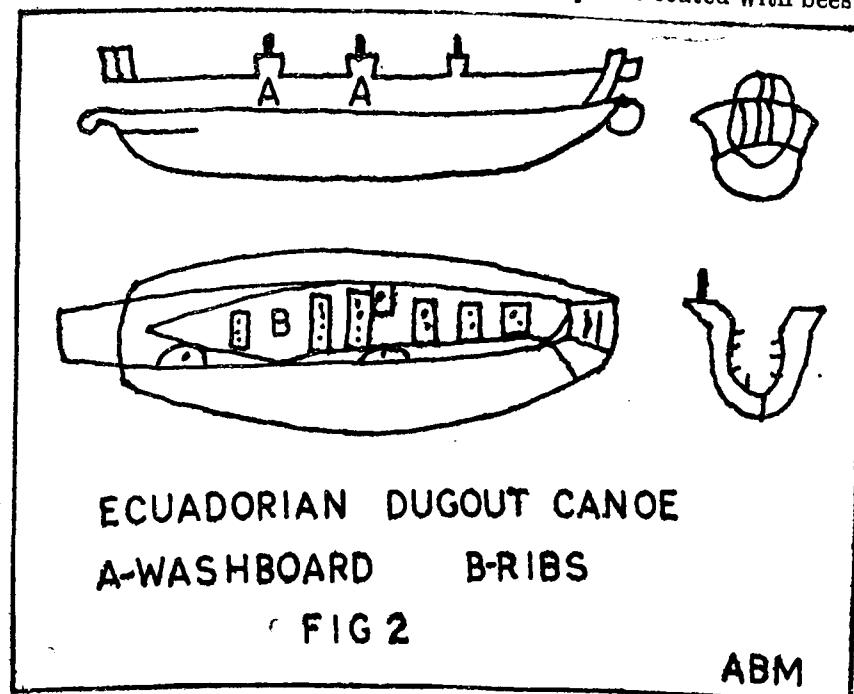


interrupts the continuity of the alluvium and low cliffs are found along the ocean front. On this narrow coast the rivers are very small. The northern part from Cobo Corrientes to Punta Garachine in South East Panama is a high mountainous coast while the southern part is a low alluvial coast, fringed by dense tidal forests and sandy beaches which stretch southward from Cobo Corrientes for more than four hundred miles into Esmeraldas province, North-Western Ecuador. These highly contrasted coasts present not only distinct scenery and geomorphic processes, but also offer differing problems for travel and subsistence. The common feature present along both the coasts is the large tidal range of eight to thirteen feet. The tide reaches many miles up the rivers. The longshore current is significant also in terms of coastal navigation (West, 1957). The vegetation consists of swamps with an abundant supply of reeds, high grass and woody shrub while mangrove trees form solid stands (West, 1957).

BOAT-TYPES:—

The principle boat type used in this area is dug out canoe with square ends (Fig. 2). This is characterised by square-ended platforms at bow and stern, long overhang both forward and aft with little or no sheer.

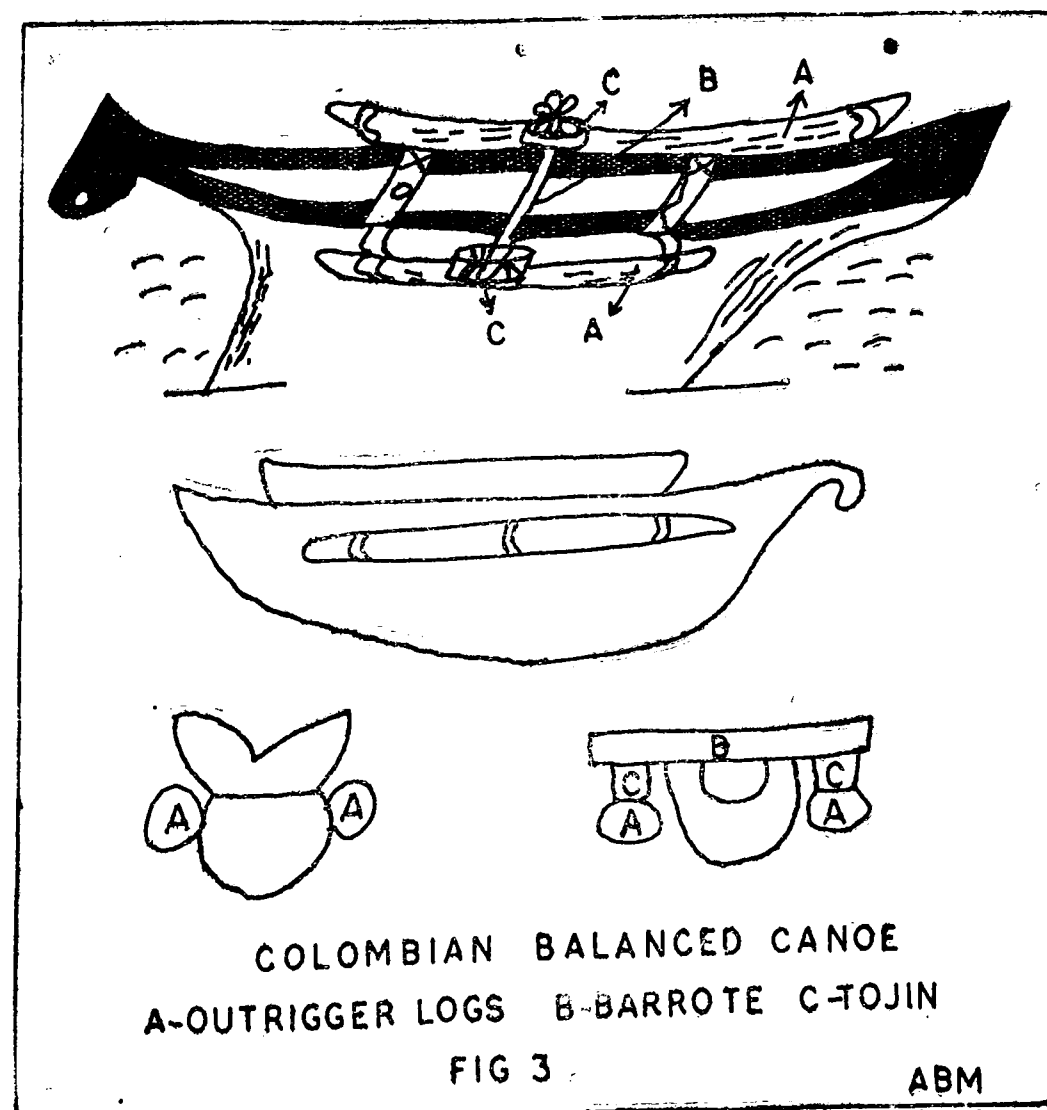
A log of medium weight of hard wood such as Chachajo or cedro is first roughly shaped both inside and outside of the hull. It is kept raised on blocks and dried for several weeks. Then it is taken by a communal group (*minga*) to the hut of the owner. The final shaping in accordance with the desire of the owner is given with the *adz*, which is the only aboriginal tool used in fashioning the canoe (West, 1957). Finally it is coated with beeswax.



Two types of paddles (*canaletes*) are used on this boat, both with pointed blades and U-shaped handles. The man propels the boat standing with a long handled paddle while women do it by sitting, with a short-handled paddle.

Among the several elements introduced by the Spaniards and used in this boat (Fig. 3) the balsa log stabilizers are the most important. Spaniards had introduced it from Philippines and it has been suggested that this was an incipient form of double-outrigger (Hornell, 1928). These boats have also been termed as balanced canoes (Hornell, 1928). Balsa logs are lashed alongside just below the gunwales. Log stabilizers are found in the interior also. Cayapa Indians use them for increased buoyancy when the cargo is heavy (Barrett, 1925).

Another newly introduced element is the anchor which consists of a stone piece enclosed in a wooden frame attached to four blades. A Calabash is also used for baling.



The dugout canoe is the principal means of transport almost everywhere. Exchange taking place between the humid littoral of the northern Panama area and the drier coasts of southern Ecuador was carried on with these canoes. The modern Negroes have adopted it as an integral part of their material culture (West, 1957). Dugout canoes are used both for fishing and coastwise voyages to market centres. For such trips the canoe is equipped with a sprit sail of canvas and perforated strut is placed well forward at the bottom of the boat to receive the small mast (West, 1957). The possession of dugout is universal. In many river and coastal villages of Colombia the family canoe is kept in water under the house which is built partly upon piles. In such villages the canoe is as much a part of family life as the automobile in the United States (Quirke, 1952).

Apart from this type of dugout canoe there are three more variations found in this region, pangas, lancha and imbabura (*ibabura*) of which the last is most important.

Imbabura is a large dugout of thirty to forty feet in length. It has pointed bows, square cut steers and finely drawn lines aft. Its sides are built with boards fixed on ribs. It is propelled by sails and is sloop-rigged. In the centre of the square steers there is a hole serving as a fulcrum for the large steering oar inserted through it. It carries one or more sails. Very often stabilizing logs are lashed to the sides. A killick (*boya*) is used for an anchor. It has been suggested that *ibabura* is a European adaptation of the native dugout (West, 1957). Since it is keelless and draws little water, it can carry heavy cargo. As a coastal ship it is very seaworthy and serviceable voyaging from Guayaquil to Panama.

The *ibabura* appears to represent an older and more primitive type than the Panamanian bongo, though both have a big dugout as the essential part of their hull. The Bongo is schooner-rigged. The addition of balance logs to the indigenous Indian dugout has been due to the initiative of the Spanish settlers. But the advance stage seen in the *ibabura* where the logs are boomed out some little distance on each side appears to be an invention of the American coast (Hornell, 1928.)

The lancha is a fishing dugout used mainly along the rugged coast north of Cobo Corrientes. It has a pointed bow, square stern and well developed keel and carries a sprit sail. It is quite seaworthy. It does not seem to be of an aboriginal origin.

The pangas (*cayuneras*) are used from Panama to Ecuador. It has a pointed bow and stern but no keel. It has little or no sheer except at the ends which curve slightly upward. It carries a small sail and stabilizers. It looks very similar to Cayuco made by the Cuno of Panama and other tribes on the north coast of Colombia and Venezuela. It seems possible that it is a pre-Colombian introduction.

PERU AND NORTHERN THIRD OF CHILE :—

Physical Setting :—

In this area the dugout canoe is of secondary importance as compared to the balsa raft. The region is an almost treeless coastal desert. Here is to be found the famous Atacama desert. The coast is very narrow and stands rather like an unbroken wall. There are very few bays and indentations which might have been conducive to high standard of oceanic movements. Along the coast the cold Peruvian current flows in the south-north

direction, turning toward the north-west near the south-western coast of Peru. The vegetation along the northern coast of Peru consists of balsa wood, in the south several types of reed and grasses are common.

BOAT-TYPES :—

The main boat types in this region are log rafts (balsa or balza), dugout canoe, reed rafts and seal hide floats. Of all these the balsa has been the most important, involved as it is with the controversial problem of the trans-Pacific contact.

It is important to note in the very beginning that the term balsa has been used for two different types of boats, rafts of balsa wood propelled by sails and balsa rafts made of bundles of reeds (Lothrop, 1932).

*Balsa Rafts :—*Log rafts (Fig. 4) are used along the coasts of Ecuador and northern Peru and were propelled by sails. The type is definitely pre-Columbian (Lothrop, 1932; Hornell, 1946). The balsa is composed of five, seven or nine beams of a soft wood, whitish and very light. The balsa is twenty to twenty-four feet in width and about twenty metres in length. The beams are fastened together by *bejucos* (a type of hemp). The thickest and the longest beam is in the centre. Over the deck, a tent of reeds is constructed. The most notable characteristic is the presence of numerous centre-board fittings used on the same system as those of the Formosan catamaran. The sail is hoisted on two poles. Steering is done by some boards three or four yards in length and half a yard in breadth called guards. There are placed vertically both in the head and the stern between the main beams. By thrusting some in the waters and by raising others, the ship makes all the motions. The method of steering by *guaras* is very simple.

These balsas were used on rivers as well as on sea. Different balsas were used for fishing and for the transport of families and goods. Balsas were also used for transporting the army along the coast. Off the Andean coast the rafts carried merchants with their women and tons of cargo. At other times these were used during Inca period for the transport of guano fertilizer from Chincha islands near Pisco to the various provinces of Peru.

The sails used in these balsas are of great antiquity. Formerly the sails were made of reeds and now they are made of cotton, which is an European introduction.

The seaworthiness of the balsa lograft has been the centre of protracted controversies. A host of scholars rather pitched their arguments against one point that the balsa raft was not seaworthy. At the most they argued its range was small and limited to the inter-coastal areas (Hornell, 1946; Dixon, 1932, 1934; Emory 1933, 1942; Morgan, 1946; Buck, 1945; and Wecler, 1943). Their main argument has been that 'balsa absorbs water very rapidly and loses its buoyancy completely after a few weeks. Owing to this characteristic it was necessary to take the balsa out of water at intervals, have the logs ashore and there allow them to dry out completely. In these circumstances, the balsa rafts were unfit for long sea voyages (Lothrop, 1932).

To disprove the existence of qualities attributed to the balsa log rafts Thor Heyerdahl undertook the Kon-Tiki expedition in 1947 and proved that the balsa was an exceedingly seaworthy craft in all weather conditions at sea. He further argues that dry balsa wood is water-resistant. The sail and the centre-boards (*guaras*) enabled it to be steered and move at right

angles to the wind-direction, very efficiently (Heyerdahl, 1952). The wash-through construction allowed the water to disappear very soon. It could rise with any threatening sea and thus ride over dangerous water-masses. The landing on rocky shores was made possible by the shallow constructions and the flexibility allowed by all independent lashings.

As to the origin of certain balsa elements it has been suggested that archeological evidence points out very conclusively to the fact that both centre-board and sail were used from very remote times (Bennett, 1954). Further more the sail was probably known on the Peruvian coast earlier than pottery and weaving (Nordenskiöld, 1931). The sail was invented on lake Titicaca and was made of reeds tied side by side into a large mat.

Paita and Tumbex were the principal Peruvian ports for balsa log rafts in Inca times. These were situated near the great balsa forests of Ecuador. Until 1900, other important ports were Sechura, Lamba-yequé, Pacasmayo and Huanchaco, five hundred miles south of Guayaquil.

REED RAFTS AND REED CANOES :—

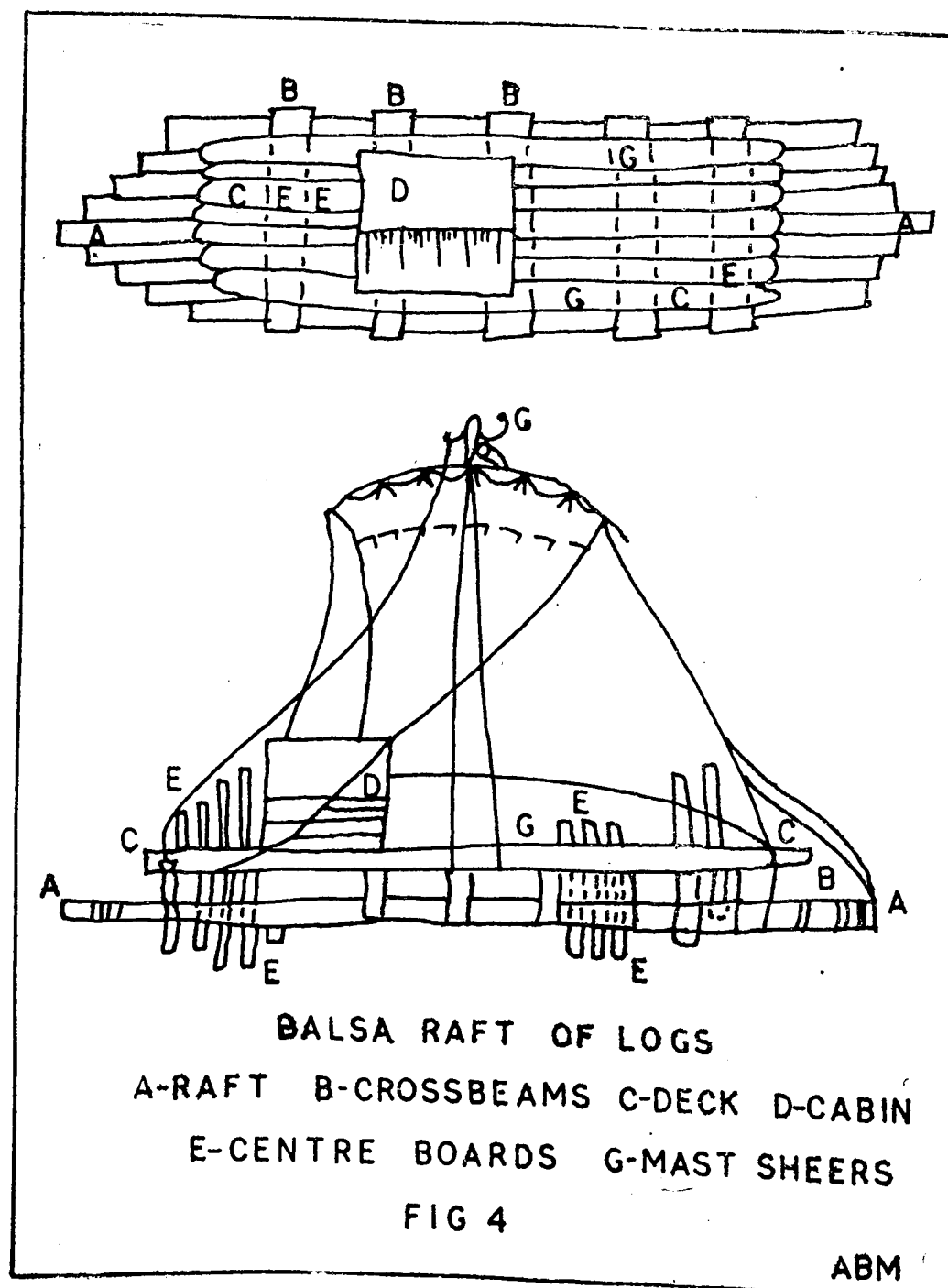
The reed rafts and the reed canoes owe their invention and continued existence primarily due to the lack of suitable wood for construction of dugouts and wooden rafts. These rafts and canoes have a wide distribution in the New World. It served as the principal vehicle for ocean navigation off the coasts of Peru but it was also seen off the coasts of Columbia and northern Chile.

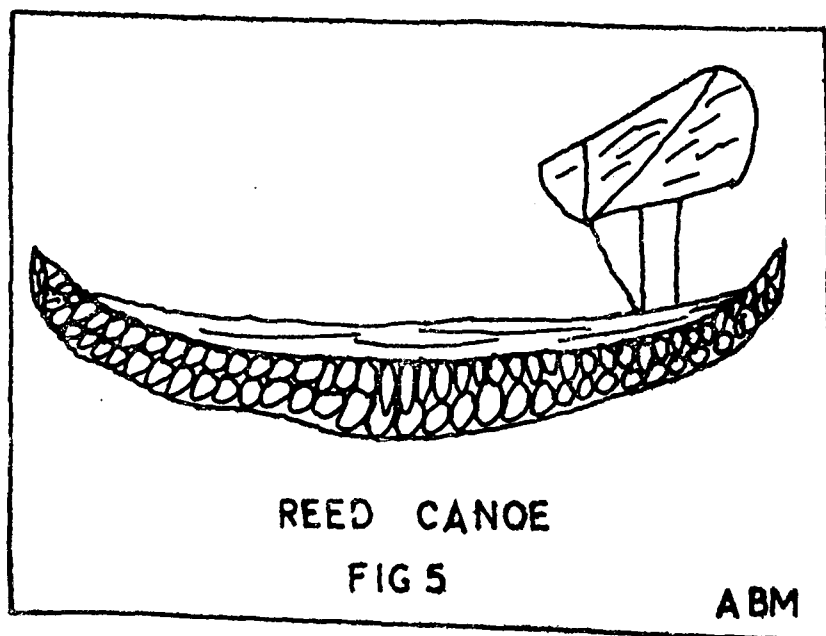
The simplest and most primitive type is known as *caballito* (pony) used by fishermen off the coast of Peru. It consists of a couple of long and slender conical bundles of totora reeds (*Scirpus totora*) lashed side by side. On this the fishermen ride paddling with a length of split bamboo. The bundle is sometimes made of two or three cones. The *caballito* measures about five metres in length and one half meter in breadth. The bundles contained in the stern are a cockpit for carrying small fish.

The *caballito* is still used in several Peruvian harbours but a century ago was widely distributed.

Much larger and much more ambitious than the *caballito* was reed canoe (Fig. 5). These were native sea-going vessels. This type had a wide distribution from Chimu region upto Cape Horn. Sails were used on this boat during pre-Columbian times. There were centre-boards also for steering. The raft was constructed of five unequal units of reed bundles with the central piece projecting beyond the rest. The stern was square-shaped with both ends very sharply pointed. Most of these were in appearance like the new moon. Some of these rafts are further distinguished by large animal figure-heads at the bow and they also have the heads projecting from the stern.

There kinds of paddles were used in this area. One was made by splitting in half a large section of bamboo. These were used to propel the *caballito*. The paddler gave strokes alternately on each side. The second kind had a leaf-shaped blade with a round shaft and the handle containing a rattle. This was also used for the *caballito*. This seems to have come from northern Peru. The third kind coming from southern Peru is about six feet long and the crew stood erect while using it. Anchors consisting simply of a stone attached by a line had diffused from Ecuador.





DUGOUT CANOE (Fig. 4) :—

The modified form of square-ended dugout canoe of Colombia and Ecuador is found in this region. They were once very common in Peru. At present they are employed chiefly by the fishermen of Callao, the port of Lima.

The canoe is made of a very hard wood known as *guachapeli*. The longevity of the vessel is said to be of one hundred years. Logs out of which canoes are made are imported from Ecuador.

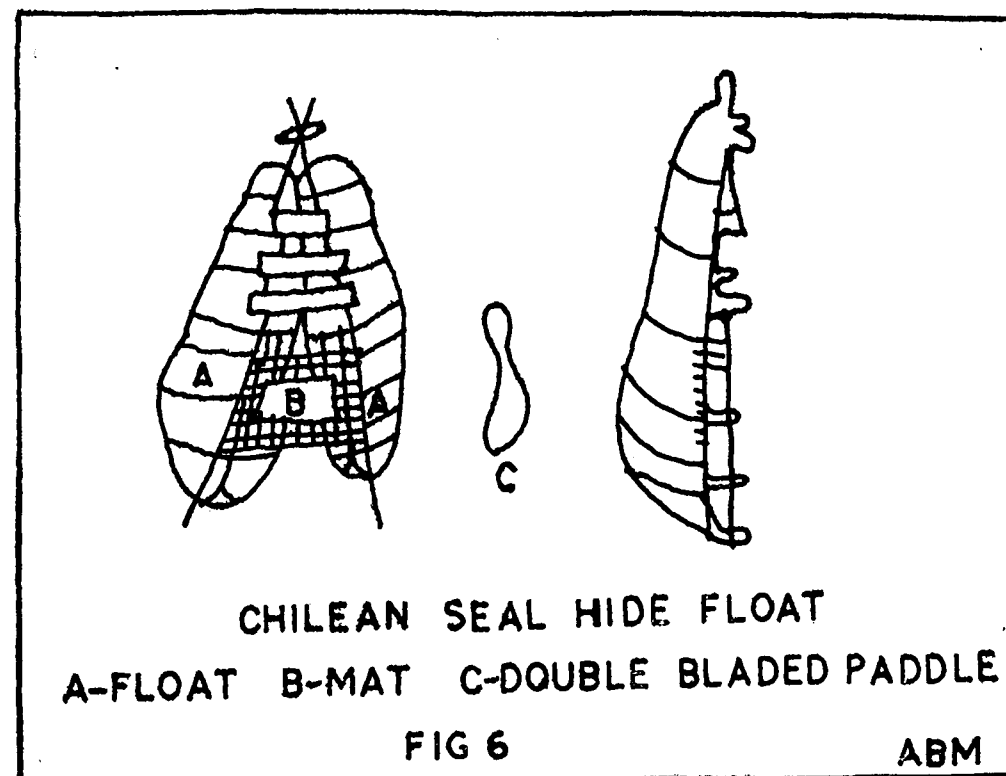
These dugouts were fifty to sixty feet in length. They were made with stone axes and fire from the trunk of the ceiba tree. At times they carried small cotton sails. The crews stood erect while they paddled.

The important difference between this and the northern dugout is that the former had washboards supported on ribs. This added to the seaworthiness of the canoe and the comfort of its occupants.

The dugout has its origins in the north and not in Peru as no suitable woods grow on the Peruvian littoral (Lothrop, 1932). The washboard was pre-Colombian as is evident from pottery models of boats from Peru. Before the conquest however when iron tools were not in use, the washboards consisted of bundles of reeds.

SEAL HIDE FLOATS (Fig. 6) :—

The chief vessel of northern Chile in aboriginal times was a float composed of two cylinders of seal hide, united by and supporting a platform. The limits of distribution have been Ica in Peru (S. Lat. 15°) and the river Maule in Chile (S. Lat. 35°). A century ago it was found upto Valparaiso but now it is used by Changos Indians between Cobija and Coquimbo on the Chilean coast. This type is now almost extinct.

CHILEAN SEAL HIDE FLOAT
A-FLOAT B-MAT C-DOUBLE BLADED PADDLE

The cylindrical floats consist of two great pouches, each two or three metres long with the ends pointed and curved slightly upwards. Each pouch is made of four or more male seal skins which are softened by being soaked in fresh water. In stitching the pieces were placed side by side and fish bones or cactus spines thrust through the hide. Then sand or reeds are put in so that the bag becomes fully distended. The sand-filled bag is allowed to dry until the hide becomes hard. Then sand is taken out. They painted the pouch with a mixture of red clay, grease and oil. Each pouch had a small tube to permit more air in the bag when it became deflated. Floats were assembled in two ways, joined parallel to each other; and lashed together at the bow with bracing apart at the stern. Wooden and reed mats were placed as platforms either on poles or inside a frame.

The crew for navigating these rafts consisted generally of two or three men. The paddler knelt at the bow and used a two-bladed paddle.

This vessel had several advantages. It could be constructed with great ease in a region lacking in those materials which are normally used for boats. The canoemen were supported well above the cold sea water and remained dry and warm which was not possible in the case of balsa raft. This was an important consideration because these natives were subject to pulmonary diseases (Quirke, 1952). The raft had a buoyancy just like that of a cork. It was the only skin boat in all South America, (Quirke 1952). It was primarily used for fishing.

ARAUCANIAN CHILE:—

Physical Setting :—

This area is characterised by the sewn-plank canoe. This coastal region extends in a north-south direction from 30°S to about 42°S latitudes. The coastal plain here is a bit wide but the rivers are all very small. It is a region of heavy rainfall, luxuriant forests and turbulent rivers. In the northern half of this region the vegetation consists of chapparral bushes and trees having bark, typical of Mediterranean climato-vegetation areas. Dense forests are found in the southern half of the area. Beeches, Laurel and Cypress are found in the former while in the latter Chilean pine is the representative tree. The absence of indentations in the coast has been partially responsible for the lack of ports and harbours.

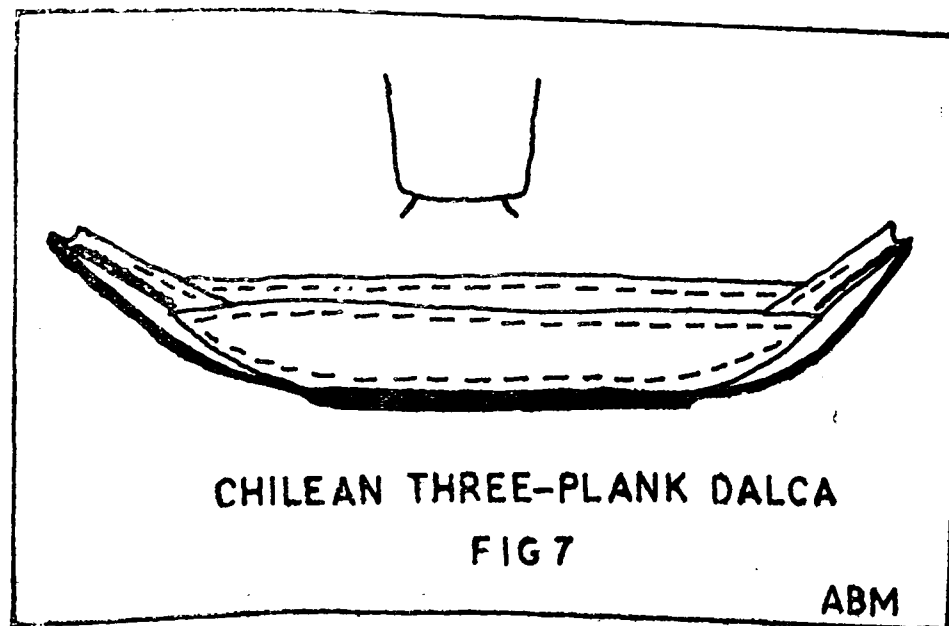
BOAT TYPES :—

Although the plank canoe is of greatest significance in this region, dugouts are also quite common.

SEWN-PLANK CANOE :—

The sewn-plank canoe or *dalca* has been of great anthropological significance because of its suggestion of Oceanic influences. Presently, however, it is all but extinct.

The *dalca* (Fig. 7) consists of three slabs of wood but after the conquest five or seven planks were used. Planks were made from larch, cypress or with stone axes. The trunk was split lengthwise and boards were worked down was softened by fire and water and bent to give the requisite overhang at bow and stern. Then all the three planks were lashed together with bamboo fibre (Chusque cobn). To keep the vessel water-tight the joints were covered by a roll of grass.



The *dalca* was used in the 16th century between Gulf of Coronados (S. Lat. 42°33') and Cobo Tress Montes (S. Lat. 47°) by Cunco, Chilote and Chond Indians. During the 18th century its use spread to the Alacaluf.

The three-planked *dalca* carried as many as eight or ten oarsmen. Oars were constructed in two pieces with a rounded shaft to which flat, square ended blade was lashed. Most of the rowing was done by the women.

As to the origin of the *dalca* two theories have been propounded, Polynesian and New world.

The opinions favouring the Polynesian origin are very few and rather based on very weak arguments and evidence. The ocean currents, winds and storm tracks all moving away from South America preclude the chance that a Polynesian canoe might drift to the New World and become a model. The Polynesian canoe is not suitable for such long journeys of four thousand miles up to Chile (Dixon, 1934). The double-hulled Polynesian has the least resemblances with *dalca* type. Hence we have to discard the Polynesian origin.

The indications that the *dalca* is a local product of the region where it was first seen are very strong. Sewn bark canoes with wadded seams are found in adjacent waters. The Southern Araucanians used to split planks with which they constructed their houses. Chono tribes used to make bark canoes while Cunco carried on plank splitting. A combinations of these two resulted in the origin of the *dalca*.

DUGOUT CANOE :—

In this type the stern is cut off square and the bow is roughly shaped. The sides are straight and parallel. It was used by the Araucanian speaking Picunche Indians.

MAGELLANIC REGION :—

Physical Setting :—

This is characterised by sewn-bark canoes. The region stretches from 50°S Lat to about 55°S Lat and consists almost entirely of islands and bays with protected water-bodies running lengthwise for great distances. This is a fiorded coastal area. The rivers are very few. Only a part of Tierra del Fuego is somewhat continuous. Dense forest vegetation is wide-spread.

BOAT TYPES :—

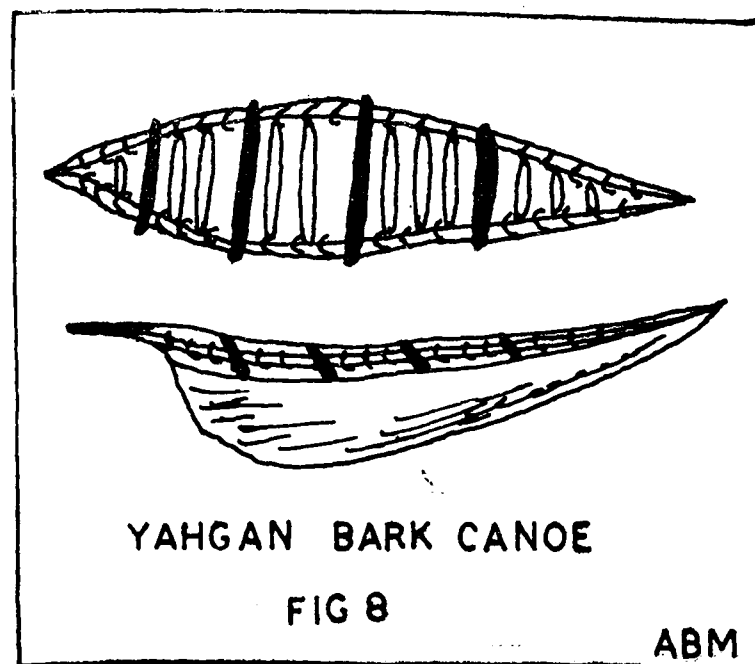
Apart from the most representative sewn-bark canoe we find a type of dugout canoe also.

SEWN-BARK CANOE (Fig. 8) :—

Formerly it was used by all the Indians inhabiting the Magellanic islands down to Cape Horn. Now the Yahgans use it but it is becoming rarer. This is also known as the Yahgan canoe.

The Yahgan canoe is made of the bark from the evergreen beech tree which grows in profusion on the western coast. The bark was stripped in the period of October to February. It was kept sunk in steam by means of stones, so that it remained flexible and soft. The bark is quite thick. The

rough exterior was knocked off first and the fat inner bark was removed with a shell chisel. Three, five or more slender cigar-shaped pieces were cut and sewn tightly together with whalebone.



The interior was then lined with split wintersbark from end to end. The slender tips of bow and stern were braced by a braided grass rope running from them to the nearest thwart. There was a fire-place of sod placed roots upward in the central section and a bailer of bark or seal hide. Paddles with long slender blades and short rounded handles were used.

Construction and repair of the canoe was done by the men but its management was in the hands of women. The latter moored the canoe in kelp bed and the men prepared the fire. The shingle shore was very hard and would break the canoe. After mooring the women swam back to the shore.

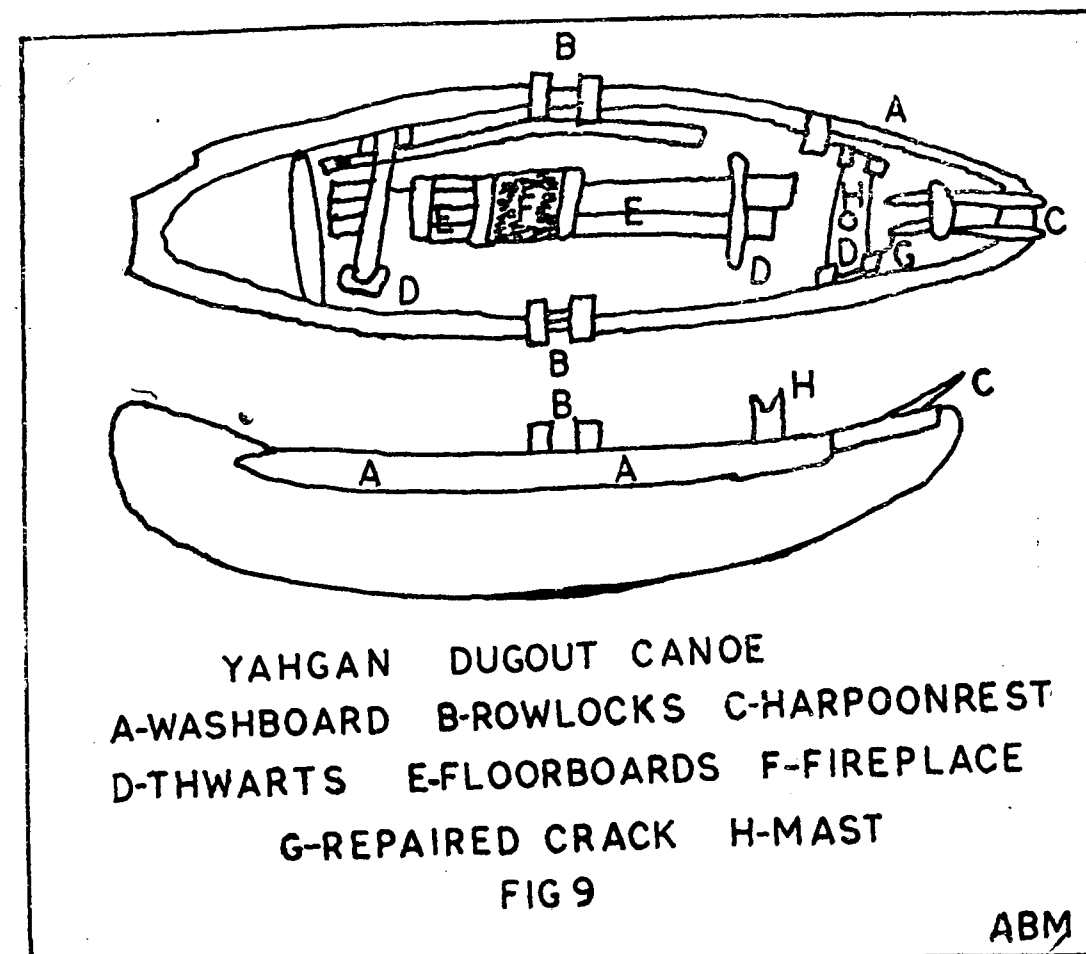
DUGOUT CANOE (Fig 9):—

This was a double-ended dugout with pointed bow and square stern. It has been used since about 1880 when it was built for the first time. It was an independent invention stimulated by the introduction of metal tools.

The Yahgan dugout with pointed bows washboards and fitted with row locks. It has a short mast and a gunny sack sail. It is in form similar to bark canoes.

II. EASTERN COAST:—

The literature on sea-transport and boat-types on the eastern coast of South America is very meagre. As has been pointed out earlier that the tribes of



the eastern parts of the continent have been mostly living on the basis of land and had little to do with sea. This coast can be divided into three parts:—

- Guiana Coast
- Brazilian Coast
- Argentinian Coast

GUIANA COAST:—

This area should be named as Guiana-Venezuelan for it includes a large part of Venezuelan Coast.

Physical Setting:—

It extends from about north of the mouth of Amazon upto about west of Orinico delta. It is a region of heavy rainfall and high temperatures. The vegetation consists of mangrove swamps containing many varieties of hardwood trees. At places the coastal plain has savannah vegetation of high grasses.

BOAT TYPES:—

The Carib and the Arawak tribes living in this area have developed the dugout canoe which is the predominant type. Caribs were experts in the management of the boats. There were four types of boats, pirogues, large canoes, small canoes and rafts.

PIROGUE:—

This was a dugout with its side built up with planks, sewn together and pitched with bitumen. The length of the pirogue was forty feet and it was large enough to carry fifty passengers. It had a raised keel and a pointed bow. It was fitted with a series of plank seats. The stern was flat-topped carved with an animal's head (*maboya*) to frighten the enemy and often decorated with a barbacued human arm. It had three masts and a sail of cotton or palm leaf matting.

CANOE:—

Dugout canoes were used by both Arawaks and Caribs. It was made of cedar or cotton wood log. The log was hollowed by alternate burning or chopping. The larger variety was twenty feet long and was used for passenger transport. The Carib canoes had high and pointed stem and stern while the Arawak canoe had square ends. The canoes had two masts and were propelled by spade-shaped paddles. The Arawak paddle had a cross-bar handle and a long blade. The smaller canoe used for fishing had a flat stern and carried only one person.

RAFTS:—

The raft consisted of logs lashed to two transverse bars.

SUPERSTITIONS:—

Caribs and Arawaks believed in several superstitions in travelling from island to island. While on sea they did not drink water neither did they eat crabs. Spilling of fresh-water into the sea was prohibited. To drive the clouds away hands were waved and in storm maniac was chewed.

BRAZILIAN COAST:—

Physical Setting:—

The area includes most of the northern part of the Brazilian coast extending from about the mouth of the Amazon southward upto Pernambuco. The region is famous as a rain-forest area. The land is divided into small patches by a maze of creeks and water is seen everywhere. The forests are impenetrable; water is the only means of transport. Mangrove forests have many varieties of hard-wood trees. The coast lacks indentations and bays and the only openings are the mouths of the rivers.

BOAT TYPES:—

The most representative boat of this area is the log-raft termed as *jangada*. The term *jangada* has been used for balsa rafts on both the Ecuadorian and Brazilian coasts (Lothrop, 1932 and Hornell, 1946.) It has also been suggested that west of the Andes they are termed as *balsa*, eastward in Brazil, they go by the name of *jangada*, a word originating in Kanara, a district on the west coast of India where *jangada* and *jangadam*

are local terms for a double-canoe, formed of two dugouts joined together by a platform and used as a ferry boat (Hornell, 1946). This however clearly shows that the south Indian *Jangada* is entirely different from the balsa raft *jangada* of Brazil.

In equatorial America the log raft has attained the dignity of sail and become of major importance in the life of the water-folk. There are many varieties ranging from simple structure of few logs tied together to crafts of great complexity. At the present time the sea-going Ecuadorian *jangada*, has become extinct but on the northern section of the coast of Brazil it is commonly used by the fishermen.

Essentially a *jangada* consists of a level platform of logs pinned together by strong transverse rods. A triangular sail, without yard, is carried on a vertical mast. The hull platform consists of an even number of massive logs of light wood, usually six, pinned together by sharply pointed rods of hardwood passing through all the logs from side to side. Below, the bottom of the platform curves into a thin horizontal edge at each end in order to ride the waves more smoothly. Of the important deck fittings centre-board and a mat cabin are the most common. The *jangada* is characterised by one single centreboard of leeboard shape.

The sailing type *jangada* is confined to the estuaries and the coast. The fishermen have great confidence in its seaworthiness and good speed. The Tupinamba and Caete used it very frequently.

PAMPAEAN COASTAL AREA:—

Physical Setting:—

This area includes the Rio de la Plata and spreads south about 50°S. Lat. Large bays and gulfs are characteristic of this coast. The vegetation consists of grass but along the northern part swamps are also found.

BOAT TYPES:—

In this area again we find the predominance of dugout canoe, used by several of the tribes. Guarani, Charrua, Chana and Timbu were among the many who used canoes. Paucity of building materials but much more so the land-based culture of the Pampaean Indians did not give them the conditions conducive for the development of sea-transport.

In the life of the Charruas however canoes and water-transportation played a very important part as they depended more on fish before the conquest. Their canoes were ten to twelve fathoms in length and half a fathom in width. The canoe was made of cedar wood and very beautifully worked. They rowed them with very long paddles decorated by crests and tassels of feathers on the handles and forty men all on foot rowed each canoe. The Charrua canoe was very common in the sixteenth century and later but in the nineteenth century due to a cultural atrophy, all the fishing and the canoes became extinct (Lothrop, 1932).

CONCLUSION:—

The east coast is rather deficient in varieties of water-crafts. The canoes and other types were meant essentially for inland rivers. Compared to this the vessels on the west coast were of many varieties. Sea-transport was definitely far more advanced on that coast. Trade and war expeditions were quite common on the Pacific side. Pre-historical evidence is

quite conclusive in pointing to the trade contact between Ecuador-Colombia region and Meso-America.

Most of the vessels had their origin in inland area. Lake Titicaca might have been one of the principal areas of origin of balsa raft. Peruvian balsa however was developed locally on the coast. The *jangada* of the Ecuadorian coast was adopted primarily for inland waters, especially for descending rivers. Similar rafts were used across the Andes or the eastern coast. It is reasonable therefore to assume that *jangada* originated in the interior. Since it was fitted with sails and centreboards it could propel and manoeuvre easily in the open ocean.

Similarly the dugout used by Carib, Arawak, Boruca, Chorotega and Antillean tribes was essentially an inferior vessel suited to river. After conquest however they were fitted with wash-boards and stabilizing logs when they became suitable for oceanic movement.

From Peru southwards the diffusion has occurred in the reverse direction. The double-ended reed balsas, the seat hide float, Araucanian dugout, *dalca* and Magellanic bark-canoe originated on the coasts and the travelled inwards.

Spanish introduction have been the outrigger stabilizers and the stone anchor. They introduced them from the Philippine boats. Cotton sail is the newly introduced European element.

The historical part played by the dugout canoe in the migration of Caribs and Arawaks from the mainland to the Caribbean Islands has been immense. It is interesting to note that the term canoe has itself been derived from an Arawak term *canoa*. On the western coast Heyerdahl suggested that the balsa took the Indians to people the Polynesian islands.

The forms and methods of construction are so similar between the two coasts for several types of boats that it seems to point to a possible continued contact between them.

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GEOGRAPHY AND RELIGION

By

Dr. GEORGE KURIYAN

On a careful analysis and examination of the manifold legends and beliefs in any religion, it would be found that large numbers of these are closely associated with geographic factors. To cite a few examples, have you wondered why among all the great religions of the world, the three religions of Judaism, Christianity and Islam alone, picture Hell as hot? The answer lies in the simple truth that these three religions originated, either in the desert or, on the border-land of the desert. It was a good teacher who brought home to his audience, through homely analogies new ideas and ideals. To the peoples who inhabited these arid regions, there could be no punishment more severe than being roasted alive in the heat of the burning desert. Interestingly enough, if we look at the concept of Hell in other religions, we find that all Hells are not hot. To the pre-Christian Scandinavians and Greenlanders, Hell was a region encased in snow and ice. To a Norseman, a hot Hell certainly sounded too good to be a Hell at all, nay, it was almost a Heaven! There is a story, centuries old, which states that an ardent Christian Missionary in attempting to proselytize the Norsemen gave them in his hell-fire sermon, a picture of the Christian Hell, burning with eternal heat and fire; but no longer had he finished it when one of the more intelligent members of his audience stood up and asked him whether they had to do all these mean and bad things he had spoken of to go to that warm nice place, which he had so beautifully described!

To cite another example, again taken from the Holy Bible, is the rather peculiar description of Heaven as a walled city, in the Book of Revelations. If Heaven is a place to which only the righteous can have entrance, one fails to see why it should be walled; for those within are not likely to get out, and those without, will find it impossible to get in, even if there were no walls. But, after a thousand years of war in Palestine, during which the country served as a football for empires and as a high road for conquerors, does it surprise anyone that a walled city, offering security and protection, becomes the ideal to look forward to? Consequently, even Heaven becomes a walled city.

The Holy Koran written by Mohammed in the central desert of Arabia depicts Heaven as a region abounding in shade and soothed by the sweet sound of running water, indeed, an exact counterpart of the Christian Hell.

Hinduism and the associated religions of Buddhism and Jainism which originated in India, in the land of agricultural prosperity, are those in which there is no definite picture of Hell. Often, the punishment for one's sins in this world is only to be born again, probably in a lower status, or in a lower caste, or as an animal, or even as a material object like a tree. On the other hand, if one were to lead a virtuous life, he would be elevated in his next birth by being born in a family of higher status and in a higher caste. Teachings of these religions thus lead us to believe that there is a perpetual attempt on the part of the human soul to be uplifted, the final goal to be attained being *Nirvana*, union with *Brahma* or God, a communion with the Absolute - the state of Perfect Bliss. Indubitably, a careful study of world literature would yield a surprising variety of Hells and Heavens, each with a geographic explanation.

GEOGRAPHY AND RELIGION

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It is not only in the picture of Hell and Heaven that religious books abound in depicting geographical phenomena. It must be remembered that most books of religion are also books of history; the Old Testament, in many places is nothing more than the history of the Jewish race. It records several natural phenomena and amongst them, the story of the great flood and Noah's Ark is perhaps the most familiar. Religious embellishment is given to all such events by attributing them to the hand of Providence. And this is by no means peculiar to Christianity.

In India, we find a large number of religious beliefs, some of which could easily be accounted for by Geography. Most rivers in India are looked upon as gifts of God and as a result thereof, they have attained a considerable amount of religious sanctity - a fact which is easily explained when one remembers the subarid nature of the region and the dominant role which the rivers play in supplying water artificially to meet the needs of agriculture. Amongst the rivers of India, the Ganga is easily the most sanctified of all, so sanctified that even the worst sinner has only to go and bathe in its holy waters to get his sins washed away; and if anyone were to die on its banks within seven *Kos** of Kasi or Varanasi (Banaras), his soul will be admitted directly into the Heaven of Shiva. Have you wondered, why amongst the manifold rivers, the Ganga alone should have this supreme sanctity? Traditionally the Ganga, jointly with the Indus and Brahmaputra is supposed to take its origin at Lake Manasarowar, in Tibet, beyond the Himalayas. But a careful study of the topographic map of the region will show that the Ganga is a sub-Himalayan river and not a trans-Himalayan one. In other words, the Ganga rises on the southern slopes of the Himalayas, on the foot-hills, far from Lake Manasarowar. Our Sanskrit Pandits, however, have an easy way of getting over this difficulty by suggesting that there is a subterranean link between the source of the Ganga in India and Lake Manasarowar in Tibet. Among the Indian rivers, it is only the Indus and the Brahmaputra which rise beyond the Himalayas and cut across the great belt of these mountains, but neither of them has any sanctity comparable to that of the Ganga. It may also be a matter of surprise to some that the Jamuna is actually longer than the Ganga, it carries more waters than the Ganga and its waters are much clearer and free from silt compared to that of the Ganga, but all the same, the Jamuna is only a tributary and the Ganga is the main river.

Great changes have taken place in the drainage system of North India since very late tertiary times, sometimes even resulting in a complete reversal of drainage. Along the foot of the Himalayas is a long thin belt of deposits, the so-called Siwalik deposits, extending from Assam in the east to the Kumaon hills of the Panjab, steadily widening westwards. Geologists and geomorphologists are in perfect agreement that this could only be ascribed to a river which was flowing north-westwards, for only then could the deposits become wider and deeper towards the north-west. Various names have been suggested to this north-westward flowing river but perhaps the name Indo-Brahm coined by Pascoe, to denote the conjoint flow of the two rivers Indus and Brahmaputra, is the most appropriate. It is, therefore, possible as a result of very recent earth movements in north-western Panjab that this drainage system of the Indo-Brahm, that is, the Brahmaputra flowing north-westwards along the present course of the Ganga to meet the Indus, and then the two flowing together south-westwards into the Arabian sea, was completely dismembered to create three independent units—(i) the

* Foot Note :—One *Kos* is about 1½ miles.

present Indus, (ii) the five tributaries in the Panjab and (iii) the Gangetic system now flowing south-eastwards into the Bay of Bengal.

This elevation of the Potwar into a plateau not only converted the north-western section of the river into an independent drainage system with the Sutlej as its easternmost tributary, but also resulted in a reversal of drainage, and instead of the rivers flowing north-westwards into the Arabian sea, they changed their direction completely and found an exit, east into the Bay of Bengal. Do we not see in this, a perfect example of a miracle? The Ganga which was flowing north-westwards, almost in the twinkling of an eye, started flowing south-eastwards, in a completely reverse direction.*

Primitive man who inhabited these regions must have found in the behaviour of this river an inexplicable phenomenon and it would only be natural for him to rush to the great and erudite Pandits to seek an explanation. For, after all, from time immemorial, it was the Pandit, the Priest, and the Monk who alone knew the secrets of the Universe, whether it be of man, or of God. And what explanation could the poor Pandit offer? However learned he was in the scriptures, he could not understand this natural phenomenon of a vertical uplift in the path of a river resulting in a reversal of drainage. So he turns round and answers the question in the simplest way, 'it is an act of God', indeed, a practice which perhaps is followed even to-day, by the so-called learned and erudite persons. They would have us believe that it is through these miracles that the Lord manifests Himself and is it surprising then that the places through which the Ganga flows across the plain, have, through the ages become the Holy of Holies? Emerging from the Himalayas at Haridwar which literally means 'Shiva's door' the river flows out from the very feet of the Almighty. From time immemorial, therefore, the Ganga becomes the most sanctified of all the rivers and its banks have been the goal of pilgrims from all over India.

There is a very interesting tradition - the tradition of the Tiruveni, which suggests that the three rivers, Ganga, Jamuna and Saraswati had their confluence at Prayag (modern Allahabad) but at the present day, we find only two rivers, the Ganga and the Jamuna. The Sanskrit Pandit has a simple explanation; he states that the third river, Saraswati, makes a subterranean connection with the Ganga at this spot, indeed, an exact replica of the traditional legend regarding the source of the Indus, Brahmaputra and Ganga at Manasarowar.

The highest elevation attained by the Indo-Gangetic low-land is only nine hundred feet above sea-level, in the vicinity of Saharanpur, Ambala and Ludhiana. Located at a distance of about a thousand miles from the mouth of the Ganga in the Bay of Bengal, it is this low line of hills with an altitude less than a 1000 feet which separates the present drainage basin of the Indus from that of the Ganga. A comparatively trifling change of level will divert the tributary of one river to that of the other, and it is probably as a result of a small uplift during sub-recent times that the Jamuna which originally flowed towards eastern Rajputana in the Panjab became a tributary of the Ganga. And it was probably as a result of this, that the Saraswati got lost itself in the desert, the greater part of its channel remaining even to-day as the dry bed of the Ghaggar or Hakra. Obviously then, the Hindu legend of Tiruveni is founded on geographic facts.

The Panjab rivers also have shown similar changes in their courses for which we have historical evidence. Panjab obviously is a land of five rivers

* Foot Note: - Is it this which has been treasured in the Bindumati legend?

(*panch* - five and *ab* - river); actually however, we find that there are six rivers at the present day, the Indus and its five great tributaries, the Jhelum, Chenab, Ravi, Beas and Sutlej. The Rig Veda calls this, the land of five rivers and here again the Sanskrit Pandit tries to explain this apparent incongruity by suggesting that the Rig Vedic Aryan did not include the main river Indus, but only the five tributaries and hence it becomes the land of five rivers. This explanation is hardly tenable, for it must be remembered that the Rig Vedic Aryan was not indigenous to India; he was an intruder who came from without, and he gave to the river the name Sindhu - the ocean - a name, which is a measure both of its size and the extreme difficulty he must have found in fording it before entering into the country. How then could he have ignored it in his count of the rivers of the Panjab? If the drainage system which existed in these regions was similar to what it is at the present day, he should have called it *Cheab* (*che* - six, *ab* - river) the land of six rivers, and not Panjab. However, we find that there are definite pieces of geographic and historical evidence to show that the Sutlej, till the twelfth century A. D., had a separate exit to the sea through what is now known as the Rann of Cutch, independent of the drainage system of the Indus. Obviously then, at the time of the Rig Vedic Aryan, the Indus had only four tributaries and the land becomes the land of five rivers, the Panjab. This explanation, it is suggested, fits the facts far better than the fanciful Sanskrit interpretation of the Vedic texts.

Next to the Ganga, among all the rivers of India, the Cauvery in the extreme south is the most sanctified, so sanctified as to be called the *Dakshina* (southern) Ganga. Traditionally again, its origin is supposed to be identical with that of the Ganga at Manasarowar, although in actual fact it rises in the hills of Coorg. The Cauvery, though much smaller than the Godavari, the Krishna or the Nerbada, is more holy. On a glance at a map, one finds that in the Cauvery we have one of the most beautiful waterfalls at Sivasamudram. In an ancient terrain like the Deccan Peninsula, one would normally expect the drainage to have attained maturity, so that the rivers will have a smooth gradient from source to mouth with no rapids or waterfalls in their courses. As a matter of fact, but for this single irregularity, the Cauvery basin exhibits perfect characteristics of maturity, a wide river valley with a very shallow gradient. Geomorphological evidence suggests that the waterfall at Sivasamudram is a very recent one, probably one which came into existence even after the advent of man.

Here is another instance of primitive man finding a remarkable miracle performed in front of his eyes, all in a twinkling; a river flowing normally in grade, suddenly generates rapids and cascades. As before, this becomes an act of God and is it surprising then that he calls the small lake created by this miracle Sivasamudram - the sea of Lord Shiva himself? It is equally probable that the same set of earth movements that generated the waterfalls at Sivasamudram were responsible for the similar waterfalls in the Nerbada near Jubbulpore and is it any wonder then that the Nerbada becomes the third sanctified river of India? We can, therefore, rightly conclude, that if we analyse the physical geography of the region, we will find that all rivers which had recent tectonic disturbances in their courses have received some sanctity or other, primitive man looking up to them as visible manifestations of God, and no wonder, he started worshipping these rivers, and sanctifying their sources and banks, which in course of time, became centres of pilgrimage, studded with shrines.

To take another set of examples, there is an interesting legend which states that Kerala on the West coast of India was created by a saint, Parasu-

raman who seized an axe (in another version of the legend, a rice winnow) and hurled it with tremendous force from Gokarnam (near modern Goa) right over the sea. By a wonderful miracle, it was carried as far south as Cape Comorin and instantaneously, the sea retreated from Goa to Cape Comorin, to create the low lying level land to the west of the Western Ghats. This legend narrates in a poetic and figurative way the origin of this coastal low-land, which has been reclaimed from the sea in very recent times, since the advent of man. In geological parlance, the age of the region is pleistocene—very, very recent. Linguistic evidence can also be cited to show that places mentioned as lying on the coast by early travellers like Ibn-Batuta, Ptolemy, Pliny and others are now lying far inland, which proves that the sea has been receding steadily. There has been an uplift of the sea bottom and an emergence of land, quite a frequent occurrence in nature, which however due to its inexplicability as before, becomes a miraculous event with a super-natural origin.

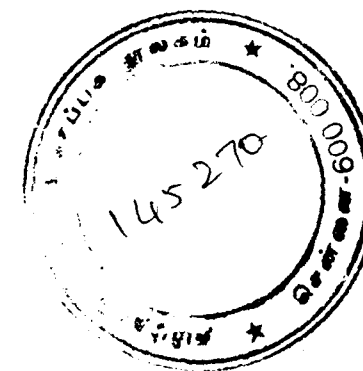
Yet another piece of interesting legend comes to us from the glorious epic of the Ramayana which narrates the story of Sita, the virtuous wife of Prince Rama, who was forcibly abducted by the *Rakshasa* (demon) King Ravana of Ceylon. In the battle that followed, Rama's monkey-general Hanuman easily leapt across from India to Ceylon, but the mortal members of the army of Rama could not perform this super-human jump of 20 miles, or more. And to enable them to ford across Adams' Strait on foot, blocks of stone were created in the sea by the magic touch of Hanuman's tail on the sea water. This is perhaps no more than an elevation of the sea bottom and the fervid imagination of successive generations of Aryan bards can easily be credited with such powers of invention to evolve the marvellous details that have been added by way of embellishment.

One more example, the small island of Rameswaram lying in the extreme south of India, in sanctity, is second only to Kasi itself. Rameswaram is a very tiny island, eleven miles long, which now lies at a distance of two miles from the mainland. Local tradition claims that the island was connected to the mainland and that the Pamban straits have been created as a result of a recent storm—perhaps as late as 1480 A.D. The abrupt manner in which point Raman on the coast terminates, and its geological formation which can be traced across the ridge of rocks to the island, almost confirms this tradition; which is further fortified by the records in the temple of Rameswaram itself, where it is stated that till the fifteenth century, the island was connected with the mainland. Even to-day the idol of the temple of Rameswaram is carried across in procession to the mainland, indicating the fact that the deity in the temple exercised jurisdiction over the mainland also. A natural phenomenon like a terrific cyclone must have resulted in creating the deep fissure and converting what was once a peninsula into an island. Here again, primitive man finds it impossible to account for this, except through super-human action and the region becomes a particularly sanctified spot, where the Lord had openly manifested Himself.

In conclusion, another illustration could be cited from the Holy Bible to elucidate the role of geography. Have you wondered why it is that Christ does not find disciples in his own city of Nazareth; on the other hand, he finds them from among the fishermen of Galilee. The inhabitants of Nazareth are patient cultivators whose little gardens may be seen, even to-day upon the hill slopes ringed in by walls of white stone. Like all cultivators throughout the world, they are rooted to the soil below and they are obliged to remain on the land which must be constantly tilled; the horizon

of their minds is limited to the walls which shut in their corner of the earth. They are by nature averse to things novel, and their work precludes any change of their leaving home, even if it were to follow the most winning of the leaders of men. The fishermen of the lake, on the other hand, are nomads through the very nature of their occupation. Fishing again is an irregular fortuitous business, which depends more on chance than anything else, and there are some days of exceptional catch which permit of rest and tranquillity for sometime and make possible the following of a whim, or the taking of a journey. It is not that the fishermen of Galilee were fatally destined to follow Christ, but the geographical conditions of their environment and their work inclined them, more than the gardeners of Nazareth to allow themselves to be led into Judaea by the Galilean.

Do not such interpretations help us to a better understanding of books of religion?



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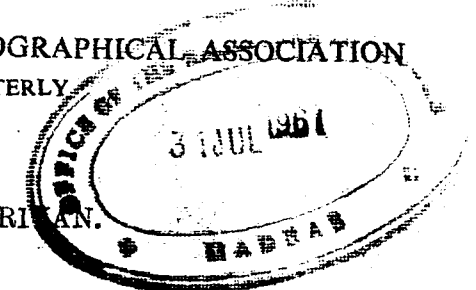
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NOTICE

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MORPHOGENETIC NATURE OF THE BHUR

By

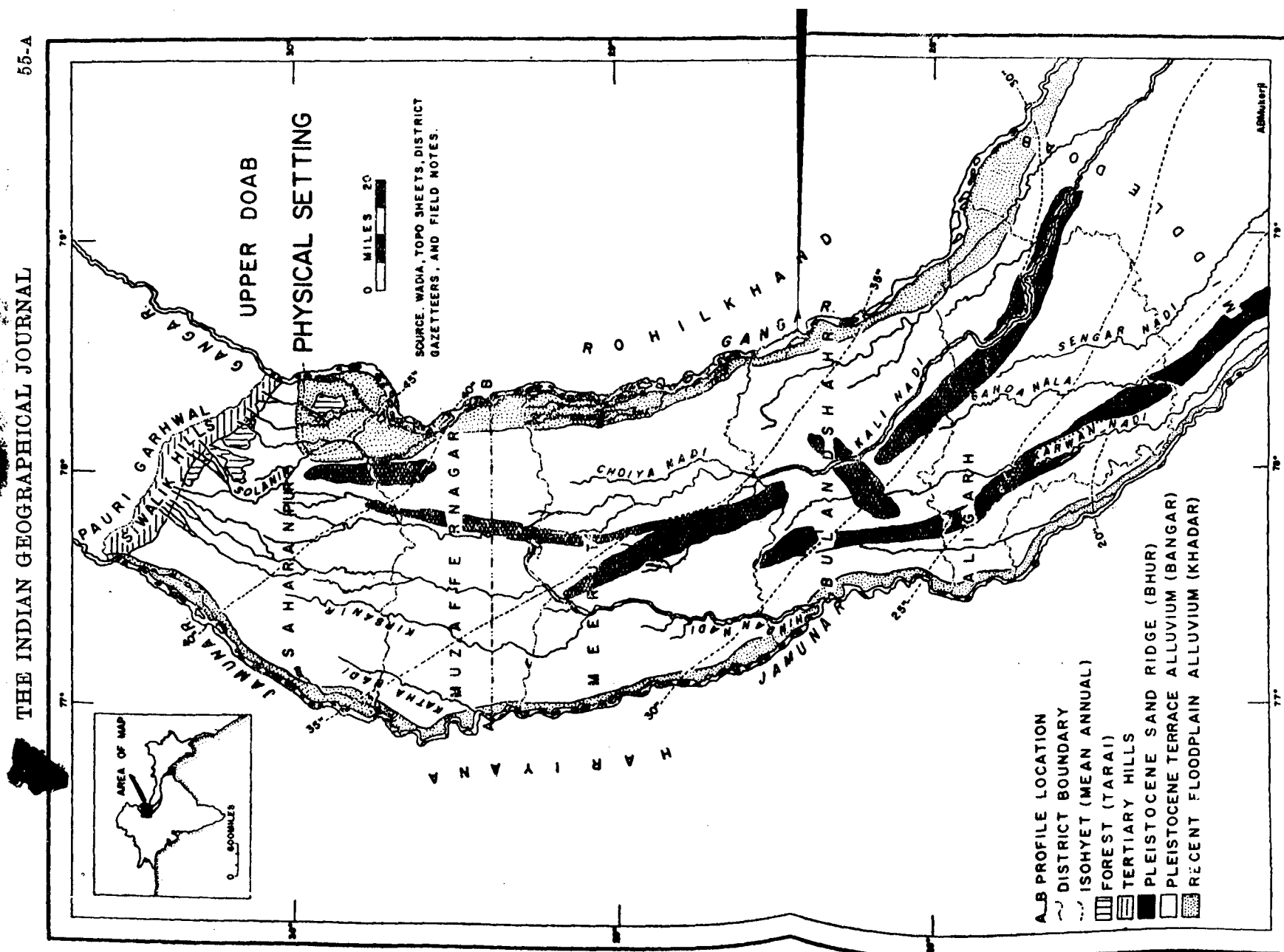
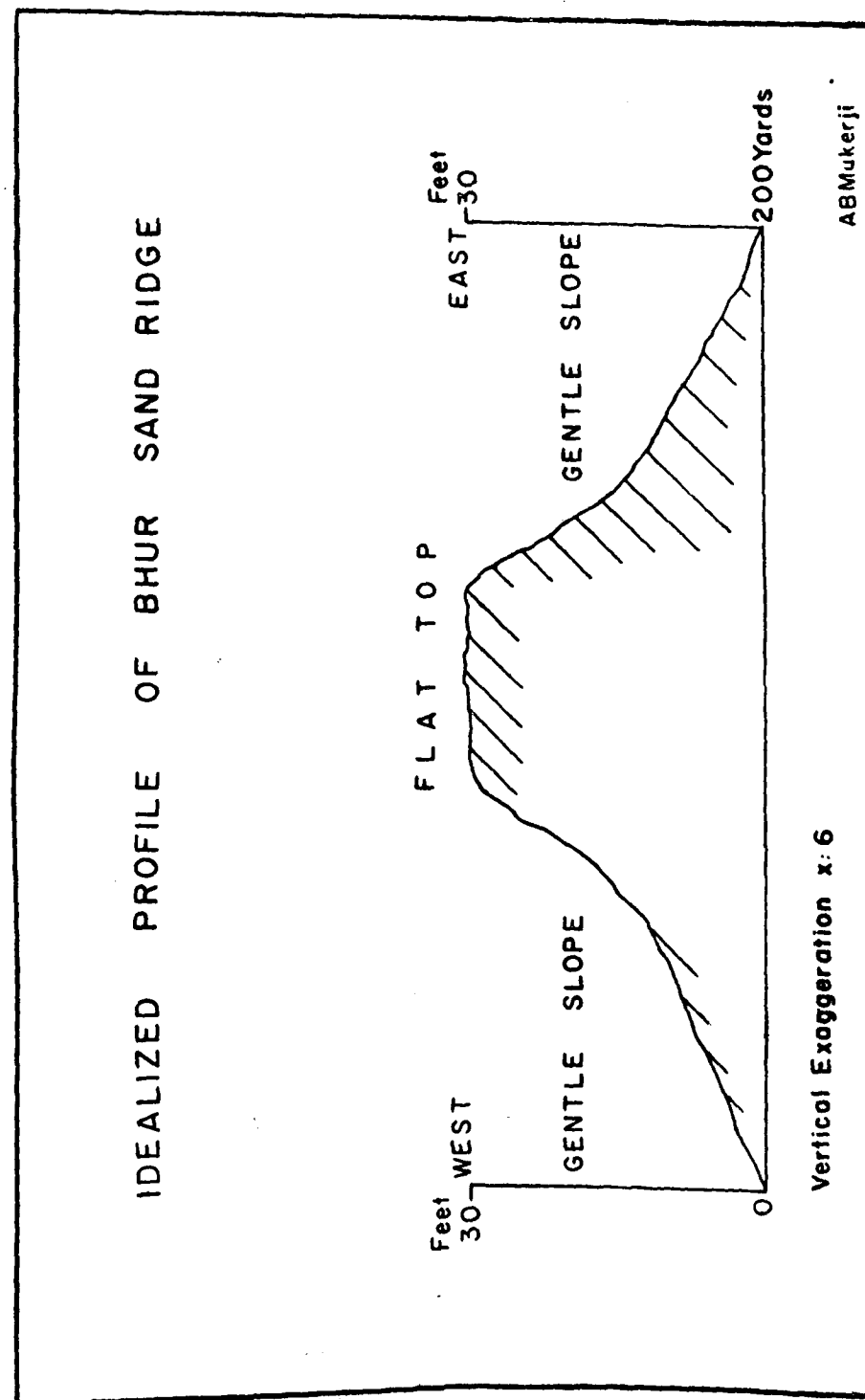
A. B. MUKERJI,

Dept. of Geography, Osmania University.

On the Pleistocene surface commonly termed the Upper Doab the *Bhur* is an unusual geomorphic feature that adds a variety to the rather monotonous natural landscape. Although of small size and limited in distribution, *Bhur* is of great geographic interest both as a geomorphic feature and having significant cultural associations.

Early writers have described the form of *Bhur* in various ways. None of these descriptions, however, are wholly true or complete. Wadia (1953, p. 393) describes it as an elevated piece of land which as a geomorphic statement lacks any definiteness. He also considers the feature as a sand dune (1953, p. 406). Spate (1954, p. 498) considers the *Bhur* to be low, undulating sandy uplands. *Bhur* has also been considered as a low, sandy ridge (Ahmad, 1952, p. 223); sand plateau of an irregular form (Dubey, 1935, p. 9); sand deposit (Login, 1872, p. 196); and sand dune (Coggin-Brown and Dey, 1955, p. 596). The folk usage of the term *Bhur* includes *Bhur* soil (*bhur ki mitti*), *Bhur* tract (*bhur ka ilaqa*), and *Bhur* ridge (*bhur ka tila*). During the field work spread over the whole of the Upper Doab the present writer found that all the connotations of the folk usage were wholly true.

In appearance *Bhur* is a ridge with a flat top and gentle, lateral slopes toward the base (Fig. 1). The *Bhur* extends in a north-south direction paralleling the Ganga, the Jamuna, and their tributaries (Map. 1). It is the length rather than its width that is the characteristic feature of the *Bhur*. It extends in a single, sinuous line and nowhere exhibits a composite feature like a dune complex or dune chains. Its height varies from ten to thirty feet. The constancy of its width of about two hundred yards is at once striking. Flat-topped, gentle-sloped ridges may thus sum up the description of the morphology of the *Bhur*.



The origin of the *Bhur* has been explained as the result of aeolian deposition (Wadia, 1953, pp. 393, 403, and 406; Coggin-Brown and Dey, 1955, p. 696; and Login, 1872, p. 196). None of these writers have, however, indicated the sources of the sand. Wadia's statements (1953, pp. 393 and 406) that the *Bhur* is found along the banks of the Ganga are true to only a limited extent. The main distribution of the *Bhur* is in the central parts of the Pleistocene interfluvial upland, located far away from the Ganga (Map. 1 and Fig. 2).

Although the sandy flood plain of the Ganga is a large source of sand, the possibility of the moisture-laden easterly winds transporting the sand against the high western bluffs of the Ganga is almost nil. At the same time, we do not find any sand dunes at the base of the western bluffs of the Ganga. These facts suggest that the ideas about the transportation and deposition of sand by the wind in the form of sand dunes are contrary to the evidence gathered from the field.

Toward the west, the Jamuna flood plain is equally farther removed from the *Bhur* and the eastern bluffs of the Jamuna river prevent transport of the sand by the westerly winds. The possibility of the Thar desert being the source of the sand for the *Bhur* of the Upper Doab is practically nil. The winds blowing in the Upper Doab come from the northwest and not from the west which is the direction of the Thar desert. Moreover, there are no sand dunes nor sand ridges like *Bhur* in the intervening area between the Thar desert and the Upper Doab. These facts suggest very definitely that there is no transportation of sand by the westerlies.

It appears from the foregoing discussion that the role of the wind in the transportation and the subsequent deposition of sand to form the *Bhur* as suggested by the early workers has not been substantiated by field evidence.

Recent investigations of the *Bhur* soil (Gerassimov, 1958, p. 195; and Singh and Chatterji, 1958, p. 191) show that the parent material of the *Bhur* soil is not pure sand deposited by wind, but sandy loam that has undergone several stages and degrees of oxidation. Different horizons in the profile of the *Bhur* soil (Fig. 3) have colours ranging from yellow to red, which could be easily correlated with an ascending scale of the intensity of oxidation. It indicates, further, that the *Bhur* ridge was formed during the Pleistocene period, a fact also stated by Wadia (1953, p. 403). Had the *Bhur* been a feature formed of accumulated wind-blown sands, during the dry, hot months of the year (Wadia, 1953, p. 393); the soil derived from it and developed on it would have exhibited morphological features entirely different from those described in the preceding lines.

Further evidence to invalidate the hypothesis of the aeolian origin of the *Bhur* could also be adduced. As contrasted against the mobile sand dunes, the *Bhur* ridges are stationary features. The local traditions, comparison of the oldest available maps with the most recent topographic sheets, and toponymical analysis of the names of the villages, eight to nine hundred years old, formed with the prefix *Bhur* indicate that it has long been an immobile feature.

The preceding discussion leads us to conclude that the *Bhur* is a ridge formed during the Pleistocene period. It was not formed by the wind-deposited sands. With the data in hand the writer suggests the hypothesis that the *Bhur* is a long, narrow ridge formed by the simple process of alluviation. At the time of deposition in the Pleistocene period, the sediments

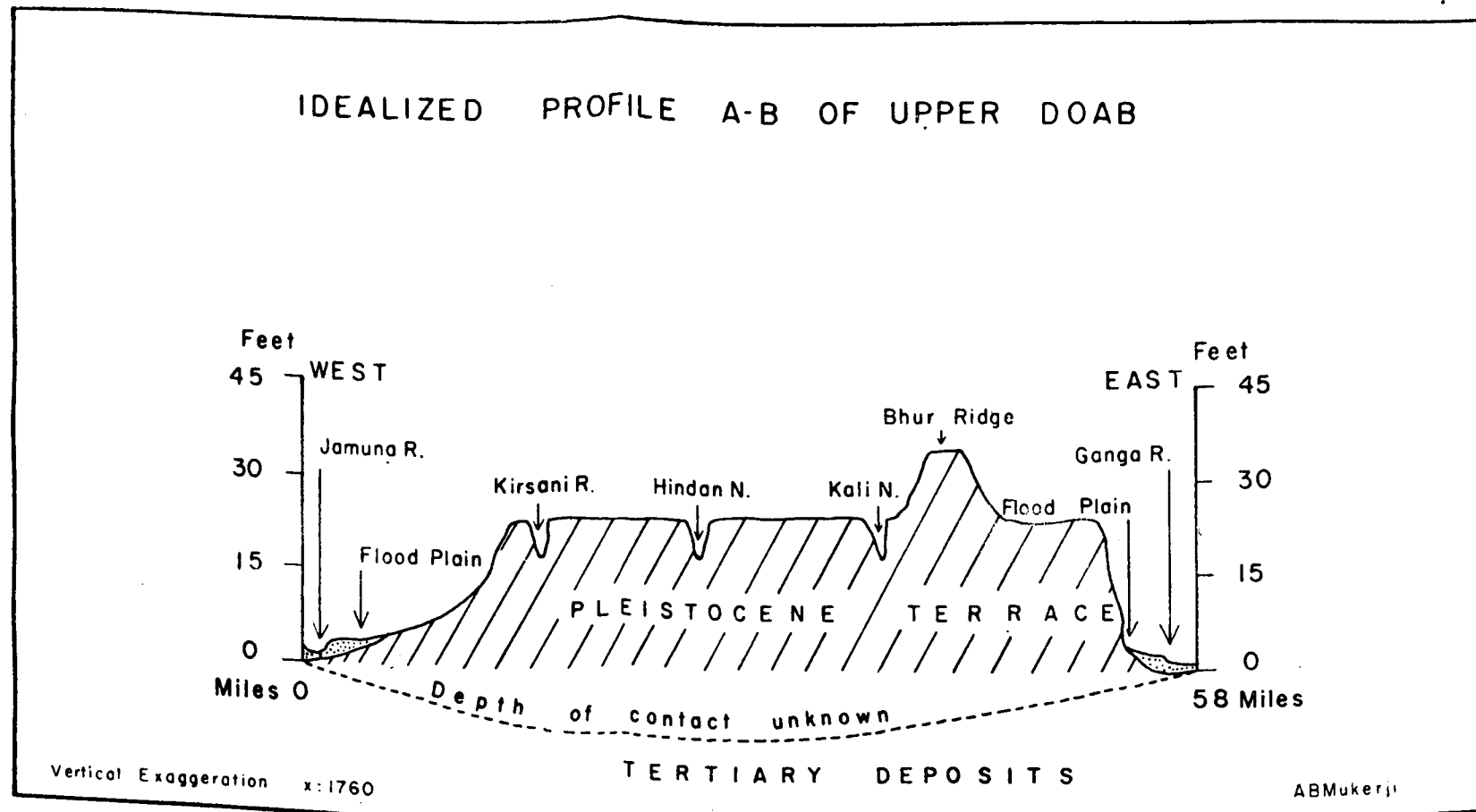


Fig. 2

MORPHOGENETIC NATURE OF THE BHUR

55-B

probably, consisted of a greater proportion of sand. The river might have been a braiding one as a result of a large bed load and the easy erodibility of the sand particles. The tow heads and channel bars connected with each other formed an almost continuous feature. This was the first stage of the formation of the sinuous *Bhur* ridge. Thus, *Bhur* is a braided channel deposit formed in the Pleistocene channels on a higher flood plain.

At the end of the Pleistocene period and the beginning of the Recent, increased alluviation and the shifting of the channels consequent upon the melting of the glaciers and the rise in the sea level abandoned the bed deposit as a high ridge and thus preserved as a permanent feature. Wind might have piled up the sand picked from the adjoining flood plain, and thus, contributed to the building of the ridge. Thus, the primary role in the formation of the *Bhur* was that of the rivers while wind played only an auxiliary role.

The presence of the Hindan, Kali, and Karwan rivers along the entire length of the *Bhur* supports the suggested alluvial origin. The form of the *Bhur* with a flat top and gentle lateral slopes also indicates a ridge formed by the river deposition. The morphological features of the *Bhur* soil are additional pieces of evidence supporting the thesis of alluvial origin.

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MORPHOGENETIC NATURE OF THE BHUR

56-A

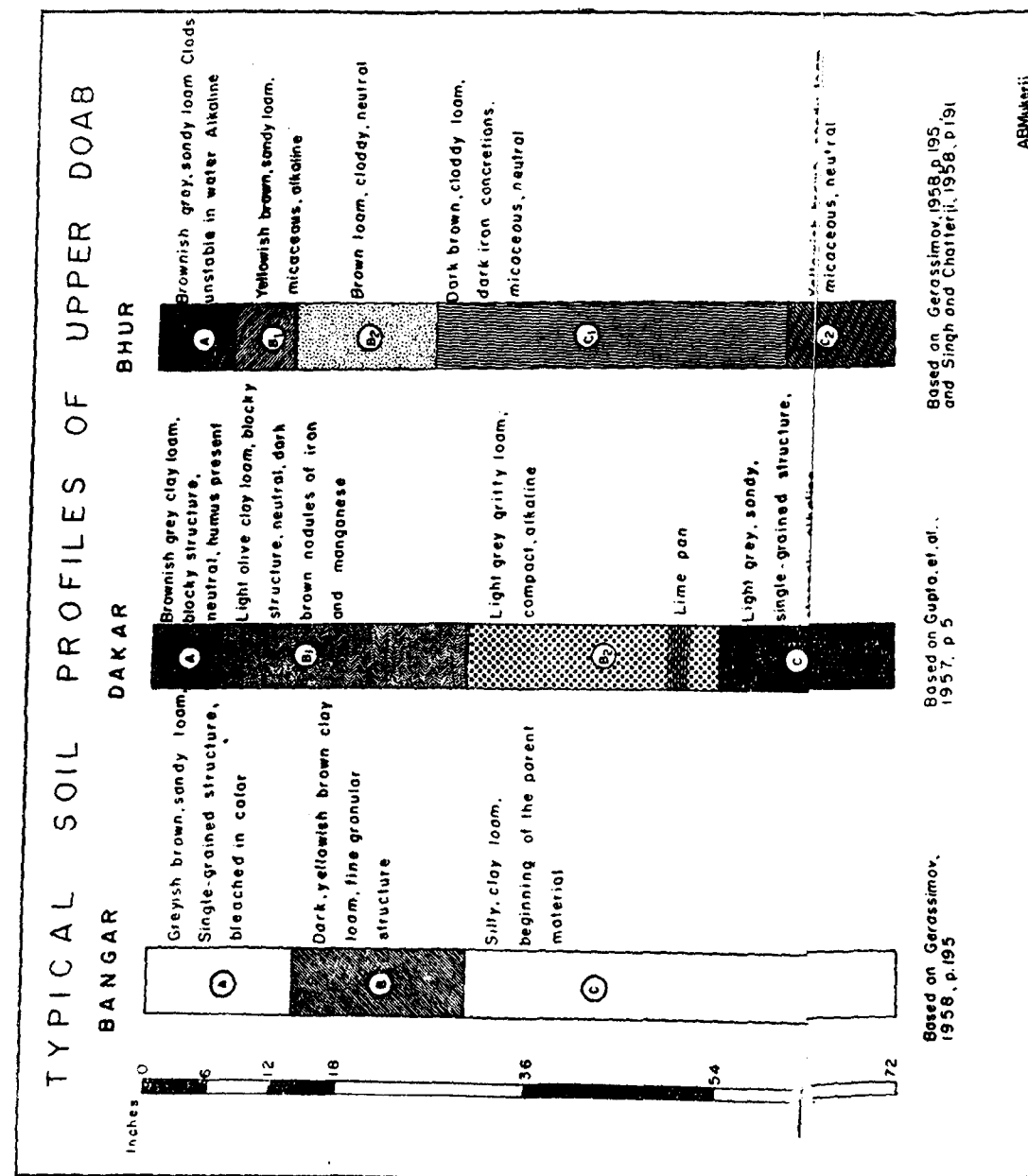


Fig. 3

PHURSUNGHI*

By

V. S. GANANATHAN,

Head of the Department of Geography, University of Poona.

INTRODUCTION:—

Urban facilities such as higher education, superior medical aid, variety of amusements, electricity, good drainage system and the like, while common enough in settlements of moderate population in the economically advanced countries of the world, are available only in settlements of large population (generally over 100,000) in India. In this country only such settlements provide enough number of people to pay for these facilities. Moreover, their municipal revenues are sufficiently high to provide these facilities. As a consequence these cities (urban settlements with population exceeding 100,000 each) have very strong urban pull over their individual umlands.

The smaller settlements in the umland of a city experience the urban pull to a greater or lesser extent depending on their distance from the city. So it is possible to speak of settlements in the immediate umland of a city as ones more strongly influenced by it. The definition of "immediate umland" has to be necessarily subjective at this stage of development of Urban Geography. It is, however, possible to say that the "immediate umland" would include settlements which can be in close touch with the city.

Even among the settlements in the immediate umland of a city, it is possible to think of two types. One type, because of location on the main road or rail-routes radiating from the city, is in daily contact with the city. The other type, because of less advantageous location, is not in such close contact with the city. For the sake of convenience the first type may be described as type 'A' and the second as type 'B'. It is generally observed that the cities expand by gradually swallowing the type A settlements. The shape of the city, therefore, is far from compact.

In the study of A and B type settlements in the immediate umland of a city, there are interesting features that represent the influence of the 'distance-time-cost' factor. The A type settlement, for example, contains features that are easily followed up to the nearby city; generally these features are not to be seen in the B type settlement. The small settlement of Phursunghi, about four miles from the periphery of urban Poona, contains many of these features that are characteristics of the A type settlement.

PHURSUNGHI:—

This settlement is located in the general west-east slope of the Maharashtra Upland; there is, however, a local dip toward NNEast leading on to the eastward flowing Mutha-Moola river. Through Phursunghi a small stream flows northwards to join the Mutha-Moola river, three miles north of the settlement.

* This paper was presented at the International Geographical Congress in Stockholm in August 1960. The paper was supported by suitable slides at the time of presentation. The abstract of this paper has appeared on page 91 of 'Abstracts of Papers, International Geographical Congress, Nordon 1960.'

Phursunghi is within two miles of the main Poona-Bangalore railroad and boasts of a small railway station bearing its name. In addition, it is within two miles of the main Poona-Sholapur road; a branch road connects it to the main road. The settlement is served by daily buses from Poona, two each way. The people of the settlement use the buses in preference to the railway. This is possibly due to the fact that the buses reach the heart of the settlement and are conveniently timed. The railway on the other hand, provides few local trains.

The whole area is part of the Deccan Trap region. Basalt appears at the surface at many places within the settlement. The small stream, already mentioned, hugs the settlement on its western side and has exposed the basalt both in its bed and its banks. Soils occur in varying thickness according to topographical variations. Soils are the typical black regur characteristic of this part of India.

Average maximum temperature is 99 to 100 degrees F. in the month of May, and the average minimum temperature is 50 to 51 degrees F. in the month of December. Diurnal ranges in temperature exceeding 25 degrees F. are quite common, particularly in the winter months. Total rainfall for the year is around 33 inches. The settlement enjoys a cool dry winter, a hot dry pre-monsoon period and a warm wet monsoon season. The stream flowing along the settlement is dry 3 to 4 months in the year. Three wells within the settlement provide a limited source of water during the hot dry season.

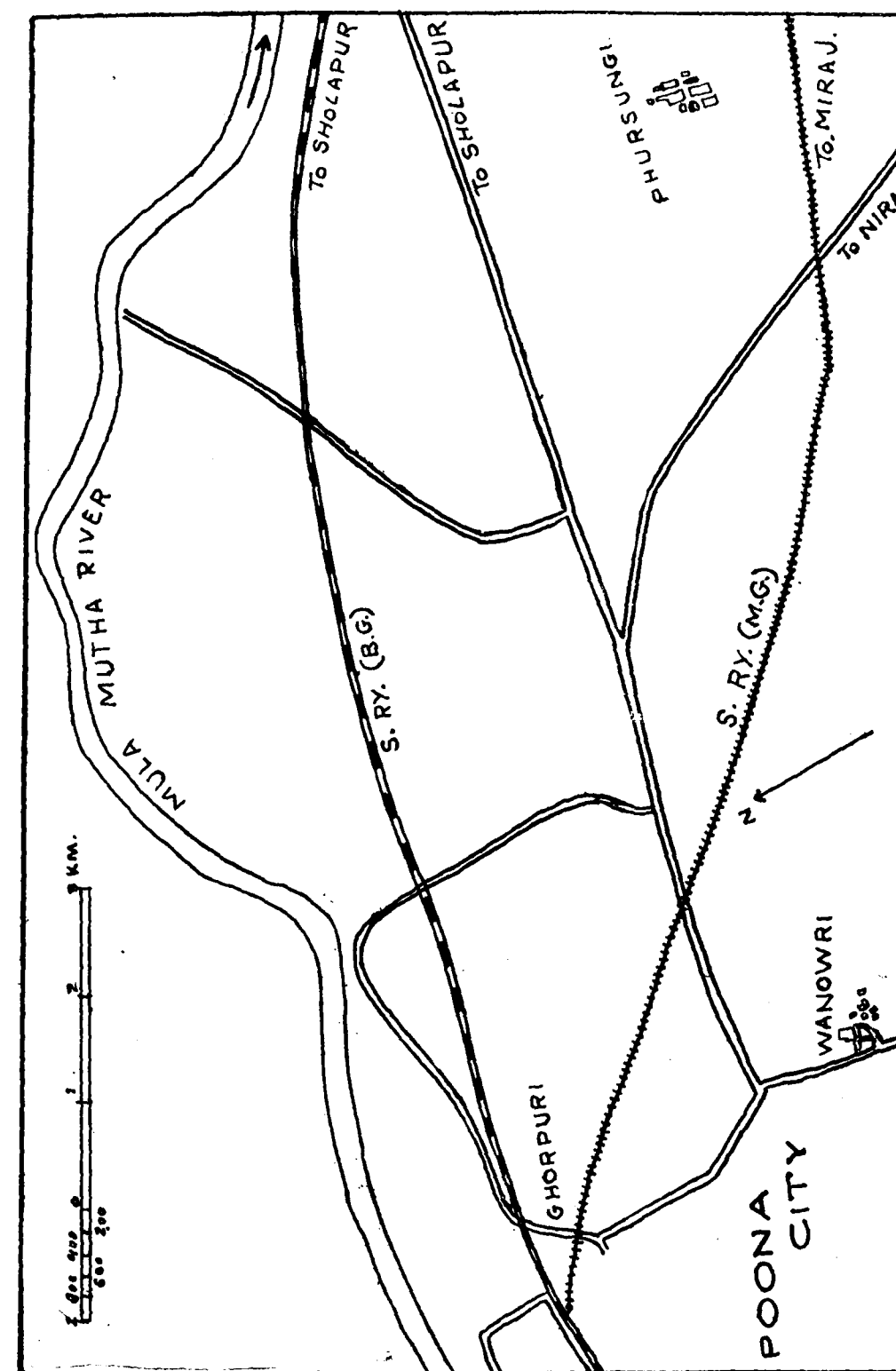
Phursunghi (with a present-day population of a little over 5,000) is an old settlement and was paying taxes to Jagirdar Khan Walsch Khan Fakheruddin in the 17th. century. Since that time, of Moslem dominance, it seems to have slowly swung over to the present day Hindu dominance. The mosque, set in a big compound, and several temples represent the cultural history of the settlement.

Its present-day economy is still largely agricultural. A variety of crops including wheat, paddy, jowar, gram, onion, and some seasonal green vegetables are produced in the land around the settlement. More than half the acreage under cultivation is rain-fed. About a fifth of the acreage is irrigated; 15% to 20% is used as pasture (refer table 1).

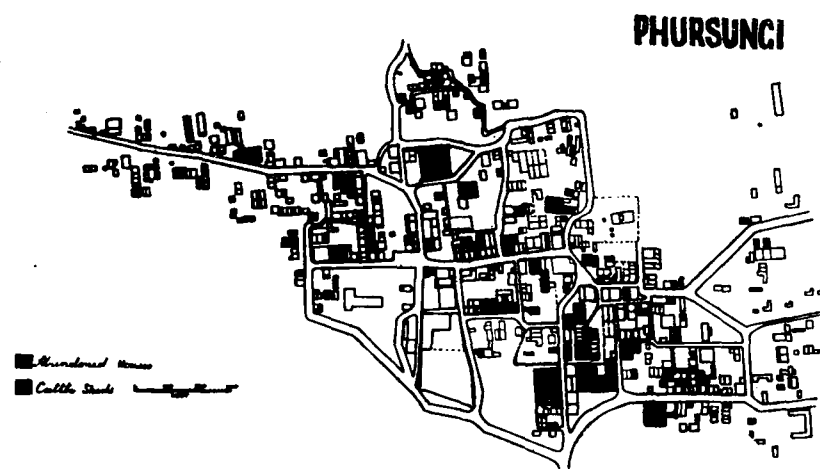
In spite of the predominantly agricultural complexion of its activities, it is worthwhile noting, a third of its wage-earners are occupied in non-agricultural occupations (refer table 2). Wages are low for those employed as labourers; they range from Rs. 1.25 to 50 nP. per day. Men get higher wages (Rs. 1 to 1.25) than women (50 nP. to 75 nP.)

The economy of the settlement is primarily oriented toward urban Poona. Agricultural products, including vegetables, go to Poona, some milk also goes to that city. Local market has very little to offer; everything is described as 'gone to Poona'. Many of the field products go directly to Poona; they are not even collected in the settlement before despatch to the nearby city.

Of the 654 built structures used for living-in, the ones actually inhabited number 518; eighty-seven are deserted and are in very bad shape. Even of the inhabited ones about 80% can be termed as third or fourth class only (refer table 4). These have no ventilation and are made up of mud-packed walls, with flat country type tiles for roofing. A little over half of



the abandoned houses may be described as abandoned by people who have migrated to urban Poona.



Apart from built structures used for living-in, there are those that serve the whole community; the school-building is the most recent one; the mosque and five Hindu temples are older and are in poorer shape: the four flour-mills are small structures. All these structures, particularly the long verandah of the school-building, are utilized by the people for sleeping at nights.

The settlement owns 408 bullock-carts, 405 bicycles, 2 tongas, 1 motor car and 1 motor cycle. The last two vehicles are owned by the Chief of the village, who represents in himself the most urbanised of the people here.

This is not a settlement that may be described as a victim of hard and restrictive environment. For eight months in the year there is no serious water scarcity; one stream and one canal supply water to lands coming within the jurisdiction of the settlement; in addition there are over 240 wells from which water is drawn up by the *mhote* system.

URBAN INFLUENCE ON PHURSUNGHI:—

The influence of the nearby city of Poona is seen in almost all aspects of the life of the people in this settlement.

It has already been noted that a third of the total number of earning members are occupied in the non-agricultural activities. These include locally employed persons like teachers, shopkeepers, carpenters, cobblers, masons, and the like, as well as ones employed in the nearby city of Poona. Approximately 5% to 7% of the earning members are employed in Poona or in activities serving that city. Most of these are the better paid wage-earners.

Since most of the products from the fields feed Poona, persons employed in agricultural activities may also be considered as serving Poona; then well over 70% of the earning members in the settlement are serving the city of Poona.

With regard to the occupational establishments within the settlement of Phursunghi one notes again considerable urban influence. The flour mills use oil-engines, which can be serviced only by the dealers in Poona. Two tailors use sewing-machines for which parts come from Poona.* Two of the occupational establishments are provision shops retailing consumer goods like washing soap, combs, pencils, note books, packets of tea and cigarettes, all purchased and brought over from Poona.

The tea-stalls, three in the settlement, are another type of establishment found generally only in such A type of rural settlement. Tea and light snacks are available here, and generally, people are found patronising these establishments both in the mornings and evenings. These are the rural counterparts to the city restaurants.

Among the structures built for use as houses, it has already been noted, 87 have been deserted. While part of this abandonment is not the result of migration to Poona, a good part however represents abandonment by people attracted to Poona. This itself represents the influence of the city nearby on the people of the settlement. It may also be noted that even among the inhabited houses, most are maintained in very poor shape; this is quite common in a village type of settlement; however, quite a few of these houses seem to be getting ready for abandonment and therefore are being maintained in a shabby condition. At the other extreme are a few houses that are distinctly superior for such a settlement; those houses have been given the urban touch.

The school and the flour mills represent built structures that have urban character. The school is the largest of the recently (within 10 years) built structures in the settlement. There are six large rooms with adjoining verandah; the building itself is 'L' shaped and the rooms are provided with three windows each, apart from one door. Such a structure for a school is found only in the A type rural settlements. The flour mills use oil-engines and are characteristic of the A type settlements.

One item in the property of the villagers, is some sort of a vehicle. In an average Indian village, a bullock-cart is a valued property. The people of Phursunghi own besides 408 bullock-carts 409 other vehicles that are largely characteristic of non-rural settlements. The very large number of bicycles (405) shows the extent of urban influence. It may be said that India is in the bicycle age as far as the A type rural settlements are concerned. Bicycles are still quite uncommon in the B type rural settlements. The two tongas, one motor car and one motor cycle may be described as truly urban feathers in Phursunghi's cap; such vehicles are uncommon even in the A type of rural settlements.

The maintenance of a motor car or motor cycle is possible in a rural settlement only if it happens to be very close to an urban one, where parts and services are available.

CONCLUSION —

Phursunghi, like other A type settlements in the immediate umlands of cities, benefits and suffers from the proximity to a large urban settlement. The benefits that Phursunghi has gained from proximity to Poona are seen in the following:—

* Most of the B type settlements have no tailors at all. Mending is done by hand; sewing-machines in regular tailoring establishments are not found there.

(a) Availability of medical aid from Poona; two physicians (both Homeopaths) visit this settlement twice a week each and gives some aid to the people. They bring the necessary drugs from Poona.

(b) Availability of current news through Marathi news-papers brought over from Poona. Not more than a dozen people purchase these news-papers; they however form the fountain heads of information to the local people. The tea-stalls provide the appropriate background to the dispersal of the latest news by these learned few. Invariably the enthusiastic listeners provide the cup of tea to the owner of the news-paper.

(c) Availability of the many conventionally used consumer goods; these include cheap stationery, lanterns, flash lights and cells, packets of cigarettes, washing soap and the like.

(d) The regular bus service between the settlement and Poona is another benefit derived by Phursunghi because of the proximity to Poona.

(e) The ready market for all its products in the nearby city of Poona is still another benefit; Phursunghi can convert its products into cash at Poona and purchase its requirements at Poona.

As against all these benefits, one must note, are some of the less desirable influences of the nearby city. Drinking tea and smoking cigarettes are not common in an average Indian village. In the B type rural settlements these are not easily procured. The nearness of Poona has resulted in considerable consumption of these two items.

What is far more undesirable is the 'inferiority complex' that has developed in the people of the settlement by contact with the city of Poona and its citizens. The people who take regular trips to Poona come back full of praise for the city and its achievements. As in other similar settlements, this has resulted in a general inferiority complex the village community has developed toward the city dwellers.

Unfortunately, the very appreciation of the wealth of Poona has not been followed up by practical efforts to improve conditions of living in the settlement. Thus the adequate drainage system, water supply and electricity of the nearby city are not found here. These would have been most desirable contributions from the nearby city; but these require considerable expenditure, normally far beyond the resources of a rural community. These benefits would come to Phursunghi when it is made another part of the expanding city of Poona; then the city would make available its resources for such benefits to the settlement. However, by then, Phursunghi would have lost its own personality; it would only be another part of the city of Poona.

TABLE I

Total area of the land coming under the jurisdiction of the settlement of Phursunghi : 5037 acres.

Nature of the land-use			
Under rain-fed agriculture	...	2727 acres	54% of total
Irrigated land	...	986 "	20% "
Pasture land	...	208 "	4% "
Waste lands	...	356 "	7% "
Reserved pastures	...	565 "	11% "
Buildings, roads etc.	...	195 "	4% "

TABLE II

Out of a total of 751 earning members in the settlement the occupational distribution is as follows :

Agriculture (in own field)	...	254 persons	33.5% of total
Agriculture (in own field and as labour in others)	...	156 "	20% "
Agriculture (labour only)	...	105 "	14% "
Industrial labour	...	37 "	5% "
Service (teacher accountant)	...	34 "	5% "
Business (shop-keeper etc.)	...	21 "	3% "
Productive labour (carpenter, cobbler, mason etc.)	...	75 "	10% "
Other occupations	...	69 "	9.5% "

TABLE III

Income groups of families (data could be obtained for only 331 houses)

Medium (over Rs. 600 per annum)	...	10 families	2% of total
Low (Rs. 200 to 600 per annum)	...	119 "	36% "
Very Low (below Rs 200 per annum)	...	202 "	62% "

TABLE IV

Of the 518 inhabited houses :

Better types (approx : value in excess of Rs. 2000/-) 1 only (school)	
Medium types (assessed value Rs. 1000-2000)	... 19% of total
Poor types (" " Rs. 500-1000)	... 38% "
Very poor types (" " below Rs. 500)	... 43% "

TABLE V

Total number of vehicles owned in the settlement :

Bullock carts 408 ;	Bicycles 405 ;	Tongas 2 ;
Motor car 1 ;	Motor Cycle 1 ;	

TABLE VI

Other features :

School 1 ;	Temples or Mandirs 5 ;	Mosque 1 ;	Wells 243 ;	Flour Mills 4.
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FOREST RESOURCES OF KUMAON*

By

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The natural vegetation of Kumaon is essentially arboreal, excepting of course, in areas having high peaks and steep barren slopes. It is, therefore, not surprising for agriculturally sub-marginal and industrially backward Kumaon to have a rich variety in forests.

According to policy statement of the Government of India¹, 30% of the total land area in the plains and about 60% in the Himalayan and other mountainous tracts is necessary as an insurance against denudation. In India, whereas, Assam, Madhya Pradesh, and Maharashtra states are well placed in respect of forest area, Uttar Pradesh, Panjab and Bihar are among the worst placed. The forest area in U.P. is about 11% of the total area of the state and this meagre percentage is also very unevenly distributed. Chief forest areas of U.P. lie in the Himalayan region. Kumaon is an important forest region of U.P. as is evident from the following table:

TABLE I—FOREST AREA IN KUMAON AND GARHWALS.

Sl. No.	District	Total Forest area in square miles	Total area in square miles	Percent of Forest area to total land area
1.	Naini Tal	1,834	2,721	67%
2.	Almora	1,232	5,389	23%
Total for Kumaon		3,066	8,110	37.8%
3.	Pauri Garhwal	2,516	5,612	45%
4.	Tehri Garhwal	3,639	4,530	80%
Total for Kumaon and Uttarakhand Civil Divisions		9,221	18,252	50.2%

From Table No. 1 it becomes clear that even Kumaon, an area having extensive forests, falls short of the requirements laid down by the Govt. of India's policy statement. The percentage has gone down because of the meagre forest area of Almora district. The position of Naini Tal is however somewhat better.

NATURAL VEGETATION TYPES:—

Following types are observed in Kumaon:

1. Savanna type of vegetation occurring in *Terai*.

*Kumaon has been used here in the restricted sense. It denotes *Kumaoni* speaking districts of U.P. i.e., Old Almora District (including newly created Pithoragarh district) and Naini Tal district.

1. Howard, Sir H.,—*Post War Forest Policy for India*, 1944.

2. Forests of *Terai* and *Bhabar* that are found throughout Kumaon hills to about 6000 feet on southern aspects and 5000 feet on the northern aspects, that is, where the climate is tropical or sub-tropical and the mean minimum temperatures do not fall below 70°F. This could further be subdivided into two major groups:

- (a) Forests of broad leaved species upto about 4000 ft. elevation where forests are absent or light and snow practically unknown. In this group the following sub-types occur:
 - (i) Deciduous riverain forests which follow the banks of the principal rivers upto about 2000 feet elevation.
 - (ii) Deciduous forests of miscellaneous species in the *Bhabar*.
 - (iii) Sub-deciduous forests of *Sal* in the sub-Himalayan tract and outermost hill ranges upto about 2500 ft. elevation.
 - (iv) Evergreen forests of *Eugenia Jambolena* (*Jamun*) and other miscellaneous species in the sub-Himalayan tract and along the banks of the streams in the outer ranges upto about 2,500 ft. elevation.
 - (v) Deciduous forests of *Anogeissus* (*Bankli*) and other miscellaneous species occurring in the central (Lesser) and outer Himalayas upto about 4000 feet elevation.
- (b) Forests of *Chir* occurring between 3000 and 7000 feet elevation where frosts are often severe and snow fall is frequent.

3. Oak and low level Silver Fir forests occurring throughout the hills between 5,000 and 11,000 feet elevation, where the climate is temperate and mean maximum temperature does not rise above 70°F. This group includes the following types:

- (i) *Benj* Oak forests between 6,000' and 8,000' elevation.
 - (ii) *Moru* Oak forests occurring between 6,500' and 9,000 feet elevation.
 - (iii) *Karshu* Oak forests occurring between 7,500' and 11,000 feet elevation.
 - (v) Low level silver fir forests occurring between 8,000' and 9,500'.
4. Alpine forests where annual precipitation varies between 10 and 40 inches. This group includes:
- (i) Blue pine forests between 6,000' and 12,000 feet elevation.
 - (ii) Spruce forests between 7,000' and 10,000 feet elevation.
 - (iii) Cypress forests between 6,500' and 9,500 feet elevation.
 - (iv) Deodar forests between 8,000' and 10,000 feet elevation.
 - (v) Forests of mixed hardwoods occurring between 7,000' and 9,000 feet.
 - (vi) High level birch forests between 9,500' and 12,000 feet.
 - (vii) High level silver fir forests between 9,500 and 12,000 feet.

5. Bushland includes:

- (i) Alpine bushland occurring between 10,000 feet and snowline.
- (ii) Bushland lying within a narrow belt in the northern parts of Almora district (Darma and Johar Parganas) bordering Tibet where the annual precipitation is below 10 inches. It includes:
 - (a) Riverside bushland between 11,000' and 15,000 feet elevation.
 - (b) Hillside bushland between 9,000' and 15,000 feet elevation.

A.—SAVANNAH TYPE OF VEGETATION IN TARAI:—

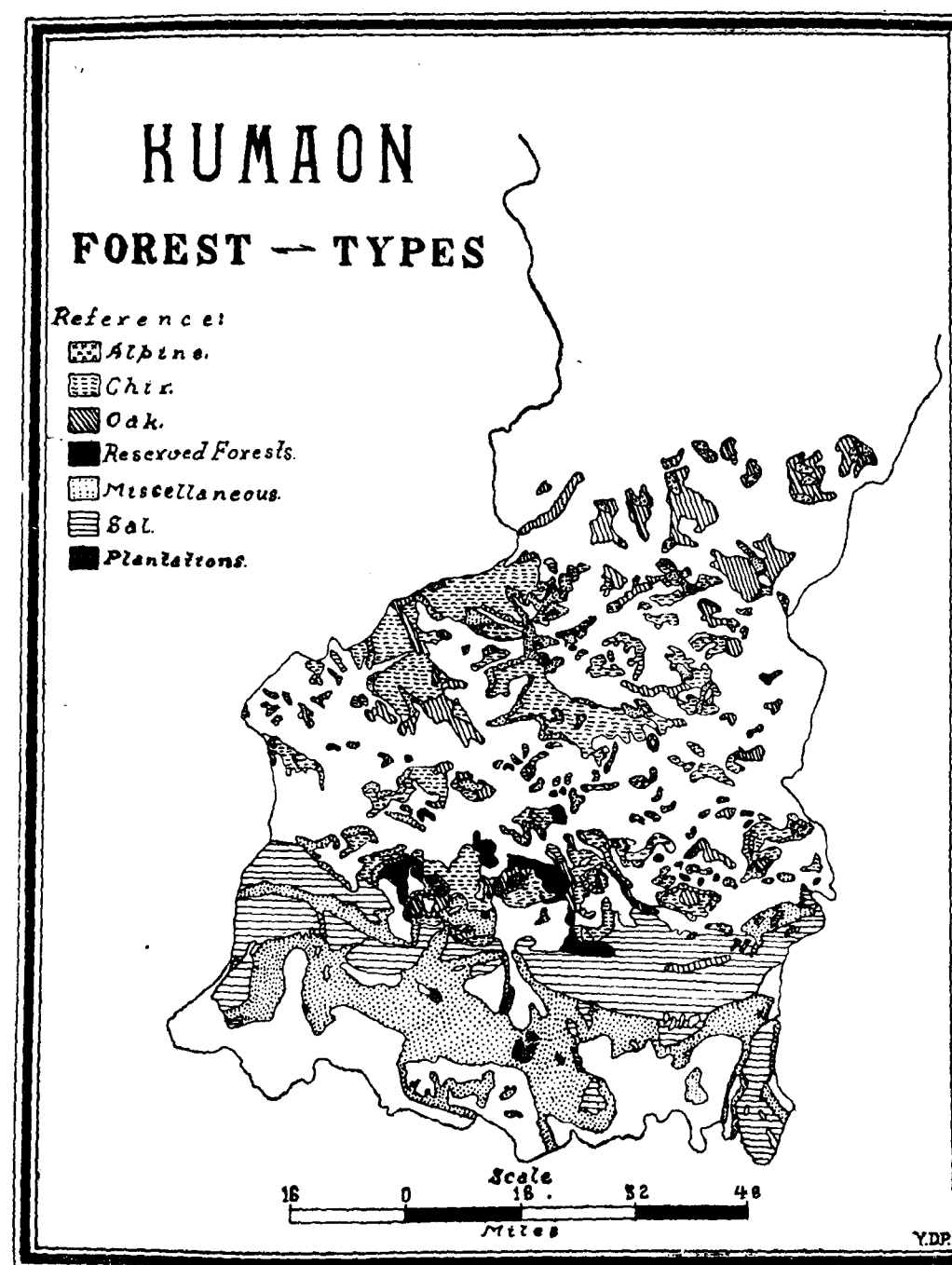
In this type are included bamboos and indigenous grasses not the exclusive claim of *tarai*; they occur in *Bhabar* as well. Moreover, they are not always of very good quality in *tarai*, more appearing as undergrowth and comes from Ramnagar forest division of Naini Tal district (i.e., *Bhabar*). Similarly grasses of better quality come from the foothill region. Some of these *Baib*, *muni*, and *Ulls* have proved their utility for paper making. The use of the word 'Savannah' is not appropriate because typical savanna vegetation does not occur in *tarai*.

B.—DECIDUOUS RIVERINE FORESTS:—

Most important trees of this group are *Sissu* (*Dalbergia sissoo*), *Khair* (*Acacia Catechu*) and *Kanju* (*Holoptelea integrifolia*). Both *sissu* and *khair* occur extensively on sandy and gravelly deposits bordering the rivers and streams of sub-Himalayan tracts. Such newly formed soils may be colonised in the beginning by grasses like *Kans* and *muni*, but the "climatic climax" is for *sissu* and *khair* which occur in these regions without the intervention of any preparatory type of vegetation. One of the characteristic features of these forests is the absence of other tree species and though *sissu* and *khair* are often found mixed, this too is rather the exception than the rule. That they are not more frequently found mixed is probably due to the heavier seeds of *khair* being deposited where there is too much current for the lighter seeds of *sissu* to come to rest. When occurring mixed, *sissu* soon outstrips the *khair* owing to its more rapid growth and greater height.

C.—MISCELLANEOUS DECIDUOUS FORESTS OF THE BHABAR:—

Flanking riverain forests are miscellaneous deciduous forests, the latter occurring distinctly on raised terraces of steplike character. These steplike features become more pronounced the nearer they are to the base of the outer hills, constituting the typical *Bhabar* deposit. As a result of their composition and origin, these deposits are characterised by a high degree of porosity combined with deep water level, and this insufficiency of water is reflected in the nature of the forest. Other factors which have had considerable influence on the development and composition of these forests are grazing, lopping and burning. Reckless grazing in winter by migrating *Kumaonis* especially near the foothills (as in Haldwani Forest Division) resulted in the destruction of these forests. Clearance was also resorted to for cold weather cultivation by migrating *Kumaonis* from times immemorial, though it has been considerably checked recently. Colonisation schemes of



the State Government after Independence have also led to the destruction of these forests. Man has, thus exerted great influence on these forests, and the natural density is often much reduced whilst in some cases land has reverted to grass or reeds (*Andropogon muricatus*).

Most commonly found trees in these forests are *Semal*, *Haldu*, *Dhauri*, *Amaltas*, *Dudhi*, and undergrowths like *Ber*, *Kathber* and *Rohini* shrub. *Semal* and *Haldu* trees are often towering head and shoulders above all other species.

D.—FORESTS OF SAL (*Shorea robusta*):—

Sal forms extensive forests and is highly gregarious. Where other factors are favourable, the upper limit of *Sal* is regulated to a great extent by frost. In excessively dry localities, such as due south aspects, it gives way to more xerophytic species. It is unable to compete with evergreen species in localities with any tendency to waterlogging. Three types of *Sal* forests are to be found: Hill *sal*, *Bhabar sal*, and *Tarai sal* forests.

Grasses appear in abundance in all types of *sal* forest, wherever sufficient light reaches the ground. In most *sal* forests of whatever type, *sal* comprises 80 to 90 percent of the dominant tree species and tends to form a dense tree canopy. That the virgin *sal* forests contained a much higher percentage of miscellaneous species than our present forests cannot be doubted. Forest administration of the Government of Uttar Pradesh annually spends large sums in eliminating comparatively worthless undergrowth and tree species, and with the efforts of man, balance of nature is now heavily weighted in favour of *sal* and a few other valuable timbers.

Hill Sal:—*Sal* does not extend beyond the outer ranges even though the main river valleys of the central ranges are well below the maximum elevation at which this species will grow. In the outer hills it is commonly found upto 2,500 feet elevation on south aspects and 3,500 feet on north. Within these altitudinal limits the driest south slopes are usually occupied by *Bakli* and other deciduous trees whilst along shady ravines on north aspects, the *sal* gives place to a mixed evergreen and deciduous forest in which *Sain* (*Terminalis tomentosa*), *Tun* (*Cedrela toona*) and *Jamun* are seldom absent. Rocks underlying these forests are almost invariably Nahan limestone. Owing to the shallowness and dryness of soil, growth of *sal* in the hills is poor. In the western part of the region (in Ramnagar), due to moderate slopes, forests bear a closer resemblance to the *Bhabar* than the Hill type. This is due to the nature of the sub-soil.

Bhabar Sal:—Descending to *Bhabar*, we find *sal* occupying high river terraces of the *Bhabar* proper as well as the most ancient *Bhabar* deposits of Kota Dun. The *sal* in these tracts may be regarded as the climatic climax to a succession of forest communities commencing with riverine and passing through the miscellaneous types already described. The soil is usually a moist loam overlying extensive beds of sand, river gravel, and boulders. The permanent water table is at a depth, but highly permeable sub-soil usually ensures a considerable degree of moisture in the upper layers. The undergrowth in these forests is dense and is composed to a large extent of *Koru* (*Clerodendron infortunatum*), which grows gregariously over large areas.

Tarai Sal:—In *Tarai sal* is usually confined to ground which is usually slightly raised above the level of swamps and waterlogged *chaors*

(flat, grassy areas). In *Tarai*, the water table is never far below the surface and excessive moisture and inferior aeration have produced a far poorer type of *sal* as compared to that of *Bhabar*. On high river banks (*damars*) and in their vicinity, the sub-soil is usually sandy with little or no indication of gravel or boulders; but in some cases the strata changes to clay and then the soil becomes still less favourable to *sal*. The grassy *chaors* which intersect the *sal* forests of *Tarai* are often extensive. They are frequently a little below the *sal* forest level, a drop of two or three feet being sufficient in some cases to change the forest into grassland.

E.—EVERGREEN FORESTS IN SWAMPS AND MOIST LOCALITIES:—

Forests of this type are of limited extent and occur for the most part along the banks of *Tarai* streams and to a much more limited extent along the banks of streams in the outer ranges upto 2,500 feet elevation. In the latter case evergreen forest is restricted to a narrow belt sometimes only a few feet wide on either side of the stream. In *Tarai*, the belt is often much wider and under exceptionally favourable conditions may extend 100 yards from either bank. These evergreen forests may be subdivided into a swamp type, a moist miscellaneous type, and the type bordering the banks of rivers in the hills. These types are, however, essentially one and differ only in that there is a greater excess of water in the swamp type which is therefore slightly more evergreen in character than the other two. *Gutel* (*Trewia nudiflora*), *Gular* (*Ficus Glomerata*), *Jamun* and to a less extent *Tun* are the trees commonly found in these forests. Dense undergrowth of evergreen shrubs is usually found in these forests. Grasses are normally absent but there may be found an abundance of ferns.

F.—MISCELLANEOUS DECIDUOUS FORESTS AT LOW ELEVATIONS IN THE HILLS:—

These forests are found throughout the central and outer hill ranges upto about 4,000 feet elevation, above which they usually give place to *chir* pine. They occur on all aspects and, therefore, differ much in composition. The slopes are frequently steep and always well drained, whilst the soil is usually shallow. In *Bhabar* well drained soils combined with higher temperatures provide more favourable conditions for these forests. The trees are mostly deciduous being leafless or nearly so during the hot weather. The only tree found gregariously over large areas is *Bakli* (*Anogeissus latifolia*); such gregarious forests are restricted to the south aspects of Naini Tal district. A characteristic of all these forests is their poor height, 50' being seldom exceeded. Common trees in addition to *Bakli* are *Sain* (*Terminalia tomentosa*), *Koiral* (*Bahunia variegata*), *Kanola* (*Bahunia retusa*) etc.

G.—FORESTS OF CHIR (*Pinus longifolia*):—

These forests ordinarily extend on south aspects from 3,500' to 7,000 feet and on north aspects from 3,000' to 6,500 feet elevation. *Chir* is found on almost all geological formations which occur within this region, though on certain southern slopes with a limestone subsoil, it is unable to exist on account of the dryness of the soil combined with relatively high temperatures. Nevertheless *chir* forests can establish themselves on dry southern aspects, where owing to xerophytic conditions and the prevalence of fires, few other tree or shrub species survive. In all *chir* forests, the pine is the dominant tree, and it is not unusual to find it the only tree species present,

though on north aspects where there is more moisture in the soil and fires are less destructive, scattered trees of other species may occur. *Chir* forests are seldom very dense. The ground is covered with grasses, sometimes dense, whatever the aspect or density of overhead canopy, and there is also a discontinuous undergrowth of shrubs often so widely scattered that even from a short distance their presence is scarcely noticeable.

The open nature of these forests, absence of other tree species and the poverty of undergrowth are partly attributable to fires which have in the past swept annually throughout their length and breadth, and partly to xerophytic conditions under which they grow and partly to the fact that the *chir* is often closely associated with cultivation zone and its attendant heavy lopping and felling.

Towards its lower limit *Chir* passes insensibly into the forest of mixed miscellaneous species and less frequently into *sal* forest direct. Towards its upper limit and in moist and shady ravines the *chir* gradually gives place to *banj*.

H.—FORESTS OF BANJ (*Quercus incana*):—

The three principal oaks are *Banj*, *Moru*, *Karshu* and each occupies a more or less distinct altitudinal zone in Kumaon. Before proceeding to a special account of each oak type, the following facts which apply to all are of special interest. The soil is usually moist though due south aspects often form marked exceptions and there is a high degree of atmospheric humidity throughout the monsoon period irrespective of aspect. The effect of this is seen in the characteristic manner in which the trees are draped in a rich epiphytic flora of mosses, ferns and lichens. Fires have passed through the forests situated on south aspects at intervals of few years and considerably influenced their density. On northern aspects fires have been much less frequent and their influence has not been a factor of great importance. On the other hand, influence of man on these forests has been great. All the oaks are good fodder and continuous unregulated lopping has converted or is still converting more accessible forests into scrub. In all the oak and silver fir (to be discussed later) forests, there is usually a more or less extensive cover of herbaceous plants which die after the rains.

Banj is ordinarily found between 6,000' and 8,000 feet elevation, but it also occupies moister ravines running down into *chir* zone where it often reaches as low an elevation as 3,500 feet. A notable feature of this species is its capacity to establish itself on the most unfavourable south aspects; but, whilst, these forests are always very open, those on north aspects are usually dense. In the former case the ground is almost invariably clothed with dense grass, which on northern aspects may be almost absent. The *Banj* forests have a large number of shrubs associated with it.

I.—FORESTS OF MORU (*Quercus dilatata*):—

Moru forests are found from 6,500' to 9,000 feet elevation occupying an intermediate zone between *Banj* and *Karshu*; but whereas the two latter form extensive forests on south aspects, the *moru* only occurs sporadically in such localities. It attains its maximum development at elevations between 7,000' and 8,000 feet on deep moist soils and especially where subsoil is limestone. On account of the density of growth and prevailing moist conditions fires only penetrate in exceptional years. There are usually a few scattered trees of other species competing with *moru* for dominance, the commonest of which are *Bani* and *Karshu*.

J.—FORESTS OF KARSHU (*Quercus semecaroifolia*):—

The *Karshu* occupies the highest zone amongst oaks, and these forests are found between 7,500' and 11,500 feet over very extensive tracts. It is found equally on north and south aspects, and in the extensive areas occupied by this type of forests the *Karshu* has few successful competitors, excepting *Silver fir* and *Moru*. The fir, however, only occurs on a small fraction of the area occupied by *Karshu* and *moru* can only compete with success on north aspects towards the lower limit of *Karshu*. At its lower limit it often passes into *Banj* forests though on due north aspects it frequently gives place to *Moru*, spruce or silver fir. At its upper limit it passes into forests of birch and silver fir, though on southern slopes it more frequently passes directly into pastureland, the passage being always abrupt without any gradual transition. Typical *Karshu* forests are dense, the most common accomplice being *Burans* (*Rhododendron arboreum*) which is almost as abundant in the *Karshu* forests as it was 3,000 feet lower in the *Banj*. Shrubs occur in great variety but some of the commonest are *Rosa sericea* and *Titmela* (*Viburnum foliolosum*).

K.—FORESTS OF LOW LEVEL SILVER FIR (*Abies Pindrow*):—

The low level silver fir is found between 7,000' and 10,500 feet elevation and forms continuous forests between 8,000' and 9,500 feet. The only wide occurrence of this species on the outer Himalayan ranges of the region is a small community at Debthal about 15 miles east of Naini Tal. There is also an outlier in the Thali reserve of East Almora. With these two exceptions, it is restricted to the higher central ranges and the great Himalayan range itself. Wherever silver fir occurs it is the dominant species excepting when it occurs mixed with spruce; in the latter case it is conjointly dominant. It is exceptional to find a forest in which silver fir trees are sufficiently dense for their crowns to be actually in contact. This however does not imply that the ground is incompletely covered. In the forests lying to the south of the great Himalayan range the second story is most frequently composed of either *Karshu* or *Moru*, but north of it oaks disappear and their place is taken by a mixture of broad leaved deciduous species, the commonest of which is *Pangar* (*Aesculus indica*).

L.—FORESTS OF BLUE PINE (*Pinus excelea*):—

Fairly extensive forests of blue pine exist beyond the great Himalayan range within the drainage basins of various rivers, whilst to the south of it only small patches of this forest occur almost invariably on limestone. This species is not found in valleys immediately east of river Findar, but reappears in the Dhaulik and Kali valleys. Its range of altitude is very variable and is dependent on snowfall. The outlying patches south of the great range are found between 6,000' and 8,500 feet; immediately north of the great range between 6,500' and 10,000 feet, whilst in still drier tracts around Malari and Untadhura it is found between 10,000' and 12,000 ft. Immediately north of the great range the principal tree associates vary with elevation. Thus between 6,500' and 7,500 feet cypress and *deodar* are often present, from 7,500' to 9,000 feet spruce, from 8,500 feet low level silver fir (*Abies Pindrow*) and from 9,500' to 10,000 feet high level silver fir (*Abies Webbiana*). Forests of blue pine usually pass into birch or high level silver fir at their upper limit and into *deodar* or cypress at their lower. Dense crops are quite exceptional owing to disastrous fires which occasionally sweep through the areas.

M.—FORESTS OF SPRUCE (*Picea Morinda*):—

On a widespread scale spruce is not found east of Garhwal district and, as in case of blue pine, such forests as occur south of the great range are usually found on limestone soils, or in localities where rainfall is below the average for the surrounding parts. Here they are usually restricted to elevations between 7,000' and 9,000 feet though to the north of the great range they reach 10,000 feet. Exclusive spruce forest patches are restricted entirely to the north or northerly aspects. To the south it occurs in various combinations usually associated with *Karshu* or *Moru*, whilst north of the great range, the principal associates are *Abies Pindrow* and *Pinus Excelsa*. Forests of spruce mixed with broad leaved deciduous species e.g., Pangar (*Aesculus indica*) and *Acer coesium*, also occupy wide areas and are a marked feature of the landscape, since tall conifers stand out like sentinels towering high above the broad leaved trees.

N.—FORESTS OF CYPRESS (*Cupressus torulosa*):—

Cypress forests occur south of the great Himalayan range as well as to the north, but in the former case in only small and scattered patches and then invariably on a limestone soil on account of its relative dryness. That lime is not in any way necessary to cypress is shown by the fact that in the drier climate to the north of the great range it grows freely on soils having quartzite and gneiss as parent rocks. These forests are found between 6,500' and 9,500 feet. It is capable of growing on rocky precipitous slopes with little soil, though in such situations its growth is always stunted and trees are scattered. Cypress is extremely susceptible to fire and it is this susceptibility than any other cause which has driven it to cling to steep rocky precipices and to shun all grassy areas. Exceptions occur in cases of few isolated patches south of the great range in which a deep soil favours a dense growth of associated species which, by reaching naturally moist conditions, create a barrier to the advance of fire. Forests as occur to the south of the great range are often associated with *Moru*, whilst to the north of the great range the principal tree associates are blue pine and deodar.

O.—FORESTS OF DEODAR (*Cedrus Deodara*):—

On the southern slopes of the great Himalayan range deodar occurs sporadically associated with blue pine and cypress. North of the great range it is found within river basins where it forms more or less pure forests between 8,000' and 10,000 feet. The forests are open and trees do not attain great height. On high elevations of central and outer Himalayan ranges (e.g., in Naini Tal), we also find deodar patches.

P.—FORESTS OF MIXED HARDWOODS:—

These forests are to be found to the south to the great range as well as to the north. Forests of this type seldom occur over large continuous areas, and seem to demand fairly deep and moist soil. The tree species are all deciduous and are found mixed.

Q.—FORESTS OF BIRCH (*Betula Utilis*):—

These forests are characteristic of the tracts lying to the north of the great Himalayan range though narrow strips of these forests are also found on north-west aspects to the south of the great range. It is usually found between 9,500' and 11,500 ft. elevation though in the area of lighter snowfall to the north of the great range it is found upto 12,000 feet.

R.—FORESTS OF HIGH LEVEL SILVER FIR (*Abies Webbiana*):—

High level silver fir never forms a continuous forest covering large areas; on the contrary it tends to occur in small patches in company with *Karshu* and birch, chiefly birch. It is practically never found on a due south aspect. To the north of the great range, it is found between 9,500, and 11,000 feet and may extend upto 12,500 feet.

S.—ALPINE BUSHLAND:—

Above the birch and silver fir forests there is often a gradual transition through xerophytic bushland into alpine pasture. The species composing this bushland are also found in open places at lower elevations where less favourable conditions prevent the formation of tree forest. Thus the lower altitudinal limits of such shrubby growth correspond roughly with those of birch forest though the upper limit extends above the birch to 13,500 feet. The bushy growth we are now considering is discontinuous in the sense that it occurs in more or less isolated patches varying in extent from a few square yards upto 100 acres. It attains its greatest development on north aspects. The terrain is often steep and strewn with boulders and is frequently intersected by rocky precipices. The largest of the species are *Rhododendron campanulatum* and *Pyrus folioloss* which also form the largest individual patches of growth.

T.—RIVERSIDE BUSHLAND:—

This type of bushland found growing along the well watered banks of streams at high elevations is composed of *Salix hastata* and *Salix selerophylla* shrubs and occupies a small area the former attaining a height of 8 feet and the latter only 4 feet.

U.—HILLSIDE BUSHLAND:—

The shrubs comprising this type of bushland are all 5' high and mostly under 2 feet. The principal species are *Artemisia maritima*, *Caragana Gerardiana*, *Hippophale Rhamnoides* and Junipers.

In conclusion, we can sum up the vertical distribution of natural vegetation of Kumaon thus:³

	15,000'	Upper limit of hillside bushland
	14,000'	Upper limit of riverside bushland
	13,500'	Upper limit of Alpine bushland
Upper limit of high level silver fir	12,500'	
Upper limit of blue pine, birch	12,000'	
Upper limit of <i>Karshu</i>	11,000'	Lower limit of riverside bushland
Upper limit of spruce, <i>deodar</i>	10,000'	Lower limit of Alpine bushland.
Upper limit of low level silver fir, cypress; lower limit of birch, high level silver fir;	9,500'	

³ The idea of summing up the vertical distribution has been taken from Spate O.H.K. India and Pakistan, 1954.

Upper limit of mixed hardwood	9,000'	Lower limit of hillside bushland
Upper limit of <i>Banj</i> , and <i>Moru</i> ; lower limit of low level silver fir, <i>deodar</i>	8,000'	
Lower limit of <i>Karshu</i>	7,500'	
Upper limit of <i>Pinus Longifolia</i> ; lower limit of <i>Moru</i> , spruce and mixed hardwoods	7,000'	
Lower limit of cypress	6,500'	
Lower limit of <i>Banj</i> , blue pine (north aspect)	6,000'	
Lower limit of oaks	5,000'	
Upper limit of deciduous <i>Bakil</i>	4,000'	
Lower limit of <i>Pinus Longifolia</i>	3,000'	
Upper limit of hill <i>sal</i> , Evergreens <i>Jamun</i> and others	2,500'	
Upper limit of deciduous forests riverine, miscellaneous <i>Bhabar</i> forests, <i>Tarai</i> & <i>Bhabar sal</i> , certain evergreens	2,000'	
	1,000'	
<i>Tarai sal</i>	650'	<i>Tarai</i> savanna type vegetation

FOREST PRODUCTS:—

Forests play an important part in the economic life of Kumaon, as suppliers of edibles and raw materials, as creators of a varied type of employment for the people, as suppliers of the requirements of a pastoral and agricultural community and as a factor affecting climate and soil. In its forests Kumaon has an accumulation of capital, some of which is being worked out but much of it is locked up and is deteriorating, for forest wealth is perishable and requires the vigilance and efforts of man to steal a march over nature by a full use of their productive capacity before nature's forces of destruction have their full and uncontrollable say.

Forest produce is classified as major and minor. Major produce consists of timber and fuel and the minor produce consists of: bamboo, grass, leaves for fodder, litter and manure, fibres, oils, tans and dyes, gums, resin, medicinal herbs, edible fruits and animal products such as honey, wax, horns, hides, etc.

Exploitation of forest produce in Kumaon is carried on in two ways, viz., by the state forest department itself and by the contractors or concessionists. In the former case, the forest department itself carries out all the operations of felling, extraction, collection, and transporting the material to sale depots, while in the latter case contractors and consumers extract and collect produce and pay the purchase price or royalty to the forest department.

MAJOR FOREST PRODUCE:—

Lumbering:—The total outturn of timber from the forests of Kumaon in 1956-57 was 2,73,28,243 cubic feet of sawn timber. There was a sudden increase in the exploitation of timber during the second world war; the peak year was 1942-43, percentage increase from the year 1939-40 being 73. Taking the average of 1939-40 to 1944-45, the average annual outturn comes to 76.91 lakhs cubic feet. In the following years of peace (ending 1956-57) the average output fell to 51.61 lakhs cubic feet.

Timber is removed in the form of logs, beams, sleepers, rafters, scantlings and planks. Timber most in demand is *sal*, though *chir* is the second largest in demand, and others like *haldu*, *shisham*, *khair*, *sandan*, *deodar*, *tun* etc., follow suit.

Semal, fir, *kail* trees are in great demand by the match companies and trees are sold in lots. The Bobbin factory at Bareilly uses *haldu*, *maurang*, *kanju*, and *dhuri* wood derived from Kumaoni forests for the manufacture of bobbins for the textile industry of India. The Western India Match Company at the same place consumes large quantities of *semal*, and fir wood for match manufacture. There are also saw mills at Lalkua, Ramnagar, Tanakpur, Haldwani and Bareilly leading to the manufacture of packing cases and furniture.

In handling vast and heavy forest products the problem of transport is very serious. Sleepers, logs etc., are brought down from the forests to streams by slides or by manual labour. Generally speaking in the eastern part they are brought there by the middle of April and then railed from Tanakpur. Tanakpur has thus developed as an important forest depot. Other important forest depots in Kumaon are at Ramnagar, Kathgodam-Haldwani, and Lalkua, from where forest produce is sent to various cities of U.P., Madhya Pradesh and Rajasthan. Extension of railhead to Tanakpur is credited to timber and resin industry.

Fuel:—Most of the fuel derived from forests is consumed locally though part of it is exported to Bareilly and neighbouring districts in the plains. The outturn of fuel comprising firewood and charcoal wood in 1956-57 was 304.75 lakhs cubic feet. This outturn has remained more or less the same in the last decade; slight variations are due to fluctuations in the local demand.

NEED FOR CONSERVATION:—

Kumaon is being exploited to the extent of 274 lakhs cubic feet of sawn timber and 305 lakhs cubic feet of firewood and charcoal-wood. The most unfortunate part of it is that the forests are not being replenished at the rate they are being cut. Most accessible ones were ravaged during the war and the process is going on unabated; furthermore inaccessible areas are deteriorating because of natural hazards.

In the present state of development, forests may well be called the only capital of Kumaon, and the forest officers should leave no stone unturned in building up this capital by making good the depletion so caused, by means of afforestation, all the same making existing ones capable of giving the highest possible returns. But this has not been the case - debit side is far exceeding the credit side. The pressure on Kumaon forests can be reduced if more lands in plains are brought under forests adequate enough to meet local demands. Clutterbuck aptly remarked. "The additional reserves in Kumaon will raise it to six or perhaps seven percent. This is a very small

area and as the country develops, as industries increase and the prosperity of inhabitants improves, the demand for forest produce, especially timber, fuel, and grass will become immense. In my opinion, therefore, it is extremely important that every district of the province should be carefully examined in order to ascertain whether there are any existing forest areas which could be acquired by purchase, or lease, or given over for systematic management to the Department in return for net profits and that waste areas are available for afforestation. But the responsibility ultimately lies how a forest officer executes the policy."

MINOR FOREST PRODUCE:—

1. *Bamboos*:—These are extensively used for building purposes and for making baskets, *chicks* etc. *Tarai* and *Bhabar* tract of Kumaon has luxuriant growth of bamboos, from where they are exported in large numbers. The outturn of bamboos and ringals in scores of members in 1956-57 was 88,00,000.

2. *Resin*:—Resin is tapped from pine trees by engraving one or more channels in the tree trunk and by placing an earthen pot and lid thereon to collect the floating resin. After this collection it is transported on pack ponies, mules and labourers to motor heads from where it is transported to rail heads and then railed to Clutterbuckganj at Factory Bareilly for refining. A tree is tapped for five years continuously, after which it is allowed to rest for ten years, so that one third of the area of pine forest is worked at a time.

In the hilly tract of Kumaon, resin as a source of income has today acquired greater importance than timber. This industry makes the best use of forests. The areas, having too many twisted and jointed trees, are not considered valuable from the point of view of timber, but resin extraction has no such consideration. Being lighter than timber and comparatively easy to transport, especially in those areas which are far away from good streams or other means of communication, this industry has gained rapid importance in the last decades. Here is an industry which gives good returns with little depletion in the capital and provides work to local population during winters when agricultural activity is at a standstill.

During 1956-57, 85,000 maunds of resin valued at Rs. 21,00,000 was produced. The average yield is about a cwt. of crude resin per acre. Resin consists of rosin and turpentine oil, the latter is separated by steam distillation. There is a huge demand for turpentine for the manufacture of varnishes and also for medicinal purposes, rosin is used for shellac adulteration, in paper mills, soap factories, linoleum, sealing wax, printing inks and gramophone records. A large turpentine factory owned by the Government was worked by the Forest Department at Bhowali in Naini Tal district for several years. The place was however, found unsuitable for several reasons and the factory was shifted to Clutterbuckganj.

There are large areas under pine in Kumaon and the resin yielded by them exceeds the requirements of the Government Factory at Clutterbuckganj. There is thus room for private enterprise. A factory for the distillation of turpentine could be opened at Tanakpur which is on the railway line and which can also command the produce of the forests of East Almora. The Forest Department at one time proposed to erect a factory at that place but the effect has not yet been given to the proposal.

4. Extract from letter No. 39, camp, dated the 6th January, 1912 from P. H. Clutterbuck, Conservator of Forests, Eastern Circle, to the Chief Secretary to Govt. U. P.

3. *Fodder Production and grazing*:—Kumaon being a deficit area in matters of food production and agricultural land being scarce, fodder growing is not a common feature in the hilly tract of Kumaon. Thus, hill people depend on the natural supply of grass. There are grasslands in sub-alpine zone and in *Tarai Bhabar*. In the former *Bugyads* or *Payers* grass is considered nutritive, but in the central climatic zone there is a scarcity of grazing grounds and fodder. The people of this part face great difficulty since most of the forests are under Government management. The Forest Department grants grass concession to contractors or auctions them.

The position has recently been eased because the Forest Department has decided to forego grazing fees in certain areas. Besides, the Department has developed a scientific method of developing pastures, which improves the quality and quantity of fodder grasses, encourages regeneration of trees and shrubs, and prevents soil erosion. In some areas cattle are allowed to graze but goats are debarred from grazing as they are most destructive to natural regeneration. The accumulated unused grass is then sold or auctioned. The Upper India Paper Mills, Lucknow and Star Paper Mills, Saharanpur are fed by *Baib* or *Sabai* and *Ulla* grasses of the forests of Kumaon.

4. *Katha or Catechu production*:—In *Tarai* and *Bhabar*, there is always a competition between *sal* and *khair* trees, and it is no wonder that the latter wins; the reason being that *khair* is the only tree in India, so far known to produce *Katha* and *cutch*. *Khair* tree is widely scattered in *Tarai* and *Bhabar*, but the reserved forests of Kumaon are most notable in this respect.

Indigenous method of *katha* making is wasteful. The bark of the *Khair* tree is used as fuel for boiling *catechu*. Wood is cut into little chips and boiled in earthen pots or occasionally in large cauldrons, until the fluid becomes as thick as syrup, when it is taken out and cooled. Kilns are generally made near streams. Between 12 to 16 pots are used in one kiln. The first pot is with chips and water. When the water begins to boil it is poured into the second pot where it is boiled for a short time and is then poured into the third pot. The process is repeated until the last pot is reached, by which time the fluid has attained the required consistency. The last pot is then removed from the kiln and its contents are poured into a hole dug out into the ground. A superior variety of *catechu* is prepared by drying the contents of the last pot on a piece of cloth. Professional *catechu* makers are the local *kherias*. Another class of men who are locally employed are known as *Chaeens* and come from Gonda and Behraich districts of U.P. The outturn of such a kiln averages five maunds. Such kilns are at Haldwani, Ramnagar, Chorgallia, Tanakpur and Kichcha. According to the Forest Department 1,81,668 maunds of *Katha* and *catechu* were produced in 1956-57. At Haldwani a factory for *Katha* making was opened which is run on modern lines, and is known as Krishna *Katha* Factory. It produced in 1957, 125 maunds of *Katha* per month and 40 maunds of *catechu* per month.

5. *Lac*:—It is obtained from the following trees of *Tarai* and *Bhabar* *Dhak*, *Babul*, *sal* and *Pipal*. There is no culture of *lac* insect; it grows naturally. It is believed that there is a bumper crop every third year. *Bhotias* (the tribal people) extract red colour out of it.

6. *Medicinal roots and herbs*:—The forests of Kumaon are reputed for medicinal roots trees and herbs, many of which still remain unidentified. The important one are *Amaltas*, *Baj*, *Banapsha*, *Rijaisar* bark, *Brahmi*, *Bilal kand*, *Sainjana*, *Siwal*, *Udal mustili*, *chiraita*, *kilmora* root, *kuchila*,

Belladonna, *rohini* etc. For better utilisation of this wealth, the State Govt. have opened an Ayurvedic laboratory at Ranikhet.

OTHER POSSIBILITIES:—

There is still a great scope for better utilisation of Kumaon's varied forest resources. At present, *chir* and *banj* forests are being used for making charcoal. The use of charcoal has been confined to burning purposes. The smaller pieces of charcoal and dust are wasted, though at times balls are made out of charcoal dust and used for burning. On the authority of Sir A. Appleyard (of the Rothamstead experimental station) the use of charcoal as a fertiliser can be recommended. If charcoal as a fertiliser is popularised, it will improve yields and increase the revenue of the forest department.

At present two or three types of trees are generally exploited for timber and the rest are used as fuel. It is, therefore, necessary that some way is found out for industrial utilisation of almost all the timbers. Since Blue pine occurs at higher elevations, it is not much in use though it has superior wood. *Chir* (*Pinus longifolia*) is readily available and is, therefore much in demand as a timber as well as for rosin tapping. The wood and roots could be used for *chir* tar manufacture. Deodar could be used for railway sleepers because it is immune from the attack of white ants. Local people extract oil from it (called Kelon-ka-tel). The Indian walnut could be used for furniture carving and decorative work. Blackwood on the Nepalese border is hard and durable and could be used for cabinet making. When painted properly, it gives the appearance of imitation ebony. Similarly other possibilities could be explored. At present the Forest Department of U.P. is concentrating on the plantations of *chir* and *sal*. If they propagate other woods as alternatives, the pressure on two or three varieties is sure to be lessened.

The two medicines, Santonine and Thymol, are much in use and are imported in to our country. But the raw materials out of which they are made grow wildly in Kumaon hills. The Santonica plant (*Artemisia Maritima*) has a wild growth in northern parts of Almora district. The plant has been examined and found valuable. Owing to lack of capital, expert knowledge and local enterprise, this profitable industry has not yet been started here. Similarly Thymol could be manufactured from the plant locally known as *BaneJuan*, which also grows wildly in abundance. All these need immediate attention.

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GEOLOGICAL PROSPECTING AND THE AGE OF ROCKS

By

ACADEMICIAN D. V. NALIVKIN

Knowledge of the age of rock-strata has tremendous bearing in the search for minerals. Take oil, for example. The region between the Volga and the Urals is now the main oil-bearing area of the Soviet Union. It supplies more oil than any other area and its reserves leave Baku far behind. In this region neither the upper young nor the lower ancient strata of the Earth contains oil. It is all situated in the lower half of the middle strata, and if you seek it in the younger or older strata you will find nothing and only squander millions of roubles on drilling.

Knowledge of the strata in which the oil lies or, as geologists say, knowledge of the "age" of oil seams is very important for the correct organisation of prospecting and drilling on which thousands of millions of roubles are spent every year. A mistake in determining the age of oil-bearing rock often costs hundreds of thousands or millions of roubles.

The same can be said of coal. If we seek it in ancient strata we shall find nothing. In the middle and younger strata it occurs often, but only in seams of a specific geological age.

Finally iron ores. We are proud of the new large deposits discovered near Belgorod, but this was made possible only because the geologists knew the age of the strata where these ores could be found.

Having determined the age of the Belgorod and identical Krivoi Rog ores, the geologists posed the question: What if we seek iron ore of the Krivoi Rog type in deposits of the same age but in other parts of the Soviet Union? Two years passed in search but nothing was found. In the third year, however, very large deposits of ores of Krivoi Rog type were discovered in the Eastern Sayan Mountains. Soon the Kazakhstan geologists reported that they too had discovered large deposits of iron ore. This was followed by similar reports from different parts of the Soviet Union. In all cases the ores were discovered in ancient Pre-Cambrian strata.

AGE AND RADIO-ACTIVITY:—

Practically all methods of determining absolute age are based on the study of radioactive elements and processes involving them. A study of transformations which take place in various substances reveals that they involve the appearance of new elements. The longer the transformation takes place, the more of the new element appears in the rock or separate minerals. The next step was to establish the time it took for the new element to appear. This made it possible to calculate with great accuracy the absolute age of the rock under study. At first only one newly created element was studied — argon. "The results obtained by a Leningrad laboratory were discussed at the first All-Union conference for the determination of absolute age." They immediately attracted universal attention. New laboratories were set up in Leningrad and Moscow. The study of changes taking place in rock requires intricate, painstaking and exceedingly accurate

research. Existing instruments had constantly to be renovated, new instruments were invented and the results became more and more accurate.

CHECKS AND RE-CHECKS :—

At first there was much doubt, especially among the geologists, who declared that the chemists were engaged in fancy. Repeated checks and rechecks were made, and when different laboratories in Moscow and Leningrad produced identical results after studying test samples the problem was taken more seriously. The "Second conference on determining absolute age" attracted more participants. The data accumulated by them had been checked and compared. It was found that it was possible to determine the age of rock which hitherto had defied study.

After that, "absolute age" laboratories were established in Kiev, Sverdlovsk, Ufa, Baku and several other research centres. The work acquired scope and became part and parcel of all more or less comprehensive geological research. Today all the laboratories are flooded with orders from all over the Soviet Union, and their number is mounting steadily.

In many cases, the age of substances, which we encounter every day, is regarded as definitely established. For example, river embankments in Leningrad are made of granite and the age of this granite is just under 1,500 million years. The limestone of which stair-cases in many houses are made are 300 to 350 million years old. Coal is younger — some 200 million years old. The ceramic clay from which crockery is made is 40 to 50 million years old. The oil of Baku is 10 to 20 million years old. The greenish clay from which bricks are usually made is quite young — 50,000 to 100,000 years old. The fine yellow sand of some beaches along the Gulf of Finland is quite an "infant", being only 10,000 or 12,000 years old, while at some beaches around Leningrad the sand is actually being born before our very eyes, being no more than 200 or 300 years old.

OLDEST ROCK :—

Ordinary cobblestone pavements are made from some of the world's oldest rock which is 2,000 to 3,000 million years old. It is difficult to imagine such spans of time, but there is even older rock. The oldest known rock dates back to 4,000 million years ago, and the history of the earth doesn't end there — it goes even farther into the past.

In conclusion it must be said that work on determining the absolute age of rock is being conducted on a big scale in many countries, but our geochemists are confidently in the lead,

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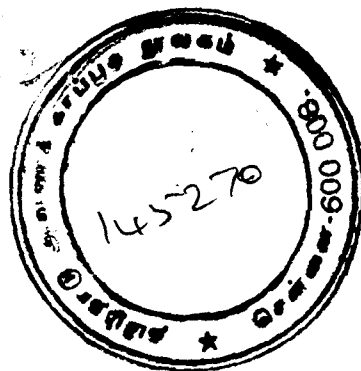
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