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Vol. XIX

April—June, 1944

No. 2

The Indian Geographical Journal

Formerly

THE JOURNAL OF THE MADRAS GEOGRAPHICAL ASSOCIATION.

PUBLISHED QUARTERLY.

EDITOR

George Kuriyan, B.A., B.Sc.



THE INDIAN GEOGRAPHICAL SOCIETY,

Wellclose,

Cathedral P.O.,

Madras.

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The Indian Geographical Journal

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Vol. XIX APRIL—JUNE, 1944 No. 2

Annual Geographical Convention, 1944

Presidential Address

By

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MINERALS OF SOUTH INDIA AND THEIR GEOGRAPHICAL DISTRIBUTION*

The natural resources of the world and of the individual countries receive closer and closer attention with the advance of industrialisation and are pressed into the service of man. The study of these resources is now a well recognised branch of geography. They include all that forms the terrestrial globe and all that grows and lives on it—viz, minerals, plants and animals. I propose in this address to consider a part of our natural resources, viz., the mineral deposits of South India, and how their regional distribution is likely to direct its development.

Minerals are formed by inorganic agencies under the control of well defined physico-chemical principles. They are related to the conditions of formation and geological environment. If we know the geology of an area, it will be possible to say what minerals can and what cannot be expected there. Natural

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geographic features and boundaries have often some definite relationship to the local geology. But most geographical boundaries are dependent upon political exigencies or administrative convenience, and may, and often do, cut across the natural divisions.

Geology.—The region I propose to deal with is roughly the part of India lying to the south of latitude 20° N. It comprises Southern Bombay, Hyderabad, part of Orissa, Madras, Mysore and Travancore.

The greater part of South India consists of very ancient metamorphic rocks—gneisses and schists—of Archaean age. The Archaean rocks are penetrated by granites, pegmatites and quartz veins. Some parts are schistose and largely of sedimentary origin and these are often referred to as belonging to the Dharwarian System whose constituent members enclose several important mineral deposits including gold, copper, iron, manganese, chromite, magnesite, pyrite, graphite, corundum, mica, beryl, etc.

Younger than these are some sedimentary rocks forming what is known as the Cuddapah basin, occupying the greater part of the Ceded districts. A smaller area of these ancient, unfossiliferous, sediments is found in Jeypore in the Eastern Ghats. These rocks contain various building stones and a few useful minerals like barytes and asbestos.

There are coal-bearing strata along the Godavari valley. Of slightly younger age, but belonging to the same (Gondwana) formations, are certain sandstones and clays in the Godavari, Kistna, Guntur and Chingleput districts. These contain some good ceramic clays.

The coastal regions show patches of Tertiary rocks which occasionally contain lignite, and deposits of sand with occasional concentrations of the heavy minerals ilmenite, monazite and zircon.

We may now consider the following geographical divisions and their resources:

Southern Bombay.

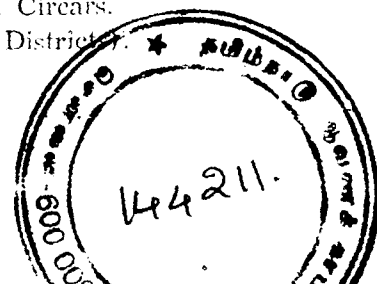
Hyderabad and the Northern Circars.

The Cuddapah basin (Ceded Districts).

The Mysore Plateau.

Southern Madras.

The Coastal Region.



Southern Bombay.—This tract is covered almost entirely by dark coloured fine-grained volcanic rocks called the Deccan Traps, used extensively as a building stone in the Bombay Presidency. Cavities in these rocks sometimes contain a group of minerals called the zeolites which are employed in water-softening, and also different forms of silica like quartz, amethyst, opal, agate, carnelian, jasper, etc., used as semi-precious stones.

The Deccan Trap hills are, in several places, capped by deposits of laterite and bauxite, the latter being an ore of aluminium. This was used formerly only in petroleum filtration as the colloidal material of the bauxite extracts and retains the colouring matter of the oil while the filtered oil becomes colourless.

Hyderabad and Northern Circars.—Hyderabad is occupied mainly by Archaean gneisses and schists. In the south-west there are some rocks of the Cuddapah system, while in the Godavari valley there is a strip of Gondwana rocks.

The Archaean area contains various mineral deposits. Gold deposits are found at Hatia and a few other places. Iron ores occur in the northern areas and in the Dharwarian rocks of the south-west. Manganese ores, though not of the best quality, have been worked for over half a century in the Vizagapatam and Ganjam districts. They are associated with crystalline limestones and garnet-bearing rocks.

Though laterite is of frequent occurrence in the region of the Eastern Ghats, good bauxite is rare and may possibly exist in the interior of Jeypore and Baster. Several deposits of graphite are known in the Vizagapatam, Godavari and Warangal districts, but most of them are of small size.

There are several deposits of ceramic clays suitable for making refractory bricks, stone-ware, pipes, bricks etc. No large deposits of true kaolins have yet been found. Fire-clays are associated with the coal bearing strata but these are not exposed on the surface.

Coal is found in the Singareni and Kothagudem fields. It is of a good bituminous variety suitable as an ordinary industrial fuel. The coal fields of Ashwaraopeta and Bedadanuru on the border of Hyderabad and W. Godavari district have not been thoroughly investigated.

In recent years chromite has been found in a few places in the Kondapalle hills in the Kistna district. Fluorspar is a

constituent of some of the granites of Nellore and Guntur but no workable veins have yet been discovered.

The Mysore Plateau.—The Mysore plateau is geographically larger than the State of Mysore as it extends partly into Anantapur, Salem and the Wynaad region of the Nilgiri district.

The gold deposits of the Kolar gold field are well known but there are also others in Anantapur and in Wynaad. In some places the gold associated with much iron pyrites could be used for the manufacture of sulphuric acid.

The iron ore deposits of Mysore are of large magnitude. Both hematite and magnetite ores are present but the former are the more important and are now utilised. Mysore has also good deposits of chromite and magnesite in the south. Other minerals worked in the State are various clays including kaolin, corundum, garnet, ochres, etc.

The Wynaad region contains good deposits of muscovite mica of the 'ruby' variety. Owing to thick soil cover, dense forests and very heavy rain, prospecting and mining in this region are beset with unusual difficulties.

The Cuddapah Basin.—This constitutes a geological unit containing rocks of the Cuddapah and Kurnool systems. It is composed of sedimentary rocks which can provide inexhaustible supplies of building stones like sandstones, flaggy limestones (familiar to us as Cuddapah slabs), slates, limestones and marbles. The so-called 'Cuddapah slabs' are quarried at several places in the Cuddapah and Kurnool districts and are excellent for paving roofing, fencing, etc. The Narji limestones of the Guntur district contain some very fine marbles of high decorative value and pleasing colours—dove grey, rosy copper red, maroon and pale green, with patterned and variegated types. They have yet to be systematically worked and used, though used locally in a small way for many decades and even centuries.

There is a belt of limestones and dolomites in these rocks passing through Pulivendla and Vempalle (Cuddapah district). These should be able to provide raw materials for a cement industry. Deposits of barytes and asbestos are found in them where they are intruded into by volcanic rocks. The barytes deposits are extensively distributed in the Cuddapah, Anantapur and Kurnool districts.

There are also good deposits of red and yellow ochres in these formations. These are worked at a few places.

Iron ore (hematite) bodies are found in a zone of disturbance and dislocation near Ramallakota in the Kurnool districts. There is sufficient ore here to support a medium sized industry, provided fuel and power could be got reasonably cheap.

Considerable importance was attached, during the last century, to certain lead ore deposits found in the Cuddapah and Kurnool districts. The old workings now seen are not encouraging but no data are available regarding the presence or absence of ore at some depth.

Southern area.—Iron ores, consisting mainly of magnetite, are developed extensively in the Salem, Trichinopoly and Arcot districts. They form part of a sedimentary sequence which has been metamorphosed, the ferruginous material having been converted into magnetite-quartz rock. These deposits contain several hundred million tons of ore.

Copper ores are known in a few places in the Nellore district but they await investigation by deep drill holes. The shallow workings now available for inspection do not give indications of rich deposits near the surface.

The pegmatites traversing the schistose rocks in Nellore (as also in a few other districts) contain rich deposits of muscovite mica, a mineral indispensable to the electrical industry. Less important deposits are known in the Salem, Coimbatore and Trichinopoly districts. Phlogopite (magnesian mica) is found in Travancore. The pegmatites in the various districts are capable of yielding large quantities of felspar and quartz which find application in the ceramic industry. Certain rarer minerals like beryl, samarskite and tantalite are also sometimes associated with the mica-bearing pegmatites.

Crystalline limestones are widely distributed in this area and contain a few patches of high purity, useful for the chemical industry. Corundum is found amidst the gneisses in the Salem district and in association with sodium-rich rocks in Coimbatore. The sodium aluminium silicate (nepheline) in the last mentioned rocks can be used in the glass industry.

Overlying the gneisses there are some sedimentary rocks (of Cretaceous age) in the Trichinopoly and South Arcot districts,

enclosing numerous interesting animal fossils. The strata contain veins of gypsum (calcium sulphate) celestite (strontium sulphate), calcium carbonate and impure nodular calcium phosphate. The limestones found in these formations are used for the manufacture of cement.

The Coastal Region.—Both the western and eastern coasts show patches of Tertiary rocks—mainly soft red ferruginous sandstones and clays. They contain deposits of lignite near Vriddhachalam in the South Arcot district and near Varkala in Travancore.

The Tertiary rocks and associated laterite are sometimes underlain by good deposits of china clay, as for instance near Quilon and Calicut. The Travancore State Ceramic Works at Kundara use these clays.

Certain low-lying areas along the coast, which are liable to seasonal flooding, are found to contain small but interesting deposits of gypsum and sulphur. These deposits are apparently being formed at the present day and need further study.

The sea beaches contain deposits of ordinary silica sand used generally only for building purposes. Sand from near Ennore (near Madras) has been used in glass making for some years. In some areas, however, the sands show layers of certain heavy minerals like ilmenite, garnet, monazite and zircon which have important uses. Such sands are found in a few places in Travancore, Malabar and Tinnevely.

THE FUTURE OF THE MINERAL INDUSTRY

Having gained an idea of the mineral resources in different parts of South India, we can now examine the lines along which mineral industries are likely to develop here. The resources are various and reasonably rich and need careful attention if they are to be wisely utilised.

Southern Bombay.—This area has excellent resources in aluminium ore (bauxite) and also in sources of water power. Hence it would be well fitted for developing an aluminium smelting and fabricating industry. It is now generally known that an aluminium smelting works is functioning in the State of Travancore, but the location of the factory was determined chiefly by the availability of cheap electric power.

Hyderabad and Northern Circars.—This region contains iron ores, manganese, chromite, graphite, ceramic materials, etc. The Hyderabad State has been for sometime considering the question of establishing an iron and steel works within her borders. This could be successfully done especially if the rich ores of Baster, only a short distance beyond the Godavari, can be developed and used to supplement her own resources.

Raw materials for the ceramic industry are found in various places in this region. They will be worth investigation and development.

The coalfields of Bedadanuru and Ashwarsopet have not been thoroughly investigated. It is likely that they will contain workable seams of coal and if so, the development of a new coalfield in this region will prove to be of great benefit to industries.

Mysore Plateau.—This region is generally better developed industrially than the rest of Southern India. Gold mining has been going on for a long time and the gold deposits will perhaps last for several years to come. Pig iron has been manufactured here since 1922 and steel since 1936, but on a modest scale. Recently the manufacture of ferro-chrome and ferro-silicon have also been commenced. There are factories manufacturing ceramic articles, glass and abrasives. There is a steady expansion and improvement of the established industries in this region while the possibilities of new ones are also being investigated.

Cuddapah Basin.—The Ceded districts now produce an appreciable tonnage of barytes, red and yellow ochres and red oxide but these are all exported as there is no paint industry to utilise them locally. The establishment of the manufacture of paints in the areas under consideration is a desideratum, for the most important raw materials are available here.

There are extensive deposits of limestones amidst the rocks of the Cuddapah basin. Some of these must be sufficiently low in magnesia to be used in the manufacture of cement. Two cement factories are now working near Bezwada but there is no factory within the Ceded districts where the manufacture will not be much more expensive.

The 'Cuddapah slabs' are extensively quarried near Yerraguntla, Jammalamadugu, Betamcherla and other places but the quarrying methods and the preparation of the material for the market can certainly bear some improvement.

Southern Madras.—The southern part of the Madras Presidency is very backward in the development of mineral industries in comparison with the known resources. All it can boast of is a couple of cement factories and one in which abrasives are made. The glass industry which was working rather unsteadily in former days is not functioning at present.

Though the iron ores of Salem-Trichinopoly have been receiving intermittent attention for many years, they have yet to be taken up seriously. Magnetic ores, easily amenable to concentration, form the bulk of the ores. Electrical smelting appears to be the most feasible way of converting the ores into metal. Fluxes and refractories are available in the neighbourhood and the general conditions for the manufacture of iron and steel are not unfavourable.

Nellore is an important mica-producing district. All the mica is split, cut and graded but not manufactured into shapes wanted by the consumers. Hence it leaves the country without bringing the full benefits of manufacture. There is, moreover, no manufacture of built-up mica or micanite for which even the waste dumps are likely to provide useful quantities of the mineral.

The phosphates, gypsum and celestite found in the Trichinopoly district are valuable materials which can be converted to chemicals and fertilisers. Schemes are afoot for the manufacture of phosphorus and phosphatic manures from the phosphatic nodules, and of ammonium sulphate by the use of gypsum.

There are raw materials for the expansion of the cement industry, and for the refractories, ceramic, glass and paint industries. Intensive surveys will reveal the extent of these resources and other particulars.

The ilmenite, monazite and zircon of the Travancore coast have been and are being exported without any effort at utilising them within the country. The quartz sands in certain places may also be amenable to purification and use for various purposes. Ilmenite is the raw material for the manufacture of a high grade white paint pigment (titanium dioxide) which should be possible to make here. Monazite contains certain rare elements including thorium and cerium and also phosphorus. It can therefore be used as a source of phosphorus for fertilisers and of the rare elements for the manufacture of gas mantles and other purposes.

The occurrence of gypsum and native sulphur in one or two places on the coast shows that they are being formed at the present day. Intensive study of the local conditions and the processes of formation will show how far it is possible to augment supplies of these materials under controlled conditions in other places.

In this short address I have attempted to give a general summary of the more important mineral resources of South India. Local conditions, transport, market and other factors will have to be studied before these resources can be developed and used to the best advantage.

It is to be hoped that geographers will play an increasingly important part in the development of the natural resources of the country and the various problems that arise during such development.

Gleanings from the Historical Geography of the South Arcot District

(A paper read before The Indian Geographical Association Conference, Annamalaiagar, May 1944)

By

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PART I. *Arcot and the Carnatic—River-Mouths and the European Settlements.*

I. *Arcot and the Carnatic.*—The District got the name of South Arcot because when it was ceded in 1801 by treaty by the Nawab of the Carnatic to the East India Company, it consisted of that portion of the Mughal Subah of Arcot which lay to the south of the Palar river, on which the capital, Arcot, had been built. In the records of those times it was named generally as The Southern Division of Arcot.¹ The district has no well-marked natural divisions except in the hills on the west leading through the Chengamah and Attur passes into the Carnatic Balaghat (or up-country) from the Payanghat (or low coast plain).

The town of Arcot itself was made (about 1705) the headquarters by Nawab Daud Khan, in the place of Gingee as it had become unhealthy, malarious and unfit for the habitation of a numerous population. The name Carnatic (identified in the 18th century, roughly, with the Nawabi Subah of Arcot), was applied to the region below the Ghats, extending from the Guntur Sarkar,

1. The word Arcot itself is held to have been derived from *Aru* (six) and *Kādu* (forests)=*Shadāranyam* meaning that, according to tradition the country along the Palar was covered by six forests in each of which a famous rishi was engaged in tapas.—(See Yule and Burnell: *Hobson Jobson*—Ed. by W. Crooke—(following Caldwell). The name is, according to a Muhammadan historian, Burhan-ibn Hasan, derived from the town arising at the junction of the river and a forest. (See Dr. S. M. H. Nainar's translation of the *Tuzuk-i-Walajahi* Part I).

being bounded on the north by the small river, Gundalakama which falls into the sea at Motupalli, over all the coast country, as far south as Cape Comorin. The territory south of the Coleroon river was known as the Southern Carnatic, and it was rather tributary to the Nawab's authority than directly under his rule; Central Carnatic extended from the Coleroon to the North Pennar and comprehended the present districts of South Arcot, Chingleput, Madras, North Arcot and large slices of Chittoor and Nellore. And Northern Carnatic stretched from the North Pennar to the Guntur Sarkar.

Payanghat or Talaghat was the name given to the coast portion of the Carnatic region, to the east of the Ghats, as distinguished from Balaghat, the country to the west of the Ghats. One portion of the Carnatic country was overrun by the forces of the Sultans of Golconda in the 17th century; it extended from the Krishna to the neighbourhood of Madras and was known as the **Hyderabadi-Carnatic**; and it contained, according to the information available from the records, both a *Balghat* portion and a *Payanghat* portion. The former comprehended the five *Sarkars* of Siddhavattam, Gandikotta, Gutti, Gurrumkonda and Cumbum; and these sarkars, except Gutti, afterwards went to constitute the petty principality of the Pathan Nawabs of Cuddapah; while Gutti fell into the hands of the well-known Maratha adventurer, Murari Rao **Ghorepade**, and subsequently into those of Haidar Ali. The Payanghat portion of the **Hyderabadi** (Kutb-Shahi or Golconda) Carnatic comprised the whole coast country extending from the bounds of the Guntur Sarkar on the north to the present South Arcot district, about its northern part. This was the nucleus of the Subah of Arcot and formed the central core of the dominions of the Nawabs of Arcot. It thus included Northern Carnatic as defined above, and a portion of Central Carnatic.

South Arcot had also political filiations with the Bijapuri-Carnatic (the territories conquered by the Adil Shahis of Bijapur in the 17th century). This portion was mostly Balaghat, though it had territories in Payanghat, viz., Vellore, Gingee and portions of Tanjore, all of which were conquered by Bijapuri generals like Randaula Khan and the famous Shahji Bhonsle, father of Sivaji. This Carnatic consisted of the settled upland districts of Bangalore, Kolar and Sera; and it was entitled to receive tribute from a number of surrounding districts.

When the rule of the Nawabs of Arcot became fully established in the first decade of the 18th century, the whole of the Balaghat

section of the Hyderabad Carnatic, with a little extension to the south was in the hands of the Pathan Nawabs of Cuddapah and the chiefs of Gutti and other places.

The Governorship of the Two Carnatics of which we read in the histories of the age, consisted of the Balaghat portion of the Bijapuri Carnatic and the Payanghat portion of the Hyderabad Carnatic. Nawab Sadatullah Khan who was appointed by the Emperor Farrukh Siyar, immediately under Nizamul Mulk, as the Nawab of the Two Carnatics in 1713, was the second regular Nawab of the land and was the acknowledged ruler between 1710 and 1732 A.D.

II. *River-Mouths and European Settlements.*—As was quite natural, the mouths of the Coleroon, the Vellar, the Gadilam and the Gingee Rivers were settled by Europeans and respectively known as Tivukotta (Devicotta), Porto-Novo, Cuddalore-Fort St. David and Pondicherry. Devicotta, built on a sandspit at the mouth of the Coleroon, is now entirely in ruins; and its very site has been lost to view. It played a considerable part in the relations between the Tanjore Kingdom and the English Company.²

Porto Novo (probably a variation of New Oporto, rather than of New Port; and otherwise known as Farangipetta—European town, and as Muhammad Bandar) has grown up on the north bank of the Vellar river on low-lying sandy soil. Krishnappa Naik of Gingee founded the town of Krishnapuram, in its vicinity, about 1600. Its history dates from the time when it was first visited by Europeans. It was occupied by the Portuguese about the end of the 16th century; the Dutch obtained in 1643 a *cowle* for the place from the local governor of Gingee, and though they abandoned it for a time, maintained an establishment therein as late as 1825. It was sacked by the Marathas and later by Haidar Ali, seized by the English in 1781 and in 1795, and subsequently restored on both occasions to the Dutch on the conclusion of peace; and it finally became an English possession by treaty. The Danes had also a factory at Porto Novo, granted to them by the Nawab of Arcot and situated on the river bank. The English started a settlement at the place as early as 1683; but they transferred it to

2. A detailed account of the fortunes of Devicotta belongs, more appropriately to the history of the Tanjore Kingdom and district.

Kunimedu, higher up the coast, after a few years of trial, though they continued to maintain the semblance of a factory at the place.

On the 1st July 1781, was fought the famous battle of Porto Novo, between Haidar Ali and Sir Eyre Coote which proved a turning point in the fortunes of that critical second Mysore War. Haidar took his stand at Mettupalayam, four miles west of the port. The account of the battle and the *terrain* on which it was fought can be had from Colonel Wyllie's *Life of Sir Eyre Coote*, Wilson's *History of the Madras Army* (Vol. II); Major Vibart's *History of the Madras Engineers*, Gleig's *Life of Sir Thomas Munro*, (Munro having been present at the battle as a subaltern and described it in a letter to his father); and Colonel Malleison's *Decisive Battles of India*. In the next year Haidar and his French allies used Porto Novo as a base for their joint attacks on Cuddalore. An interesting attempt was started at the place for making steel from iron ore got by the river from the interior; but the concern had to be wound up after several futile attempts to manufacture good steel.

Cuddalore, unlike most other European settlements on this coast, still continues as a flourishing place. It means either Kadal+ur (sea-town) or Kūdal—ur (town at the junction of two rivers, the Gadilam and the Uppanār, the latter being largely a **drainage channel**. Cuddalore proper (the Old Town) is situated to the south of the mouth of the Gadilam which is closed by a sand bar, except in seasons of heavy floods, and a branch of (rather back-water from) it turns southwards and runs along the eastern face of the town, emerging into the sea just south of it over a bar, which, though shallow, always remains open. It is only along this back-water that the entire commerce of the place has been carried on since the first establishment of the English factory thereat.³ Fort St. David, acquired from the Maratha rulers of the country on the spit of land to the north of the mouth of the Gadilam, opposite the Old Town, flourished as a factory, fortified

3. Backwaters or lagoons similar to this are common along the coast. They are formed out of "the antagonism of the sand-laden currents of the Bay and the waters of the rivers endeavouring to find an outlet to the sea". A bar of sand is formed as a consequence at the mouth of each river; the water is backed up; and a lagoon is formed; while the bar is continuously enlarged by the operation of the winds and the currents. Similar backwaters exist at Markanam and north of Porto Novo also.

and garrisoned, functioned as the seat of the Presidency, for a few years, when Madras was in French hands (1746-49) and even for a little time after its rendition, and was destroyed almost to ground-level by Count Lally in 1758. Robert Orme, 'the Thucydides of British Indian History' is exhaustive as to the operations leading to its destruction and the condition of the Fort and its environs at the time.⁴ Its demolished fortifications were never repaired. According to old records, it was the northern outlet to the sea that was the principal passage for boats and cargoes of Old Cuddalore; but the traffic has been diverted to the southern outlet, as the other one is usually closed by sand except after floods. Even the southern outlet is constantly shifting in its deep channel, northwards or southwards, the extreme limits of the movement being about a mile and a half; while the back-water itself has been becoming shallower and shallower; and even light country cargo boats have to wait each day for full tide to get out or come in.

Cuddalore is a typical relic of a decaying port which was very prosperous in the 17th and 18th centuries, with a number of weaving villages developing by its side and growing settlements of weavers, washers and dyers of the cloth for export by the Company. From records, we learn, as in the case of Madras and Pondicherry, of suburbs known as *pettahs* for the weavers on whose industry the prosperity of the settlement wholly depended. Thus there were founded, in the course of the 18th century, for attracting weavers on favourable conditions, by Brooke, Chief of Cuddalore (1767-1769), by Lathom, Chief (1773-76), by Cuming, Chief (1778-80) and by Kinchant who became Chief in 1798, *pettahs* which came to be known after themselves. Cumingpet was raided and plundered by Tipu in 1783; and its weavers fled into the jungles of the west. Kinchantpetta has long been cultivated land. The old Factory House remains fairly intact; as well as Christ Church which was taken over from the Jesuits in 1749 and given over to the S.P.C.K. by the English Presidency which then functioned at Fort St. David and successfully defended their settlement against the attacks of Dupleix. But the fortifications round the Factory House have vanished. The Garden House at Manjakuppam, which is the Collector's residence and one of the fine buildings opening out on the

4. See also R. O. Cambridge—*Account of the War in India between the English and the French on the Coast of Coromandel 1750-1760—(1761)*.

almost English-looking *Maidan*, was built before 1705 when it was first repaired; it corresponded, in its origin and first use, to the Company's garden-houses in Madras where the Governor and factors retired from the cramped Fort for a breath of fresh air. Clive might have resided in it for the two months in 1756, when he was the Deputy-Governor of Fort St. David; and the French destroyed a good portion of it, when they captured and demolished the Fort (St. David) in 1758. The Fort was never again used as a military post after its destruction; and its ruins now consist of two brick bastions facing the river, part of the moat and of the old glacis.

Pondicherry, which would have rivalled Madras in power and glory but for unkindly Fate, is situated on the dead level coast, fourteen miles north of Cuddalore on the fringe of the delta of the Pennar and near the two mouths of the Varahanadhi. It is surrounded on the west by a range of low hillocks known as the Red Hills, similar in appearance and formation to the Mount Capper Range to the west of Cuddalore. Purchased from Sher Khan Lodi, the Bijapurian Governor of Gingee, in 1674 by Francois Martin, and settled by him with a small body of refugee Frenchmen, it developed under the fostering care of its founder and first Governor, (Martin. *d.* 1706) into a prosperous settlement containing over 50,000 inhabitants and equipped with a pentagonal fort (Fort Louis, now the *Place du Gouvernement*). The town was properly strengthened with walls, an outer hedge of thorny trees and shrubs (usually called the Bound Hedge, as in the case of Madras) with redoubts at its angles and an outer fort at Ariancopang, near the northern mouth of the Varahanadhi. The vicissitudes of the place are fully reflected in the interesting and informative Diurnal Journal written in Tamil by Ananda Ranga Pillai,⁵ the courtier of the Company and Chief of the Indians at Pondicherry during the glorious rule of Dupleix (1742-54) and in the darker days that followed, culminating in Coote's capture of the place in January 1761 and the utter demolition of its fortifications, so thoroughly carried out that even the tomb of Martin in the Chapel of St. Louis in the Fort could not be discovered. (*Vide Relation du siege*

5. *The Private Diary of Ananda Ranga Pillai (1736-61)* in 12 volumes, translated and edited by Price and Dodwell. Also Ananda Ranga Pillai, the *Pepys of French India* by C. S. Srinivasachari. Also *Le Vieux Pondicherry* by M. V. Labernadie (Pondicherry, 1930) and the works of Jules Vinson and A. Martineau on the history of the French.

de Pondicherry, 1766) which details the English assaults on the place in 1747 and 1748 and Orme's *History of Indostan*, dealing with its fall in 1761).

When Pondicherry was restored to the French in 1765 its fortifications were begun anew by the Governor, M. Law of Lauriston. It was taken again after a sharp siege in 1778 from Governor Bellecombe by Major Hector Munro. When it was restored in 1783 to French hands, the old veteran general, Bussy, was commissioned to be its Governor; but he died within two years after his accession and was buried in the little graveyard adjoining the Cathedral of Notre Dame de Anges (January, 1785). The place was again taken by Colonel Braithwaite in 1793 and only restored in 1816, after a continuous occupation by the English for more than 23 years.

The old canal running parallel to the sea which separated Ville Blanche from Ville Noire still exists as the dividing line between the two parts of the town which, even to-day retains a "most un-Asian appearance"—the streets provided with trottoirs with stone-kerbs and the courtyards with high gates leading to the houses. The base of Dupleix's statue in the Place de la République is built up of pieces of sculpture taken from Gingee which was under French occupation for about ten years and on whose fortifications French engineers had laid a deep impress.

The temple of Villianur, in which there are inscriptions of Vijayanagara rulers, Bahur with its ruined fortifications and shrine containing valuable lithic records and Arianeopang are places of historical interest within the limits of Pondicherry territory. The neighbouring forts of Valudavur and Perumukkal hillock call for some attention on the part of the student of the wars of the Carnatic in the 18th century.

Thirteen miles north of Pondicherry is the site of the old and ruined English factory at Kunimedu (Conimeer) which was started as early as 1682 soon after the failure of the English to effect a settlement at Cuddalore. The Dutch entertained for a time an idea of getting possession of Kunimedu when it was abandoned by the English on their acquisition of Fort St. David. The outlines of the factory can even now be traced, as well as the foundation of the flag-staff and the tank to the west, known as the Printers' Tank (Eluttukkārar Kulam) where the Company's cloth-printers used to wash the cloths they wove.

Thus the coast is full of the mementos and relics of European settlements. The Portuguese occupation of Porto Novo was short-lived and barren of results. The Dutch factories at Porto Novo (villages like Bhuvanagiri in the interior giving it a steady supply of cloth) and at Devanampatnam, before the English acquired it and built thereon Fort St. David, as well as their claim to a lease of Manjakuppam (a part of Cuddalore New Town) and their short-lived occupation of Pondicherry (1693-99) form a more interesting topic of study. The epic of the Anglo-French struggle for dominance in the Carnatic, centres to a large extent, in this District. Pondicherry and Cuddalore, Divukotta and Porto Novo on the coast, Vriddhachalam, Tiruvadi, Gingee and Tyagadrug which constitute the main links in the inner chain of historical places of significance in the wars of the 17th and 18th centuries—these should be understood in their proper geographical relation to the coast and the activities of the Europeans in order to be grasped in their proper historical significance. The hinterland reacting on, and in its turn, being affected by the coast can be best seen in the part played by Gingee in the last century of its remarkable history which witnessed, as through a panorama of changes, indigenous tribal rule, Chola and Vijayanagara occupation, the conflict of the Nayaks of the country, the coming in of the Bijapurians, the Maratha occupation and struggle with the Mughal and the penultimate struggles of the country-powers that constituted a veritable 'witches' revel' and a fitting prelude to its final acquisition by the French and, later, by the English.

(To be continued)

Some Aspects of Drainage in South Arcot District

By

JANAB A. GHULAM MAHOMED BAHADUR
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Irrigation and Drainage form the arterial and the venous systems of the body Agriculture. One without the other cannot exist as both are inter-dependant on each other. Irrigation as a system has been duly understood and planned out. But drainage as such has not received the same attention at the hands of the public. This is clear in the South Arcot District.

The District of South Arcot consists of an open undulating plain bounded on the West by a range of hills called Kalvarayan. In this undulating plain a small number of isolated hills are scattered in parts of Gingee, Tirukoilur and Villupuram. There are also two elevated plateaus, one of small dimension near Pondicherry and the other of some length running from Vridhachalam to Cuddalore. The slope of this plain is generally towards the East and it can also be said that the land slopes slightly from South and North towards a point near about Cuddalore and a strip parallel to the Coast containing Cuddalore in it. This plain is traversed by about nine rivers which run from West to East generally. Of these nine, three are the most important and are of some length. The Pennai which is on the Northern side of the District has a course of 75 miles across the District. Gadilam is next in importance and this begins and ends in the District itself. The Vellar on the South has a course, bordering and partly through the District, of 82 miles. All these rivers are shallow and their beds are heavily sanded, specially towards the coast. The average depth of the rivers, particularly near the coast is hardly more than 6 feet. On to these physical features of the land, peculiar climatic conditions are brought to bear. The Monsoons, particularly North-East Monsoons are heaviest on a narrow strip of the coastal land and as these travel inland the vigour is lost and the rainfall in the Western areas of the District is the lowest. Added to this, the District has to receive the surplus and drained off waters of the Salem District which is on its west.

By its various irrigation systems about 516,730 acres are cultivated for about nine months in a year supplied with water received from the Western areas. These lands are kept flooded with irrigational waters during the cropping season, that is starting from June onwards. Most of these irrigated lands are found in blocks of dead uniform levels and movement of water in these dead level lands is slow. The various channels because of a slow movement in their waters, get flooded and even overflow their banks in case there happens to be continuous rain anywhere in the vicinity. The case in the District is that the greater damage is caused to paddy crop by flooding than by a famine of water. This is true, particularly in the low lying areas of Chidambaram, Killai, etc. In the Tindivanam taluk there is a swamp near the sea of about 31 square miles in extent which is the result of seepage water from the surrounding areas.

During the Monsoonic period of October and November this district has been experiencing every other year flooding of some importance or other. For days and weeks on end, the coastal strip of land from thousand to thousand five hundred square miles is under water. Damage of considerable importance is periodically experienced and borne on fields, crops, roads, railways, towns, etc., Nature is best in her violence in this District and that is almost an annual feature.

Almost all the rivers which traverse this District have been dammed and waters are diverted for irrigation purposes at various points in their courses. Thus this District has the largest number of small Anicuts that have been usefully utilized. But in spite of all the various engineering devices to arrest flooding at various points of the rivers, flooding, resulting in enormous loss of both human life and material, is still an annual feature. It may also be asked whether these rivers due to huge quantities of sanding and shifting sands in their beds will not lead to shifting of their course, as it has been happening in China. It may be that the process may be slow. But it is bound to be that. Even Cuddalore town will be reduced to a low swamp if things are allowed to drift their own way.

This district also presents another picture quite the reverse of flooding. In this apparently well watered district there are pockets of areas which are susceptible to famines. In these pockets of land the soil is generally shallow with hard sub-strata and the rainfall also happens to be poor and irregular. Pakkam is a firca

in the Kallakurichi taluk which is famine affected. Manalurpettai is another firca in the Tirukoilur taluk and through this firca, it is astonishing to note, Pennaiar flows. In Gingee taluk also there is a pocket of a famine affected area called the Melmalayanur. In Cuddalore there are two fircas which are constantly affected with famine — Kurinjipady and Kadampuliyur. Now, it is for consideration whether in the face of surplus waters available in the District such pockets of famine affected areas can be permitted to exist without the Present Age trying to improve upon matters.

The State plans and looks after irrigation. The Public Works Department attends to this. The Revenue Department takes up distribution of the irrigation waters. This is, so far as the major irrigation is concerned. The repair and upkeep of the various tanks is attended to by the Minor Irrigation Section of the Revenue Department. But nowhere is drainage recognized as such and put on the statute and cold print. The legal language recognizes drainage to co-exist with irrigation, but otherwise it is not of any important consequence with any Department with the Government. It is necessary therefore that there should be a Department which should attend to the safe and economic removal of water from a field or fields when its purpose as an irrigational water is over; that means water has got a function in a field only so long as it is required by the crop and after that it is no longer required by the crop. That means in a field where the crop-plants are living and which are looked after, for and towards an economic end it cannot tolerate stagnating water. When once the water is stagnating in a field it is injurious to the living crop-plants. Those plants will suffer from physiological drought. So it is necessary that the Public Works Department should provide the supply channels with water, the Revenue Department should see to the distribution of this water and there should be another Department which should see to "Drainage" of the fields to which water has been supplied. It will be better if all these three functions should be attended to by one and the same Department, and in no case should any Department lose sight of the economics of drainage.

When irrigation is defined as the arterial system for the well-being of Agriculture, drainage is to be taken as the counter part of irrigation being the removal of the water containing un-required metabolic products of living plants in a place. So the irrigation water from a field will become the drainage water after circulating in that field and the same drainage water can become the irrigation water lower down, depending on levels. The same water

in this respect, plays the double role of irrigation and drainage water in the same field. When irrigation is planned, drainage also should be planned so that nothing is lost of the precious liquid which is the main stay of crop-plants. By suitable projects the famine affected pockets can be planned to have economic irrigation suitable to those areas. Surplus waters which now go waste can be tapped on top-reaches of the rivers of the District and diverted to these famine affected areas. It may be that levels may not be favourable and gravitational flow of waters cannot be obtained at economic cost. Water may have to be pumped to higher regions to meet the land level requirements of these famine stricken areas. It is only in this way that the water resources of this district can be economically utilized to maximum benefit. The general flooding of the district has got to be controlled by regulating the flow of waters in its rivers. For purposes of "Drainage" this District should be cut off from the District of Salem. Pennaiar and Vellar rivers have to be controlled from outside the District itself and the River Gadilam which does the largest damage has got to be deepened to form the main drainage river by removing its sand from its bed and by increasing the number of anicuts on it and strengthening its banks. It may all look utopian, but to save a District of 2,608,763 inhabitants some such himalayan effort is necessary.

For all this, it is necessary to undertake a survey of the whole area of the District and its adjoining parts so far as levels are concerned. From a study of these levels the whole irrigation is to be planned out so that the total rainfall is taken into consideration and all the waters are uniformly distributed all over the country without allowing either surplus or deficit in distribution. This planning has got to take into consideration the periodic cyclonic weather conditions and suitable safety outlets have to be planned and kept open. Thus irrigation should co-exist literally with drainage. When Malabar with its high rainfall could be free of flood damage it is no reason why South Arcot District on the Eastern coast should suffer from floods and famines in spite of the highest intellectual attainments of the Present Age.

Some Knotty Problems of Indian Historical Geography

By

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The aid, which the science of Geography can render to all historical studies, is indeed very great. It is now an acknowledged fact that it is necessary to *discover the geography behind history* in order to grasp the trends of events during the course of centuries and the achievements of human beings throughout the ages. More so in the case of pre-history, for which reliable data are scantily found, in spite of the progress of archaeology.

The purpose of this article is to emphasise the importance of the *historical* geography of India, which still remains to be written and to draw the attention of such august bodies as the Indian Historical Commission and the Baharta Itihasa Mandal to this glaring defect in historical research.

A sincere study of the *place factor* in human history cannot be ignored, and unless and until Indian historians seek the co-operation of geographers in re-writing the whole history of the country, any work which they may produce will be seriously defective and in some cases even doubtful. The unstable courses of our great Indian rivers on the banks of which most of the ancient settlements were established, the vagaries of our climate, the growing accumulation of sand in dry regions and the natural catastrophies, such as earthquakes, floods, famines, etc., have all their bearings on the historical aspects of India. Besides, *nature never remains constant* and a whole science of geomorphology has emerged in recent years from the study of the earth. Even the geographical values of large or small natural regions also change. The only course open to historians, therefore, is to know the geography of their region.

To prove my case, I shall take the example of a recent contribution on *The Sarasvati* in "Science and Culture".* Although from the point of view of history it is a good study, it is to be admitted that it lacks in the background of geography, and consequently the various theories discussed in the paper have no value atleast from the view of the Indian geographer. A historian as the author is, he has expressed doubts about certain matters which he could have cleared better with the help of a geographer. In fact, it is my contention that *many a knotty problem of India's history can and should be solved with the aid of geographical science*. Seeking correlations between the historical and archaeological records on the one hand and the physical geography of the region on the other, I offer the solution of three such problems, which, I hope, will be acceptable to all.

1. Which is the real Sarasvati of the Vedas?

Why is it that the name Sarasvati has been given to several rivers of antiquity? The chief reason is that the Vedic Aryans were *definitely a migratory people* and, after their separation from the Persian Aryans (the ancestors of the Parsee Zoroastrians) somewhere in Central Asia, they migrated south-eastwards step by step, through certain habitable river valleys and settled ultimately on the Sarsuti-Ghagger-Hakra river, which has been identified by Mr. Chaudhuri as the Oghavati in Kurukshetra, and on the banks of which the Vedic hymns were composed.

Their love for this mighty and sacred river was so great that wherever they went they named the new river valley, which gave them shelter, after this old river Sarasvati. And even after this Vedic period, when due to pressure the Aryans moved still further into the Indian Peninsula, they did the same thing with other rivers they chose for settlement, e.g., the Suprabha in Pushkara near Ajmer, the Kanchanakshi in Oudh, and the present Sarasvati in Gujarat flowing into the Rann of Cutch, are all named similarly and for the same reason. So also the Western Sarasvati, identified as the Harakhaiti or Arghandab, a tributary of the Helmand in Arachosia, is called Sarasvati, showing definitely that before the

*H. C. Ray Chaudhuri—"The Sarasvati"—"Science and Culture, Vol. VIII, No. 12, June 1943. Pp. 468-474. Also the Editor's Foot Note on "The Sarasvati and the Jumna" in the same issue; and the "Geography Journal" Vol. XCIX No. 4, April 1942, London.

Vedic Aryans passed through the Khaibar Pass and came over to the Punjab region, they had settled on its bank.

This so-called Western Sarasvati has been fondly remembered also by the Persian Aryans as Harakhaiti (Avesta root *har*, Sanskrit *sar* to flow) in the Vendidad I, 13. "The tenth among the best places and cities (in the world) created by me, who am Ahura Mazda, is Harakhaiti, the beautiful". Sir Aurel Stein, who has done such a yeoman service to Asian archaeology, also identified it long ago as the Arghandab in Seistan, which was the home of the Kyanian dynasty of Ancient Persia. There is another interesting instance of a similar nature found in the historical geography of changing Sind. The tendency of the people was to build new cities out of the materials of the old and to give them the same name for sheer patriotism, e.g. Mohenjo Daro (seven cities are already excavated), Debal, Mahommed Tur, Khairpur, etc., (see my "Some Old Sites in Sind" 1938 pp. 16,28).

We are, indeed, greatly indebted to Stein for proving archaeologically that what is recorded in the Vedas and the Zend-Avesta is largely true, so much so that in his "*River names in the Rg. Veda*" he has revealed: "The analysis of the river names given in our Rg. Veda Verse (Hymn X75) has proved that, leaving aside the still uncertain Arjikiya, they follow each other in strict order from east to west. The exact geographical knowledge, thus indicated, ranging over a great extent of country, might at first sight cause surprise, since it seems impossible to suppose that the composer of the Nadistuti could have had before him a topographical record in the shape of either text or map. Yet the difficulty is easily removed in the light of actual travel experience" (*Jour. Roy. Asia. Soc.* 1917 p. 98). Stein has thereby brought geography close to archaeology, to our infinite advantage.

2. How did the Ghagger-Hakra, i.e., the Sarasvati of the Rg. Veda, dry up and when?

The four theories advanced in the article under review are examined here with the help of the laws of physiography:

(a) Drifting of sand from the Rajputana Desert and smothering of the great sea-going river (D. N. Wadia).

But this cannot be the chief cause, as in spite of such a drift, rivers have existed in other parts of the world. One powerful source of the Ghagger even now is the Ambala streams, which are

snow-fed in the Himalayas. Stein has shown that wind-borne sand is stopped by the vegetation growing in the riverine belts and the river bed is marvellously preserved even now. So the process of drying is not due to sand.

(b) Diversion of the Monsoon Current elsewhere (the author of the article Mr. Ray Chaudhuri).

This is again very doubtful and not definitely proved by climatologists for this region. Only a very small fringe of the country, now covered by S. Persia, Makran, Baluchistan and Sind, is suspected to have been left by the S. W. Monsoon and the current shifted to lower latitudes. But so far nothing has been proved with the aid of rainfall statistics that the Ghagger-Hakra valley has also suffered from a diminution of rainfall during the last millenium. The present average rainfall (35 years' table) is about 10". Something else has happened to the region of the *Sarasvati*.

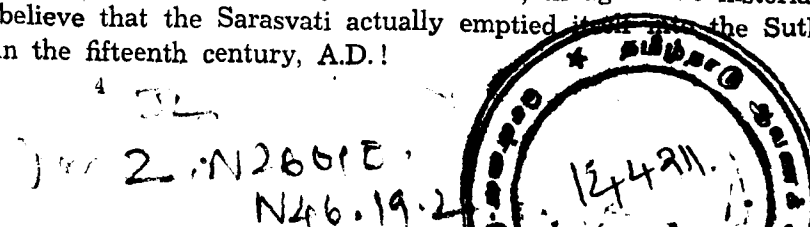
(c) River Capture by the Jumna (*Tarikh-i-Mubarik Shahi*).

The Jumna has been a definite river system throughout the historical period. If the Jumna flowed westward and if at all such a capture of the river took place, it was in late geological times, millions of years ago, and not during late historic times in which the *Sarasvati*, atleast its upper part, has dried up. (See my "*Settlements in the Lower Indus Basin*" 1939 Part I Pp. 343-344). I had a personal discussion with the late Mr. R. D. Oldham at Llandirod Wells, Wales on this very point and he was in agreement with this view.

(d) Uplift of the Delhi-Ambala Ridge (*The Editor, Science and Culture*).

On the contrary, this relic of the Delhi Ridge constitutes some of the lowest parts of the degraded mountain system of the once mighty Aravalli Mountains. The levels here have been constantly lowered by sub-aerial agencies in this area. The rise in level in alluvial rivers is due to accretion or silting most certainly (see my article on "*The Physics of the Indus*", *Science and Culture*, 1, July 1943).

The question when this great river ultimately dried up is not yet satisfactorily solved. But both geographers and archaeologists agree that it was in early historic times, though some historians believe that the *Sarasvati* actually emptied itself into the Sutlej in the fifteenth century, A.D.!



3. *Is there any northward march of the Rajputana Desert due to desiccation?*

This is a general problem of desiccation in Asia and is the most hotly discussed at present. To a certain extent, Sir Aurel Stein, who is our chief authority here, has given the lie to it. He is definitely of the opinion that there is no real desiccation or any great cycle in Asia, as Ellsworth Huntington and other geographers would make us believe. Large areas in Asia have been dried up due to other causes, such as the diminution of glaciers on the Himalayas, the diversion of a branch or branches of a river, a cut-off avulsion, drift sand, etc., but most important of all, human interferences, such as cutting down of forests on the hill side, diversion of flood-water for irrigation and other purposes, making or breaking of dams across rivers for political purposes, etc.

To all these causes, I like to add one more for the whole Indus Basin viz., the westering tendencies of most of the rivers of the Indus system. In my above mentioned paper on "*The Physics of the Indus*" I have proved this tendency of the river in Sind definitely and most of the historical maps of the Five Rivers (Punjab) also show this as a marked tendency. I differ from Sir Aurel Stein in his theory that the lower Ghagger-Hakra dried up "due to the Sutlej having in late pre-historic times abandoned the bed which before had joined the Ghagger". Hydraulic data show that the whole of the Sutlej could not have flowed into the Ghagger, but a branch of it and, later on, only flood waters from it could have gone into the latter to make it a flowing and prosperous river. Even at present and during a powerful flood season, waters from the Sutlej do enter the dry bed of the Hakra through the Bahawalpur State territory.¹ Similarly the whole of the Indus never flowed into the Eastern Nara (the remnant of the old Hakra) but only a branch of it did pass through the Aror gorge and make the Hakra a degrading river and the present Thar desert fertile and habitable upto late historic times.² So the Thar desert is not at all a real desert and there is no northward movement of it.

1. Col. Minchin and Mr. Barnes—Punjab States Gazetteer Vol. XXXVI-A, Lahore, 1908, Pp. 2-3.

2. R. D. Oldham—"The lost River of the Indian Desert" J.A.S.B. Vol. IV, Part 2, 1886.

Lastly, the problem of desiccation and climatic change in Asia, can be said to have been solved finally by Sir Aurel Stein.³ Nearly half a century's explorations in Central Asia convinced him that, except in a small fringe of the country in Persian Makran, Baluchistan and Sind as shown above, there is no real desiccation taking place in this region, but "physical changes which might suggest desiccation, can be proved to have directly or indirectly resulted from human activity as attested by history." The breaking of a dam, destruction of forests and diversion of flood waters for irrigation, or of a water-channel by enemy action, etc., cause a really fertile land to be reduced to barrenness. These were the findings of this great world-renowned explorer, and geographers all over the world are indebted to this unique and indefatigable archaeologist for this valuable service rendered to them. Only a year before he died, the present writer had the good fortune of discussing with him at Karachi this question of desiccation and I was impressed deeply with his enthusiastic protest against blind belief in the theory of wholesale desiccation in the region, as of E. Huntington. He was a real friend of Asia and I wish a suitable memorial is raised in his name.

3. See Sir Aurel Stein—"Desiccation in Asia, a geographical problem in the light of history"—*Hungarian Quarterly*, Spring Number, 1939, also my "Climatic Conditions in Sind", *Proc. Ind. Aca. Sci.* Vol. VI, No. 1, 1937.

Notes on Some Ancient Political Geographical Names

By

DR. V. RAGHAVAN

Preharā again

In an article of the above title in Vol. V. Part 2, 1940-41, of the *Annals of Oriental Research*, University of Madras, I discussed five geographical names the first of which was *Preharā* mentioned in the *Tālaguṇḍa* inscription of Kākutsthavarman as one of the two boundaries of the territory received by the founder of the Kadamba line, *Mayūrasarman*. The western boundary given here is clear, being the western sea, *Aparāṇava*, but the other boundary, *Prehara*, was not clearly understood by scholars. After reviewing the discussions on the name *Prehara* by scholars starting with Kielhorn himself who edited the inscription in the *Epi. Ind.*, VIII, I adduced in my above mentioned article conclusive proof that *Preharā* was a river in the *Aparānta* region. The proof I cited there was a passage describing the rivers of the *Aparānta* region in Daṇḍin's *Avantisundarī* (Trivandrum Curator's Office Ms.). Now I adduce here further proof in support of my identification of *Preharā* as an *Aparānta* river.

In Jinasena's *Pūrvapurāṇa** composed in the 9th Cent. A.D. under King Amoghavarṣa I, in Ch. 31, there is a context similar to that in Daṇḍin's *Avantisundarī*, describing elephants and rivers born of the *Sahyādrī*. (Śloka 54-60). Jinasena mentions here the following rivers: Bhaimarathī, Dāruveṇā, Nirā, Mūlā, Bāṇā, Ketambā, Karīri, *Praharā*, Muralā (given as *Muravā*), Pārā, Damanā and Godāvarī.

प्रहरां विषमग्राहैः दूषितामसतीमिव ।

मुरां कुरैस्सेव्यामपपंकां सतीमिव ॥

This list may be compared with that given by Daṇḍin—*Preharā*-*Muralā*, *Godāvarī*-*Dāruveṇā*, *Bāṇā*-*Mūlā*, *Nirā*-*Bhaimarathī*, *Parā*-

Madhukrandā, *Damanatāpī*-*Naitambā* (Ketambā in Jinasena's work), and *Karīri*-*Lāngalaghātā*. One may even say that the context and the passage in the *Pūrvapurāṇa* suggest Jinasena's knowledge of Daṇḍin's *Avantisundarī*, which latter some cautious scholars are yet to accept as authentic.

Now, a *Pravara* is found as a river starting from the Trimbak hill, down below Naik, falling early into the *Godāvarī*, at a place called *Pravara Samgam*, and itself being fed by a river called *Mula*. Corresponding to the western ocean given as the western boundary of the Kadamba territory, we expect *Preharā* to furnish us the eastern boundary; the present river *Pravara* flows mostly east to west, but the names *Pravara* and *Preharā* are so similar that one may be disposed to identify the two.

*Kannada script edition, Mysore. Dr. N. Venkataramanayya drew my attention to this reference.

The Warm Temperate Grasslands

By

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In most of the geography books, grasslands of the world have been divided into two types namely the tropical grasslands and the temperate grasslands. However, actually it appears that there are four types of grasslands namely, tropical grasslands, warm temperate grasslands, cool temperate grasslands and cold temperate grasslands. As these four main types of grass lands have not received sufficient recognition, the result is that there is a confusion in the treatment of these grasslands by various geographers. The removal of this confusion is necessary so that the subject may be made more scientific. Besides, if geography is to be taught effectively this confusion should be removed.

The temperate grasslands of the world have been dealt with under the cool temperate continental type of climate by some geographers, while other geographers have included the temperate grasslands in the warm temperate belt and yet others have treated them under the China type of climate in the warm temperate belt. Thus in 'Economic and Social Geography' by Huntington no attempt has been made to classify the temperate grasslands. Dudley Stamp in his book 'Commercial Geography' has treated the temperate grasslands under the cool temperate continental type of climate. De Martonne has treated these grasslands under the cool temperate continental and cool temperate transitional types of climates. Austin Miller in his 'Climatology' has treated the grasslands of the northern hemisphere under cool temperate continental type of climate and the temperate grasslands of South America and Australia under the warm temperate eastern margin or China type of climate, but he has dealt with the temperate grasslands of South Africa under high altitude tropical climate.

Dudley Stamp has of course included the temperate grasslands of the southern hemisphere under the cool temperate continental type of climate and therefore the Pampas of Argentina have been

treated under this type and he has cited Bahia Blanca as an example of a station with this type of climate. On the other hand Austin Miller in his book 'Climatology' has dealt with the Pampas under the eastern margin warm temperate or China type of climate and he has mentioned Bahia Blanca as an example of a station with a China type of climate. Nevertheless, De Martonne has included these grasslands under the cool temperate transitional type of climate.

Apparently in the Pampas the winters are as mild as they are in the China type of climate and hence these should be considered under the warm temperate belt. For this purpose let us examine the mean monthly temperature of Bahia Blanca and compare it with Chengtu in Central China with a China type of climate.

Stations °F.	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Bahia Blanca	74	72	67	60	53	47	47	49	54	59	66	71	60
Chengtu	44	45	53	63	70	76	79	78	70	63	54	47	61

At Bahia Blanca the mean annual temperature is lower than 68°F and the winters are distinctly mild with a mean monthly temperature of 47°F for the coldest month. If the mean monthly temperature of Bahia Blanca is compared with Chengtu it is at once evident that winters are cooler at Chengtu and there is practically no difference in the mean annual temperature of these two places, for the mean annual temperature of Bahia Blanca is 60°F and of Chengtu it is 61°F and therefore both these stations must be considered to have a warm temperate type of climate.

Now let us examine the mean monthly temperature of Omaha in U.S.A. and compare it with Bahia Blanca.

Station °F.	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Omaha	22	25	37	51	63	72	77	75	66	55	39	27	51

At Omaha the winters are distinctly colder than they are at Bahia Blanca. Moreover, the mean annual temperature is also much lower at Omaha than it is at Bahia Blanca, and therefore Omaha may rightly be considered to have a cool temperate continental type of climate, but Bahia Blanca cannot be considered under this type. Austin Miller therefore has rightly included Bahia Blanca under the warm temperate belt. However in this belt he has included it under the China type of climate.

Similarly the temperate grasslands of New South Wales and Victoria in Australia should be considered under the warm temperate belt and not under the cool temperate belt, for here also, the winters are as mild as they are in the China type and the Mediterranean type of climate. This is quite evident from the study of the mean monthly temperatures of some of the stations in these grasslands. The mean monthly temperatures of Bourke and Dubbo in New South Wales are given below:—

Stations °F.	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Bourke	84	83	77	68	58	54	51	56	63	70	76	82	68
Dubbo	79	77	71	64	55	49	47	51	56	63	71	76	63

At these stations the winters are even milder than they are at places like Chung-king with a China type of climate and if the mean monthly temperatures of these stations are compared with a station like Odessa, it is quite evident that the winters at Odessa are far colder. At Bourke in the coldest month, the mean monthly temperature is 51°F. while at Odessa in the coldest month, the mean monthly temperature is 25°F. However, the mean monthly temperature of Odessa is very similar to the mean monthly temperature of Omaha. Thus the cool temperate grasslands of U.S.A., Russia and Asia should not be grouped with the warm temperate grasslands of the southern hemisphere as it has been done by Preece and Wood in 'Foundations of Geography.'

On the other hand, Brettell in 'Social and Economic Geography' has dealt rightly with these grasslands under the sub-tropical belt, but he has mixed them up with such semi-arid regions as Iran, central parts of Algeria and Tunisia and northern and central prairies in U.S.A. immediately east of the Rocky mountains. In the case of Central Asia he has cited Tashkent as an example of a station with this type of climate, but at Tashkent in the coldest month the mean monthly temperature is 30°F. and therefore it is very different from places like Bourke and Bahia Blanca with very mild winters.

The temperate grasslands of South Africa are similar to those of Australia. This is quite evident from the study of the mean monthly temperature of the stations Graaff Reinet and Kimberley:

Stations °F.	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Graaff Reinet	72	72	68	62	56	53	51	54	59	64	68	72	63
Kimberley	76	75	71	64	56	50	51	55	62	67	71	75	64

At both these stations the winters are very mild and therefore these grasslands also come under the warm temperate belt. However, Austin Miller has treated these grasslands under high altitude tropical climate. It is true that these grasslands have considerable altitude and temperature becomes lower with altitude, but generally in tropical highlands the annual range of temperature is smaller. Thus Addis Ababa has an annual range of 7°F. and at Mexico City it is 11°F. On the contrary in the warm temperate grasslands of Africa the annual range of temperature is much greater. Thus Kimberley has an annual range of 26°F. while Graaff Reinet has an annual range of 21°F. Apart from this, the tropical highlands such as Mexico, Kenya, Abyssinia and the high plateaus of Andes are situated within the tropics, but these grasslands are practically situated outside the tropics and hence these grasslands should be treated as warm temperate grasslands.

In the northern hemisphere the warm temperate grasslands have a very small distribution. In U.S.A. the southern prairies or grand prairies of Texas have this type of climate. Thus the mean monthly temperature at San Antonio in Texas is very similar to that of Bourke in New South Wales.

Station °F.	J	F	M	A	M	J	J	A	S	O	N	D
San Antonio	53	55	63	69	75	81	83	83	78	70	61	54

However, further north the central and northern prairies of U.S.A. have severe winters and therefore here the climate is of the cool temperate continental type, while in Canada on account of very cold winters these grasslands have a cold temperate type of climate. Likewise the temperate grasslands of Europe and Asia have colder winters and therefore they cannot be included in the warm temperate grasslands.

The warm temperate grasslands have been treated by Austin Miller under the China type of climate. But as these grasslands differ from the China type of climate both in the total amount of rainfall and in the natural vegetation, they form a type by themselves under the warm temperate belt. This may be called warm temperate continental type of climate, as it resembles the cool temperate continental type of climate in the distribution of its rainfall and natural vegetation. In the warm temperate grasslands of South Africa and Australia the rainfall is between 15 and 30 inches. However, in the case of the warm temperate grasslands of South America the rainfall is slightly

more. These grasslands lie between the isohyets of 15 and 35 inches.

Nevertheless, in all these grasslands, the grasses are of the same kind. As the warm temperate grasslands occupy a large area in South America there is a great diversity of grasses here. Among the grasses, *stipa aristida*, *melica* and *andropogan* grasses are important. The grasslands are dotted with ombu trees. The warm temperate grasslands of South Africa are not so extensive and hence there is a smaller variety of grasses. Here *aristida* and *andropogan* grasses are important. These grasslands are dotted with mopani trees. Similarly, in the warm temperate grasslands of Australia *stipa* and *andropogan* grasses are important. Here the grasslands are dotted with *eucalyptus* and *unimoras*. In the southern prairies of Texas the grasses are taller than they are in the central and the northern cool temperate prairies of U.S.A. The southern prairies are dotted with mesquites.

Proceedings of the Indian Geographical Conference Held at Annamalai University, Annamalainagar, on the 9th & 10th May 1944

The Annual Conference of the Indian Geographical Society was held at the Annamalai University, Annamalainagar, on the 9th and 10th May 1944, conjointly with the Provincial Educational Conference.

The Conference was opened by M. Ruthnaswamy Esq., C.I.E., Vice-Chancellor, Annamalai University. Dr. M. S. Krishnan the President-elect was then proposed to the Chair by Miss A. R. Irawathy. After the Presidential address on the 'Mineral Resources of South India' was delivered by Dr. M. S. Krishnan, the first day's session concluded with a vote of thanks by the Secretary.

On Wednesday the 10th May, the following papers were read:—

- (1) Historical Geography of the South Arcot District by Sri Rao Bahadur Prof. C. S. Srinivasachari.
- (2) Some Aspects of Drainage in South Arcot by Janab A. Ghulam Mahomad Bahadur, District Agricultural Officer, South Arcot.
- (3) Communication Lines in South Arcot by Sri M. P. Rajagopalan.
- (4) Population in South Arcot District by Mr. George Kuriyan.

Then followed a discussion on the following topics:—

- (1) Place of A-Group Geography in the S.S.L.C. syllabus.

- (2) Question papers in A-Group Geography for the S.S.L.C.

The following resolutions were passed:—

- (1) Resolved that the Conference expresses its thanks to the Director of Public Instruction for having arranged the time table for the S.S.L.C. Examination in such a way

that the paper on Geography is held as the first test for the day and not the last, as was hitherto conducted.

- (2) Resolved that A-Group Geography be given equal status with the other similar subjects like History in the S.S.L.C. syllabus by increasing (i) the duration of the Geography paper from 1 to at least 1½ hours and (ii) the maximum marks from 40 to 50.
- (3) This Conference feels that the question paper in A-Group Geography for the S.S.L.C., for 1944, is in many ways unsatisfactory and the translations of the paper into Tamil and Telugu still more so. As examples of inaccuracies and wrong statements the following are cited:—
 - (a) Question 2 (d):—As it is worded, this is not quite correct, since the towns mentioned are not exactly at the river mouths.
 - (b) Question 8 (b):—This is wrong in two respects. Darjeeling and Calcutta are in different latitudes and the difference in temperature between these stations does not depend upon the altitude alone. Secondly the question involves the relationship between the mean temperature at different latitudes and absolute altitude. There is no known law by which the mean temperature falls with the absolute altitude at different latitudes. If the question merely resolves itself to an arithmetical division, then it is certainly out of place in a paper on Geography and should be relegated to one in Elementary Arithmetic.
 - (c) Question 8 (b):—The paper in English refers to tributaries while the Tamil translation denotes distributaries:—These are fundamentally different.
 - (d) Question 8 (a):—The Tamil translation conveys a meaning of determining the average of the rainfall measures during the year instead of annual rainfall and is therefore misleading to the students.

Further, the Conference feels that the question paper is too long for the time allotted and that it is undesirable to ask only questions which require one word answers, or filling up of blanks by a single word, or group of words.

The Conference therefore recommends that questions on general principles testing the knowledge of the candidates instead of their memory, requiring answers in short paragraphs, be set in future. Further, this Conference requests the Director of Public Instruction to be pleased to issue a new model paper in A-Group Geography based on these suggestions.

- (4) Resolved that the Secretary be authorised to forward a copy of all these proceedings of the Conference together with the Resolutions to the Director of Public Instruction for his favourable consideration.

The Secretary Mr. George Kuriyan then made an appeal for contributions towards the N. Subrahmanyam Memorial id.

With the President's concluding remarks and vote of thanks the Secretary the session concluded.

GEORGE KURIYAN,
Hon. Secretary.

News and Notes

(Contributed)

Prof. Hill's Mission.—Prof. A. V. Hill, Secretary of the Royal Society, London, has come and gone. He saw the working of the various Government bodies, societies, Universities and made his proposals for India's future development on scientific lines. He clearly stated in his farewell talk to Press correspondents at New Delhi that the five scientific organisations in India, *viz* medical, agricultural, industrial, engineering and surveying, should be tied together in some way to ensure a consistent policy for the country to move on. He even emphasised researches of many kinds to be done, including genetics, even breeding of animals did not escape his attention. But he made no mention of that *much neglected branch of Science, Geography* and geographical researches, which in our opinion, are the panacea for all the political and economic ills from which our country is suffering today. If there is any *constructive branch of Science* which takes count of almost all other branches of Science, interpreting the complex relationship between nature and human activities of all kinds, thereby putting a country and its nation on the right path of progress, it is *Geography*. But it is a great pity that a scientist of Prof. Hill's standing should have missed the opportunity to have this important science well established here, especially in the Indian University centres. Even the Delhi University has turned a deaf ear to the nation's call in this respect for a Geography department. No proper planning of any kind can be done without a survey of the geographical conditions existing in the various natural regions into which it should be divided, instead of the present most unnatural and defective man-made presidencies, provinces, districts etc. "The natural resources of India", said Prof. Hill himself, "are very great, but nobody knows yet exactly what and where they are." Exactly so. How can this be known unless the whole land is *properly and geographically surveyed*? This defect in the scheme of reconstruction can only be remedied by a band of self-sacrificing Indian geographers who should be engaged on the task of preparing an authentic regional geography of India, *region by region; on a co-operative basis*. It is high time the Government of India should insist on asking the collaboration of all the Indian

Universities in the matter, giving them substantial grants-in-aid to help them in starting such research centres without the least possible delay.

Geography in the Bombay University.—Prof. Pithawalla, Bombay University Teacher in Geography for Postgraduate Research, we are glad to record, has succeeded in getting Geography introduced as a subject in the Science Faculty for B.Sc., subsidiary from the next academic term, for the first time. Hitherto Geography has been greatly neglected by this premier University in India, most of the senators being ignorant of the value of this subject. It took Prof. Pithawalla and his colleagues *nearly a decade* to have it recognised as a science subject after a hard struggle and we congratulate them on their success.

And yet it seems to us that this is only a half-hearted reform ~~made by the Bombay University~~. Up till now Geography has only been a minor optional subject at the First Year Arts, not Science courses. Just a small section carrying 40 marks is made compulsory at the Matriculation examination in the History paper, so that the students who will take Geography as a subsidiary subject at the B.Sc. will have no grounding whatever at an earlier stage. They will hardly be able to learn the mere rudiments of the Science in the *two terms to be kept for the degree examination*. Besides, it is not understood why *this same course in Subsidiary B.Sc.*, is not simultaneously prescribed for B.A. Pass and Honours. We hope wiser counsels will prevail and Geography will be started in right earnest as a subject both for the B.A. and B.Sc. examinations. Also a Diploma course in Geography for both the present and the would-be teachers is a great desideratum.

"Grow More Food".—For the campaign of Grow More Food which has been started in our country and for which the Government of India spent 2½ lakhs of rupees last year, the attention of the authorities should be drawn to the untold wealth of fish which can be found on our coasts. 5000 miles of India's coastland should provide millions of tons of fish of all kinds for the starving millions. The whole of Bengal could have been saved from the catastrophe thereby. Besides, there are rivers and lakes, which are also rich in fresh-water fishes. But, for this, efficient fishery departments should be organised under expert officers. There is virgin ground for fishing, for example, on the Sind coast, which would give this otherwise backward province an excellent

lead in India and would enable it to exchange this commodity for surplus products of other Indian provinces. *Inter-provincial exchange of goods is the best for national planning in our country.*

At least a portion of the grant of three crores sanctioned for Grow More Food, for the current year, should be set apart for fishery propaganda.



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