

Study of East Coast Laterite soils of Madras State

I. Profile Characteristics

by

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Introduction ; Ever since Buchanan's recognition of the peculiar formation known as laterite, differences of opinion regarding it have been held by soil scientists. Still much remains to be done about the clarification of ideas regarding the formation and also the categorisation of laterite soils and related groups. Most of the laterite area is under favourable climatic conditions. The ever-increasing demand for cultivable lands in India can be solved to a certain extent by exploiting the vast laterite tracts of East Coast of Madras State which have hitherto not been brought under the plough. Moderate rainfall, high temperature and sparse vegetation are the features associated with the East Coast laterite area. The realisation of the handicaps inherent in laterite soils, as seen in the case of West Coast and high level laterites has not been apparent in the case of East Coast laterite soils.

Review of Literature ; Buchanan (1807) gave the term laterite to the soft material lying beneath the surface, which can be cut into the required shape with a trowel or a large knife and becomes as hard as brick and resists air and water much better than bricks; its colour becomes black and its pores and inequalities give it a kind of resemblance to the skin of a person affected with cutaneous disorders. Kellogg (1949) introduced 'latosol' as a pedogenic term. But Mohr and van Baren (1954) were not convinced about the correctness of the term 'latosol' because 'late' meant broad in latin, which deviated from Buchanan's view. Further this term would add to the misconception of associating 'laterite' with a brick-red color instead of with brick itself as a building material as was originally conceived by Buchanan (Prescott and Pendleton, 1952). While sub-dividing red soils, Raychaudhuri (1941) grouped laterite soil as one which had the presence of definite layer of vesicular rock below. According to Sen (1938), if the vesicular structure was in the eluviated horizon, the colour being red and the soil being formed under a fair amount of rainfall, with alternating wet period of four months and dry period of eight months, then the soil may be called laterite.

Latosols, ferrallitic kaolisols (Papadakis, 1962) plinthite and oxisol (7th Approximation, U.S.D.A, 1960) have been given as synonyms for laterite soils. The following are a few local terms for laterite :-

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'*Shurri cull*' in Tamil (Buchanan, 1807), '*Cabook*' in Ceylon (Joachim and Kandiah, 1941), '*Sila laeng*' and '*hin daer*' in Thailand (Pendleton, 1941), '*Cem-pa ran-kal*' and '*Cempurai-k-kal*' as other equivalents in Tamil (Tamil Lexicon, 1928).

Material and Methods: The East Coast laterite is stated to occur in Madras State from Cape Comorin to Madras city according to various survey reports of the Geological Survey of India. The rivers flowing in this area are Thambiraparani, Vaigai, Koriar, Pamaniar, Ikaniar, Cauvery, Pennar, Palar and Gadilam. In the area visited for the present study, laterite is found to occur in detached masses. For making a detailed investigation a tour was undertaken from Manamadurai in Ramanathapuram district up to Madras City, and the localities where the laterite occurred were fixed. Surface features like presence of ferruginous gravel occurring at the surface, and the fact that the laterite blocks were used for building purposes were taken as criteria for recognising laterites in consonance with Buchanan's original definition of laterite.

Generally all the buildings (Karaikudi, Chettinad, Puduvayal and Pallatoor), temple tanks (Pallatoor, Puduvayal and Chettinad), temples (Periakoil of Thanjavur, temples in Pallatoor and Puduvayal), bridges (Karaikudi) and forts (Aranthangi, Vallam and Sivagangai) were observed to have been built with laterite blocks even in very early years. There were some quarries which provided good laterite road metals (Vallam and Pallatoor).

Six profiles were selected from representative areas for morphological description during the field study. The following places were chosen for morphological descriptions:

Name of village	District	Depth in inches
1. Sivagangai	Ramanathapuram	0-58
2. Tirupattur	-do-	0-60
3. Pallatoor	-do-	0-38
4. Vallam	Thanjavur	0-36
5. Capper Quarry	South Arcot	0-84
6. Puzhal	Madras	0-48

The information regarding rainfall, elevation, natural vegetation and drainage was gathered. Depth, boundary, colour (Munsell colour notation), texture, structure, consistency, special features and local variation were taken into account in the morphological description.

Observation: The mean annual rainfall is low, ranging from 27.06 inches (Manamadurai) to 52.58 inches (Capper Quarry) and the rain per day from 0.70 inch (Manamadurai) to 0.94 inch (Capper Quarry). The mean monthly rainfall-evaporation figures in inches for Madras, Madurai and Pamban as was calculated by Raman and Satakopan (1935) are -12.64, -62.15 and -51.4 respectively. These figures can be taken for the East Coast laterite tract also because of their close proximity to the above places. The mean temperature for this tract is 84.0°F. The vegetation in this tract is shrubby in nature and comprises, *Euphorbia* sp., *Zizyphus jujuba*, *Commiphora* sp., *Vitis quadrangularis*, *Cassia auriculata*, *Dedonaea viscosa* and small grass species. Wherever there are deep channels and gullies there is no soil due to accelerated erosion. There is no vegetation in places wherever the ferruginous gravel is left behind by the removal of the fine particles. Cashew is the common cultivated crop. *Eucalyptus* sp. is grown in some places. Paddy and other food crops are also cultivated.

The elevation is more or less uniform, generally between 150 and 300 feet above mean sea level. The land is generally undulating with fair drainage. The following general profile characters were observed in the majority of cases; (Profile descriptions are given in Appendix). The soil horizon was between one and two feet in depth. There was marked similarity in the hue of colour. In no case did the soil matrix exceed 50 per cent, the rest comprising ferruginous gravel and concretions. The size of the gravel exceeded 2mm, the distribution being more or less uniform. The texture was clayey and the structure compact.

In some cases, the subsequent horizons were limited to one, as in the case of Pallatoor and Vallam, followed by consolidated yellowish compact parent material with differently coloured mottles (white, red, brown and violet) which was quarried and used as road metal. The second horizon was found to differ from the first one in the distribution of ferruginous gravel and concretions which amounted to more than 75 to 80 per cent, but there was no variation in other characteristics. Kaolin was found to occur in pockets, the distribution of quartz was sparse in parent material. In the fresh condition it was easy to quarry with the use of ordinary crowbar, but in the laboratory after 20 to 30 days it required considerable effort to break it. Clear-cut line of demarcation was observed between the consolidated material and the horizons above but between horizons, there was diffuse boundary.

In the freshly exposed condition, the yellow consolidated material was found to be clayey. But after 20 days when it was examined in the laboratory, it was difficult to break it with the fingers. Tubular channels were observed in the consolidated material, the length was in some places up to fifteen feet, with one inch thickness.

The vesicular, pitted, indurated laterite stone was observed in the top most portion of the consolidated materials where there was no soil and also in places wherever the consolidated parent material was exposed to atmospheric agencies as in gullies or temple tanks.

Discussion ; The profiles occurring at Vallam and Pallatoor can be taken as type profiles of East Coast laterite soils. The following are the characteristics of the Pallatoor profile. The depth of solum was 36 inches followed by the consolidated compact, yellowish parent material, the laterite with differently coloured mottles (white, red, brown and violet), kaolin occurred in pockets. The parent material was being cut and used as road metal immediately. The solum can be distinguished into two horizons on the basis of the gravel content. Both horizons were brownish red, compact and clayey. The ferruginous gravel was about 50 per cent in the first horizon (0-25") and in the second horizon (25-38"), about 80 per cent. The boundary line was diffuse between solum and parent material. The detailed description is given in Appendix profile No. 3.

The Pallatoor profile resembled more or less that of the West Coast laterite soil profile at the type locality Angadipuram described by Stephens (1961), in the presence of dark red colour, presence of ferruginous gravel in moderate amount and the horizon differentiation on the basis of gravel. From the second foot onwards there was a massive layer of laterite, fairly well defined on the top with red and yellow colour and with light grey mottles increasing with depth which was capable of being cut into blocks with a broad bladed pickaxe at Angadipuram. The vesicular structure described by Stephens was not found in the *freshly* quarried profiles (Vallam and Palltoor).

The East Coast laterite soil profiles were found to differ from the Nilgiri profiles described by Durairaj (1964) in not having a distinct character suggesting colluvial origin, namely, the reversion of the sequence of horizons, in not having a distinct gravel layer consisting mostly of quartz and limonitic material, demarcated from the soil layers above and below, in not having distinct peat and localised kaolin layers, and in the presence of vesicular structure everywhere. *In situ* weathering from charnockite rock was also observed by Durairaj (1964) at Coonoor but during the present study, the original rock from which the laterite derived was not seen.

Summary: The morphological and chemical definitions put forward by geologists and pedologists for defining laterite and the synonyms of laterite have been reviewed. Six representative profiles of varying depth in East Coast area was taken for morphological descriptions. The special features of the locality where the laterite is found to occur in the East Coast of Madras State have been given besides the general observations during the profile study. The

shallow profile was embedded with ferruginous gravel and concretions. The texture was clayey and the structure compact. The colour was found to be red to dark red. The consolidated compact, massive parent material was yellowish with differently coloured mottles of white, red, brown and violet. Kaolin was found to occur in pockets and quartz distribution was sparse. The line of demarcation between horizons was diffuse, while between the solum and the parent material, it was clear-cut.

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