

# "CABOOK" OR LATERITE IN RELATION TO THE SOIL SURVEY OF THE RUBBER GROWING DISTRICTS

By

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## **Introduction.**

The manurial requirements of any crop are known to vary according to the different soil types on which it is grown. And Hevea is no exception to this. With a view to assess the manurial requirements of rubber, several field manurial trials have been laid down by the Rubber Research Institute in different rubber growing districts of Ceylon. In conjunction with this, a programme of soil survey was initiated to find out to what extent the findings of these field trials can be applied to a particular district or districts, on the basis of soil similarity.

In the course of this soil survey, various soil types have been encountered which have been grouped together as *lateritic* soils.

This paper attempts to answer the leading questions on the controversial subject of laterite as far as soil scientists are concerned :

## **What is laterite ?**

Can local *cabook* be called laterite ?

Is the use of the adjective justified in describing a soil ?

The paper was read at the thirteenth annual sessions of the Ceylon Association for the Advancement of Science. It is reproduced here with a view to enlightening the planting public of Ceylon as to what they mean when they describe a soil as laterite or lateritic.

## **Cabook.**

*Cabook* is the Sinhalese name for a mottled deep red, yellow or reddish brown, ferruginous material showing vesicular structure. It has the peculiar property of being soft when newly quarried but becomes hard and compact on exposure to air. Material similar to *cabook* has been used for building purposes in other tropical countries *e.g.* Malaya, Siam and India.

In Ceylon it has been stated that *cabook* occurs chiefly in the low country wet zone, on the Western coast from Negombo to Matara, and for some distance inland. According to Joachim (1) *cabook* in Ceylon is found where the igneous rock charnockite occurs in a region with an annual rainfall of over 100" per annum with dry intervals.

*Cabook* is quarried up to various depths, sometimes as much as 30-40 ft., and occasionally deeper. The surface of these pits is sometimes mantled with concretionary gravel embedded in a matrix of fine clay loam of depth varying from 2-6 feet. The uppermost layer of *cabook* is hard and scoriaceous, but the hardness rapidly decreases with depth, to a point at which it is possible to cut the material into bricks for building purposes. The lower horizons consist of very soft *cabook* containing large proportions of a yellowish white clayey material (chiefly hydrated aluminium oxides) in the interstices.

### Can local cabook be called laterite ?

The term laterite was originally suggested by Buchanan (1807) as a name for a highly ferruginous deposit first observed by him in Malabar during his journey through the states of Mysore, Canara, and Malabar (1800-1). Because of the indefinite and often inexact uses of the term it is worth while to turn back to Buchanan's original description as quoted below :—

“What I have called indurated clay is one of the most valuable materials for building. It is diffused in immense masses without any appearance of stratification, and is placed over the granite that forms the basis of Malayala. It is full of cavities and pores and contains a very large quantity of iron in the form of red and yellow ochres. In the mass, while excluded from the air, it is so soft that any iron instrument readily cuts it and it is dug into square masses with a pick-axe and immediately cut into the shape wanted with a trowel or large knife. It very soon after becomes as hard as brick and resists the air and water much better than any bricks I have seen in India.

As it is usually cut into the form of bricks for building it is in several of the native dialects called brickstone. The most proper English name would be laterite, from ‘lateritis,’ the appellation that may be given to it in science.”

The derivation of the word is from the Latin “later” meaning a brick and obviously relates to its use as a building material and not to its red colour.

Following Buchanan, the word laterite has been used by geologists and soil scientists all over the world.

In 1931 Fermor, Director of the Geological Survey of India, in his editorial introduction to the report on Buchanan's laterite of Malabar by Fox, (3) states :—

“Buchanan's original laterite consists mainly of what we should now call lithomargic laterite and even in part lateritic lithomarge, and that the rocks studied by Buchanan represent but a stage in the passage from granites and gneisses through kaolin or lithomarge, characterised by the presence of combined silica, to a rock consisting mainly of hydrated oxides of alumina and iron in which combined silica is characteristically absent. The latter portion of this process of weathering or change is now generally known as laterization, and the final product is known as laterite. From this point of view Buchanan's laterite is an intermediate form needing some qualifying adjective such as ‘lithomargic.’

“If Dr. Fox were possessed of the zeal shown by some systematists who delight to upset established usage in favour of the strict application of the laws of priority, often with either annoying or amusing results, he would now propose that the term laterite should be restricted to the lithomargic rocks studied by Buchanan, and

that a completely new term should be adopted for the high level laterites of Deccan. Such a proposal would also necessitate the scrapping of the term laterization. However, Dr. Fox has shown a sense of proportion in recognising the facts of present usage, and it is clear from his paper that in future, whilst the term laterite can be applied in a comprehensive sense both to Buchanan's laterite overlying original acid rocks, namely granites and acid gneisses, and to the high level laterites of the Deccan overlying basic rocks, mainly basalts, yet when it is desirable to be more precise, we must regard the high level laterites of the Deccan as the finished products—the fully formed laterite—whilst Buchanan's laterite of the Malabar coast must in the main be regarded as lithomargic laterite, in so far as it has not become a more finished laterite."

From the above description it is evident that the local *cabook* fits in with the material originally described as laterite and may rightly be called laterite.

Various views have been expressed as to the origin of laterite and the process of laterization, but a discussion of that subject is not appropriate in the present context.

### **Cabook and Associated Soils encountered in the Low Country Wet Zone.**

In this region, and at elevations of up to 500 ft., *cabook* is quarried in different areas at various depths with an average of about 2 feet from the surface. In some areas the hard honeycomb laterite is seen protruding on the surface. There are other areas where the quarriable *cabook* layer is not very deep. However, these *cabook* occurrences are not very extensive and therefore soils developed solely on laterite are not found to a great extent.

But the majority of the soils encountered seem to have some connection with *cabook* either by their morphological appearance or by the presence of one or more of the constituents found in profiles containing *cabook*.

Deep, compact, gravelly soils, with colour variations, both within and between profiles, of red and pinkish red to reddish yellow and yellowish brown are of common occurrence. Ironstone gravel or quartz are generally associated with such soils. There are others with ironstone gravel that show no distinct colour horizons except for the surface layer which, in virgin soils especially, is brownish due to the admixture of humus. In still other soils pieces of hard honeycomb laterite may be present on the surface or in the profile.

Certain soils show the morphological characteristics of *cabook* but lack the cohesive properties of same and therefore are not quarried for building stones. These are less indurated and therefore softer than *cabook*. To what extent are the above soils laterite or lateritic?

The presence in soils of one or more of the constituents found in a *cabook* quarry may be due to pedogenesis following the dissection of a true laterite profile or may be due to their formation *in situ*.

For example (a) Ironstone gravel, called "Boralu" in Sinhalese, may arise as a result of breakdown of hard honeycomb laterite crust or as a result of true laterite being exposed, transported to other sites and subsequently broken down or it may have been formed by the deposition of iron compounds on suitable nuclei, such as broken pieces of rock or quartz either in profile or on the surface of the soil, in areas of suitable moisture status.

(b) Hard honeycomb laterite boulders may be present due to the dissection of true laterite profile and subsequent transport of broken boulders. (It is likely that big boulders of hard honeycomb laterite encountered in many rubber-growing areas may have resulted in this manner). On the other hand, there is evidence of material similar to hard honeycomb laterite being formed as a result of the natural process of weathering of undecomposed pieces of rock on the surface of the soil.

Obviously these soils cannot be laterite. Nor can they be described as lateritic, for the origin of the said constituents may or may not be from a true laterite.

Soils with horizons resembling *cabook* morphologically but differing from it physically cannot be described as laterite or lateritic for the reason that they differ from the original description of laterite.

It is possible that these differences may be due to variations in the parent material or that the process of laterization is not complete. But until such time as the origin of laterite and the process of laterization is clearly understood, it may not be advisable to use the adjective "lateritic" in the description of these soils.

Other workers have tried to use the difficultly determined and often meaningless criteria of  $\text{SiO}_2/\text{R}_2\text{O}_3$  or  $\text{SiO}_2/\text{Al}_2\text{O}_3$  ratios of the clay fraction to determine whether or not a soil is a laterite or is lateritic.

#### **Elastic use of the word laterite.**

The above is typical of the confusion on a wide scale by pedological authorities in regard to the use of the word laterite and its derivatives.

Joachim (4), working on the composition of Ceylon laterites, found that analyses of laterite samples showed great variations in composition dependent on—

- (a) The rock from which the sample was derived.
- (b) The depth from which it was taken.

In view of this marked variation he states that the classification of soils into laterite, lateritic and non-lateritic on the basis of chemical criteria alone, *e.g.*  $\text{SiO}_2/\text{R}_2\text{O}_3$  ratio of the clay fraction, is likely to be misleading. But being of the opinion that these ratios are a useful index for classifying soils on a broad basis he has classified a "Bata" jungle sandy loam, a "deniya" soil and an "owitta" soil, as being laterite or lateritic on the results of his analyses. (5)

$\text{SiO}_2/\text{R}_2\text{O}_3$  ratios are interesting and useful when considering large areas but do not distinguish sufficiently between agriculturally separate soils within such areas.

Kellogg (6) has suggested that laterite be defined as ferruginous material that hardens on exposure and the relics of such material. This definition would include the following forms of sesquioxide rich materials:

- (1) Soft mottled clays that change irreversibly to hard pans and crusts when exposed.
- (2) Cellular and mottled hard pans and crusts.

- (3) Concretions.
- (4) Consolidated concretions.

He has further suggested that a new term "Latosol" be adopted to comprehend all the zonal soils in tropical and equatorial regions having their dominant characteristics associated with low silica-sesquioxide ratios of clay fraction, low base-exchange capacities, low activities of the clay, low content of most primary minerals and few other properties. This name has been proposed at the categorical level of suborder.

Some of the Dutch workers in East Indies have gone even to the extent of calling anything red and rich in iron and alumina under rain forest conditions as lateritic. Van der Voorte (1950) (7) justifies the action of describing even red limestone soils which occur widely in the limestone area of South-Eastern Java as red lateritic limestone soils.

### **Suggested Soil Distinctions.**

In view of what has been said it is evident that there is a need for criteria giving a reasonable number of soil distinctions in describing and classifying soils associated with laterite. We must therefore seek more specific criteria appropriate to detailed as opposed to wide-scale reconnaissance work. Preferably such distinctions should be real and reflected in agricultural variations.

Proper *cabook* soils are obviously one such distinction, with clear agricultural association, but may have to be distinguished from *cabook*-like soils which resemble *cabook* morphologically but differ from it physically. These are of greater agricultural value.

Proper *cabook* soils may also have to be distinguished from artificial *cabook* soils based on  $\text{SiO}_2/\text{R}_2\text{O}_3$  or similar ratios.

Similarly other soils may be distinguished by an apparent association with true *cabook* subsequently broken up and/or transported. The presence of material for the most part mechanically derived from hardened *cabook* will affect the nutritional value of a soil.

### **Conclusion.**

The whole subject seems to be very controversial. It appears safer to adhere to the original clear definition and to classify soils in terms of this definition rather than try to introduce criteria not in the original description.

This paper has been written in order to stimulate discussion on a controversial subject which needs clear thinking and a fresh outlook. This would also serve to emphasize the need for greater co-ordination between organizations engaged in similar work, so that some day it may be possible to produce a soil map of Ceylon.

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