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A NOTE ON LATERITIZATION CYCLES ASSOCIATED WITH SEDIMENTARIES, KASARAGOD DISTRICT, KERALA

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Abstract

Laterite overlying the Tertiary sediments is a common feature throughout Kerala. The occurrence of lateritic zones underlying the Tertiary sediments are reported from north Kerala. Their nature and mode of occurrence are suggestive of two lateritization spells.

Introduction

The Tertiary sequence of Kerala has been divided into Quilon beds (Middle Miocene) and Warkalli beds (Mio-Pliocene), unconformably overlying Precambrian granulites, gneisses etc (Paulose and Narayanaswamy, 1968). Based on surface and subsurface data, the sequence was divided into three formations, under Warkalli Group (Raha *et al*, 1983), Laterite/bauxite below the sedimentary rock was reported from several localities in Kerala (Paulose 1967, Subramanian and Mani, 1978; Mallikarjuna *et al*, 1981). According to Subramanian and Mani (1978) these are faulted and are a part of planation surfaces found in the western Ghats. Mallikarjuna *et al*. 1981 suggest three spells of lateritization, the first spell underlying the Tertiary sediments, the second overlying the Tertiary sediments and the third one overlying the Quaternary sediments.

The field relations, mineralogy and geochemistry of the recent finds of laterite under the Tertiary sections around Cheruvathur (12°13'15" : 75°09'40") and Nileswar (12°13'25" : 75°07'00") in north Kerala (Fig. 1) are discussed here.

Field Relations

Sedimentary sections around Cheruvathur, Karyankote and Nileswar reveal that the sedimentary units are sandwiched between two laterite horizons (Fig. 2 and Table I). Field observations indicate a detrital component at the top and a residual component at the base. The laterite at the bottom has relict textures of the parent rock. A gradual transformation of charnockite to weathered zone (kaolinised bed) and *in situ* laterite development is clearly visible.

The boundary between the laterite at the bottom of the sections and the sediments is sharp, in contrast to the gradational contact of the topmost laterite and the sediments. This gradational contact is probably due to *in situ* lateritization of the upper part of the sediments, which is further substantiated by relict sedimentary features like current bedding which occur in the overlying laterite. The laterite underlying the sedimentaries is hard and compact and fine-grained as compared to the laterite exposed at the top of the profiles.

Chemistry and Mineralogy

The laterite below the Tertiaries (laterite-I) has more SiO_2, Al_2O_3 and less Fe_2O_3 than the (laterite-II) over the Tertiaries (Table II), Ternary diagram (Shellman 1979) of SiO_2. Fe_2O_3 and Al_2O_3 (Fig 3) indicates that laterite below the

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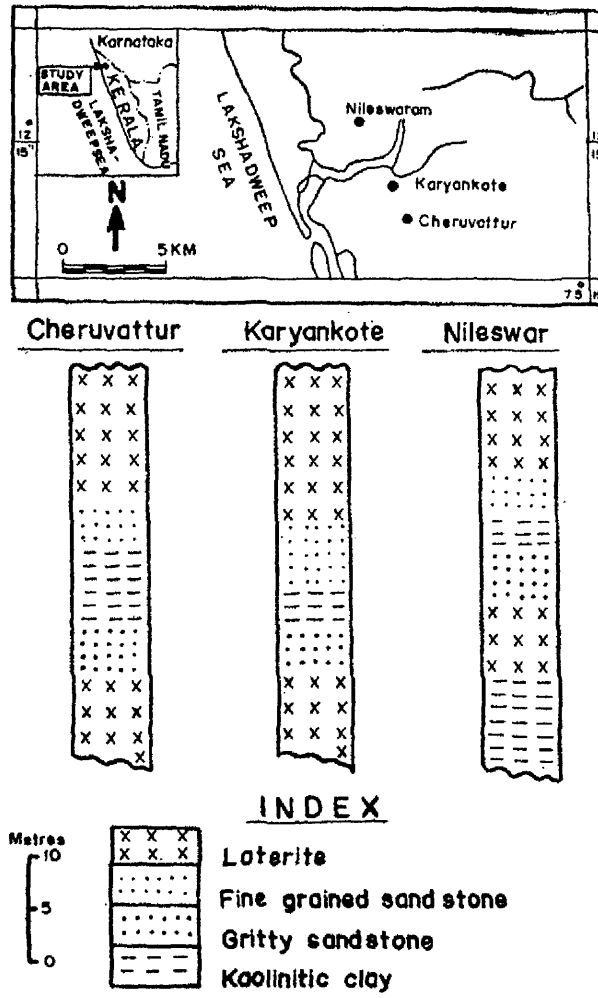

Figure 1. Location map and lithological sections at Cheruvathur, Karyankote and Nileswar.

Tertiaries is weakly lateritized compared to the laterite occurring above. Mineralogical study reveals significant increase of coarse quartz grains which are mostly angular to sub-angular and minerals like goethite and hematite in the laterite at the top as compared to the laterite at the base. Study of the results of X-ray analyses of laterite samples (laterite I and laterite II) indicate characteristic mineralogical constituents (Fig. 4) in both types of laterites, such as kaolinite, gibbsite, goethite quartz and hematite. There is a high incidence of gibbsite in the laterite below the sedimentaries (laterite I in Fig. 4).

Heavy mineral studies suggest that the parent material for laterite below the sedimentaries must have originated from charnockitic rocks. The heavy mineral assemblage of the top laterite does not compare with that of the laterite at the base and is suggestive of a different source for the laterite at the base.

Figure 2. Stratigraphic section exposing laterite at the base and overlying sedimentaries and laterite at Karyankote.

TABLE I. Lithologic units exposed at Cheruvathur, Karyankote and Nileswar.

Lithology	Thickness in metres (approx.)
Laterite	: 4.50 m – 12 m
Red ferruginous fine-grained and cross-bedded sandstone	: – 3.5 m
Kaolinitic clay admixed with sand	: 0.50 m – 3.5 m
Ferruginous gritty sandstone	: 0.50 m – 1.5 m
Laterite	: 2.0 m – 4.0 m
Kaolinitic clay	: 2.0 m – 3.0 m

(base not exposed)

TABLE II. Major elements in the laterite samples, Kasaragod Dist., Kerala.

Samples	Locality	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	TiO_2	Na_2O	K_2O	Moist.	LOI
C-1-A	Cheruvathur-laterite-I	43.8	13.57	26.98	0.10	0.10	0.005	0.65	0.23	1.89	12.34
C-1-B	Cheruvathur-laterite-II	12.41	43.90	23.93	0.15	0.10	0.01	1.05	0.20	2.44	14.86
N-1-A	Nileswar-laterite-I	45.61	12.33	24.95	0.10	0.10	0.005	0.65	0.24	2.68	12.90
N-2-B	Nileswar-laterite-II	15.60	48.01	23.93	0.10	0.10	0.005	0.58	0.26	2.14	9.24

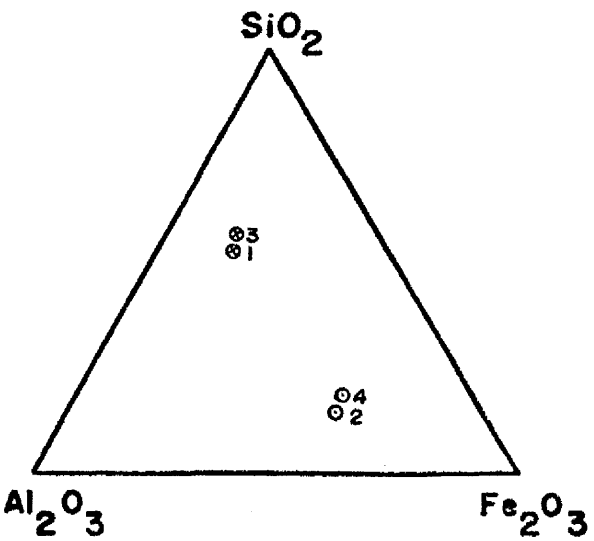

Figure 3. Position of laterites in the ternary diagram: 1) Cheruvathur laterite - I; 2) Cheruvathur laterite - II; 3) Nileswar laterite - I; 4) Nileswar laterite - II.

Discussion

Gradual downward passage of laterite into kaolinitic clay and weathered crystalline rocks and the heavy mineral assemblage point to the *in situ* nature of the laterite underlying the sedimentaries. The predominance of gibbsite in this laterite suggests initiation of desilication or bauxitisation due to some favourable conditions. At a later stage this desilication process stopped and lateritization processes commenced (Rao, 1981). The sedimentary sections of these areas indicate that the laterite at the bottom is overlain by gritty ferruginous sandstone. This sequence of ferruginous sandstone was identified elsewhere in Kerala as the oldest Tertiary sequence (Raha and Rajendran, 1984). The occurrence of laterite under the Tertiary sediments suggests that there was a period of widespread lateritization in Kerala during the Early Tertiary period (Valenton, 1972, Mallikarjuna *et al*, 1981).

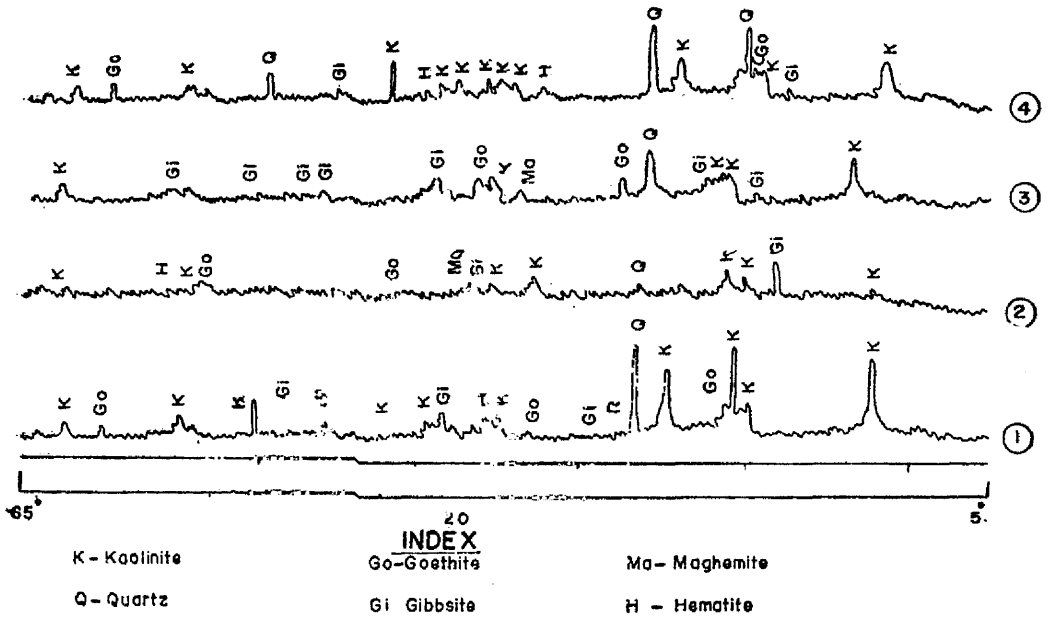

Figure 4. X-ray diffraction of laterite samples: 1) Cheruvathur laterite – I; 2) Cheruvathur laterite – II; 3) Nileswar laterite – I; 4) Nileswar laterite – II.

The laterite overlying the Tertiary sequence is suggestive of another spell of lateritization during upper Tertiary period. Paleomagnetic data of the laterites over the Tertiary sediments in south Kerala also indicate a mid to late-Tertiary age (Schmidt *et al*, 1983). Thus it can be surmised that there are two lateritization cycles in the area under study.

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