

SAND GRAIN MINERALOGY OF PATTUKKOTTAI SERIES IN LATERITIC SOIL TRACT

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ABSTRACT

Four profiles of Pattukkottai series of lateritic soil tract, Sivagangai taluk were studied for the various sand grain minerals. The Pattukkottai series is a red soil formed in-situ from plinthite mixed with weathered gneisses having a thick argillic horizon, extending over 150 cm depth of solum. It contains less of heavy minerals and more of light minerals, indicating the oldness of soil. The coarse sand fraction contained more light minerals than fine sand. Among the minerals, quartz was the most predominant in both coarse and fine sand fractions under this lateritic soil tract.

KEY WORDS : *Lateritic Soil, Mineralogical studies*

The mineralogical make up of earth crust decides the important physical and chemical properties of soils. It is obvious that the mineralogy of the soil particle size fractions will help for making effective land use and management for increasing crop production. The mineralogical studies of soils in Tamilnadu are very much inadequate. With this background, the study was taken up for a dominant soil series in typical lateritic tract. The average rainfall of the study area varies from 700 to 800 mm and the mean summer, mean winter and mean annual temperatures are 30.30°C, 24.9°C, and 28.7°C respectively.

MATERIALS AND METHODS

Horizonwise samples of four profiles from Nedumangalam, Sholapuram, Sembanur and Pullangulam of Sivagangai Taluk, Tamilnadu were

studied (Soil Survey Staff, 1951 and Sampath, 1987). The mechanical analysis was carried out as per the International Pipette method (Piper, 1966) to get sand fractions. Fine sand and coarse sand grains minerals were identified on numerical basis as per the technique and criteria prescribed by Milner (1962).

RESULTS AND DISCUSSION

The morphological study revealed that the Pattukkottai series was a red, medium to fine textured, very deep, neutral, very well developed and thick argillic horizon containing soil developed from granitic gneiss overlaid with plinthitic stone (Sampath, 1987). It was a member of fine loamy, illitic, non-acid, hyperthermic family of Ultic Haplustalfs (Soil Survey Staff, 1975).

Table 1. Sand grain mineralogy of Pattukkottai series (Per cent on numerical basis)

Horizon	Depth in cm	Heavy minerals										
		Qz	Fel	Apa	Pxn	Hb	Bio	Gar	Lim	Mag	Pli	Mus
Pedon I Nadumangalam. 5th km from Lalaiyarkovil to Thiruvandanai road - left side - 150m												
Ap	0-18	96(92)	..(3)	...	...	...	..(1)	...	...	1(3)	3(1)	...
Blt	18-40	96(90)	..(6)	...	...	...	..(1)	...	...	1(1)	3(2)	...
B21t	40-52	95(86)	..(2)	...	...	...	..(4)	...	...	1(3)	4(5)	...
B22t	52-110	90(85)	..(4)	...	...	...	..(2)	...	...	2(2)	8(7)	...
B3	110-140	90(83)	..(2)	...	...	...	..(5)	...	...	2(5)	6(5)	...
Pedon II Sholapuram. Sivagangai to Sholapuram main road - 7th km from Sholapuram - 250m-rightside												
Ap	0-15	90(93)	..(3)	...	...	...	..(1)	...	...	7(1)	3(2)	...
B21t	15-62	88(91)	..(2)	...	...	...	..(2)	...	...	5(3)	7(2)	...
B22t	62-87	86(83)	..(4)	...	...	...	..(1)	...	...	4(5)	10(7)	...
B3	87-132	87(81)	..(3)	...	...	...	..(3)	...	...	6(6)	7(7)	...
Pedon III Sambanur. Thiruvadanai - Sambanur road - 0.5 km from sambanur - 150m - right side.												
Ap	0-10	94(92)	..(4)	...	...	...	..(1)	...	...	2(1)	4(2)	...
Blt	10-50	92(82)	..(3)	...	...	...	..(2)	...	...	2(5)	6(8)	...
B21t	50-80	92(82)	..(2)	...	...	...	..(4)	...	...	5(3)	3(9)	...
B22t	80-109	90(83)	..(3)	...	...	...	..(4)	...	...	4(2)	6(8)	...
B3	109-148	89(82)	..(4)	...	...	...	..(1)	...	...	7(5)	4(8)	...
Pedon IV Pullangulam 1.5km from Pullangulam - Sivagangai road - left side - 200 m.												
Ap	0-13	88(87)	..(5)	...	...	...	..(3)	...	...	2(1)	10(4)	...
Blt	13-43	87(86)	..(2)	...	...	...	..(2)	...	...	3(3)	10(7)	...
B21t	43-79	85(86)	..(2)	...	...	...	..(2)	...	...	5(5)	10(5)	...
B22t	79-103	85(81)	..(4)	...	...	...	..(5)	...	...	4(5)	10(5)	...
B3	103-143	85(81)	..(5)	...	...	...	..(4)	...	...	7(4)	8(6)	...

The figures in parenthesis refer to fine sand fractions.

Qz-Quartzite; Fel-Feldspar; Apa-Apatite; Pxn-Pyroxene; Hb-Hornblende; Bio-Biotite; Gar-Garnet; Lim-Limonite; Mag-Magnetite; Pli-Plinthe; Mus-Muscovite

The minerals of fine and coarse sand fractions are presented in Table 1.

Light minerals.

The data revealed that the light minerals varied from 85-86 and 81-93 per cent in this coarse and fine sand fractions respectively in this series. There is a decreasing pattern with depth in all pedons, possibly due to well developed pedon differentiation. There was not much difference between coarse sand and fine sand fractions with respect to both total light minerals and total heavy minerals. This might be due to the parent materials composition and initial stage of weathering of original parent material. In all the four pedons studied, the light minerals dominated markedly over heavy minerals due to relative resistance to weatherability of the former. This is in line with the view of Naglikar (1980), Bosch et al., (1993), Rao and Kirshnamurthi (1982), and Sahu et al (1983). Similar proportions of light minerals to heavy minerals were reported by and Balasubramanian (1987).

Among the predominant soil series of the tract, viz., Pattukottai, Madukulam Kothakottai and Padalur as mentioned by Sampath (1987), Pattukottai series had relatively the highest amount of light minerals. Consequently, the heavy minerals (percentage in both fractions of sand) was the least in Pattukottai series. The above observation from the data clearly revealed the easy weatherability of heavy minerals in relation to light mineral. In this juncture, a note worth and confirmative inference could be drawn that the Pattukottai series

is highly weathered and pedogenetically advanced owing to the highest amount of light minerals (resistance to weathering) and least heavy minerals (easily weatherable) present in its pedons. Amount the light minerals, the quartz dominated exceptionally over the others in all the four pedons. Very little feldspars was identified especially in fine sand fraction and apatites were missing totally in all these pedons, indicating the relatively more weatherable nature of apatite and feldspar than quartz and old age of soil formation. The abundance of quartz would lead to predict that these red and lateritic soils might have been derived from acid igneous rock like granites or granitic gneisses. These are in agreement with the remarks of Sahu et al. (1983).

The heavy minerals in coarse sand fractions varied from 4-15 per cent. In fine sand fraction, it ranged from 4-16 per cent. As already pointed out, the total of heavy minerals was the least in Pattukottai series comparing with other predominant soil series of the lateritic tract of Sivagangai taluk, confirming the most weathered and highly developed nature of Pattukottai series.

Among the heavy minerals, the plinthite dominated over the others in both the fractions of sand in all the four pedons, followed by magnetite. The absence of garnet, hornblende, haematite, biotite etc. in coarse sand and fine sand fractions pointed out their easy weatherability. The presence of plinthite, in all the pedons indicated the fact that there was atleast partial laterization in

this region possibly due to the conducive palaeo-climate. Absence of haematite and less of magnetite indicated the easy weathering of them, becoming the constituent of soil and enhancing the iron content of these soils. Based on this sand mineralogy, it could be projected

that these soils would not show any deficiency of iron for crops growing on them. These are in agreement with conclusions of Harikrishnan Nair and Koshy (1982) and Balansubramanian (1987).

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