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Effect of Toposequence on Morphological Characteristics of Soils from Alagar Hill's Toe Slope to Vaigai River Basin, Madurai District, Tamilnadu , India

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Abstract
In Madurai North taluk, Madurai district, TamilNadu , India from Alagar hill's toe slope near Ayathampatty to Vaigai river's alluvial fan near Vandiyur, ten different soil profile sites were fixed approximately at 2 km intervals and 2 pedons in each site were dug up to 50 m apart, examined and morphological properties were described. The data revealed that the development of pedon in different lands is as follows. The sites 1, 2 and 3 fall under foot hill 4, 5 and 6 are distributed in basin position, while the sites 7 and 8 occupy basin rim position and the sites 9 and 10 are in alluvial fan. The solum depth is a function of slope generally. The reddish colour is dominant in upper topography up to basin position. But the alluvial fan position soil is pale yellow to olive. Based on the soil properties, the pedon development in the transect follows the order: Basin> upper terrace > basin rim > lower terrace > foot hill > alluvial fan. The morphological details reveal that the solum depth increases with decreasing elevation from foot hill to alluvial fan position

Keywords: *Solum, pedon, basin, Alluvail fan and Toposequence*

1. INTRODUCTION

Soil and land resources form the basic wealth of a nation. India, being an agricultural country, has to be developed further by utilising the rich potentialities in the land area. For agricultural property in any region, a thorough understanding of the soil resources and limitations is highly essential. The soil, water and nutrient management in a tract from site to site according to the physiographic position and the individual soils potentialities. There is every possibility for necessity to manage the soil according to land position in the transect from upland or foot hill to basin and alluvial fan positions. Even in each and every natural land division, soil differences count in a big way to decide the management strategy to be followed. Bearing the above points of importance in mind, the present investigation of a catenary sequence studies on soils from Alagar hill's toe slope (Near Ayathampatty) to Alluvial fan position of Vaigai river (near Vandiyur) was carried out.

2. MATERIALS AND METHODS:

In Madurai North taluk, from Alagar hill's toe slope (Ayathampatty) to Vaigai river (Vandiyur), a study on catenary sequence of soils was taken. Ten profile sites at an interval of approximately 2 km were selected. The approximate elevations at the different profile sites from foot slope to Vaigai river were taken from a toposheet of the tract. The values were 230, 195, 175, 156, 150, 146, 142,141, 138 and 122 m above Mean Sea Level (Fig .1) . Considering the physiography of the area of the transect line, the individual site comes under the following natural land divisions of physiography.

Site No	Place	Elevation MSL	Natural land division
1	Ayathampatty	230	Foot hill
2	poi kaikaraipatty	195	Upper terrace
3	Kallanthiri	175	Upper terrace
4	Mathoor	156	Basin
5	Arampanoor	150	Basin
6	Karungalakudi	146	Basin

7	Kadkshi vanendal	142	Basin rim
8	Uthankudi	141	Basin rim
9	Lakea rea	138	Alluvial fan
10	Vandiyur	122	Alluvial fan

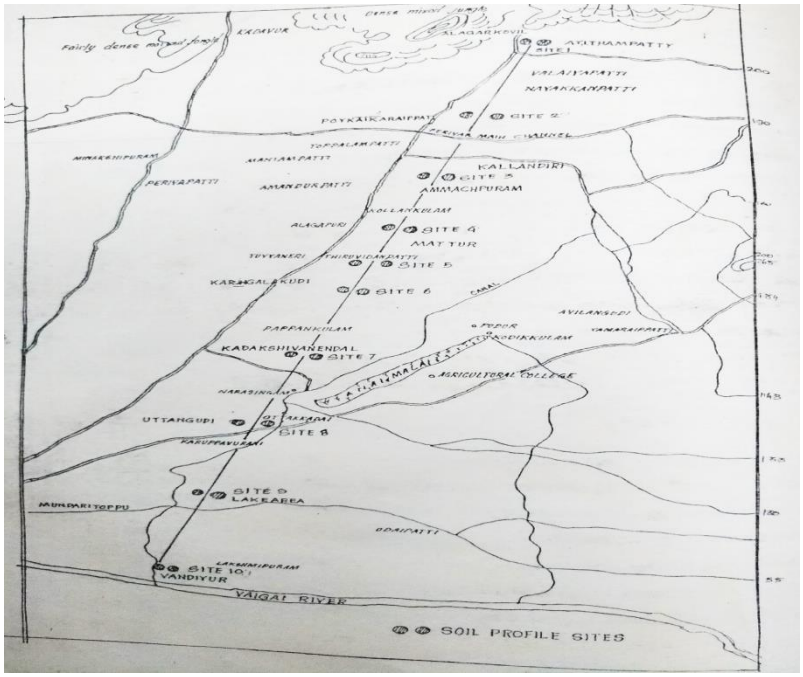


Fig. 1. Physiography and location of Soil profile in the study area

In each profile site, 2 profiles were dug up 50 m apart examined, described and horizonwise soil samples were drawn for laboratory analysis. In each profile site, infiltration study was also made. In addition to horizon wise bulk sample, the undisturbed core samples also drawn for hydraulic conductivity and in-situ bulk density measurements. Since both the soil profiles in each elevation site were quite alike in morphological characteristics, only one pedon for each site is described. The descriptions of the ten pedons at the rate of one pedon per site are given below.

3. RESULTS AND DISCUSSION

The study area lies from Alagar hill's toe slope near Ayathampatty to Vaigai river near Vandiyur in Madurai North taluk. Geographically, the transect line lies between 9°53' and $10^0$3' north latitude and approximately in 78° 10' east longitude line. The area has semi arid tropical climate with the summer season from March to May and winter season from December to February. The average annual precipitation is about 8000 mm with about 44.03 per cent benefit from North East Monsoon , 39.31 per cent from South West Monsoon and the rest from summer showers.

3.1.MORPHOLOGICAL CHARACTERISTICS

SITE 1 AYATHAMPATTY SITE

SITE VIEW

PROFILE VIEW

Site characteristics:

Soil type - Ayathampatty sand; Location Mrs. Alagupillai Gurunathan's field - R.S. No 22/2 centre of the field - Ayathampatty; Geographical land scape - foot hill / toe slope; Slope - B; Erosion - e_3; Aspect - south; Ground water table - 20 m; Drainage Excessively drained; Salt, alkali - Nil; Mode of formation - Secondary; Parent material - Weathered granitic gneiss; Climate - Mean annual temperature - 33°c, Mean winter temperature - 28.3°c, mean summer temperature - 35.0°c and mean annual rainfall – 800 mm; Natural cover - Prosopis, Neem, Calotropis, Acacia and grasses; Soil profile group - IX; Higher categories - Entisol: Genetically related soil series - Chavadiparai and Vyalogam series.

Pedon features:

Horizon	Depth (cm)	Description
AP	0-5	Reddish brown (2.5 YR 4/4), Reddish brown (5YR 4/4) ; sandy; massive; loose, friable, non sticky and non - plastic; many, medium to fine roots; many pores; rapid permeability; clear wavy boundary; pH 7.35.
A12	5-25	Reddish brown (2.5 YR 4/4), reddish brown (5YR 4/4); sandy clay loam; moderate, medium to coarse, sub angular blocky; slightly hard, slightly firm, slightly sticky, and slightly plastic; few, medium grass roots; many pores; few, medium dark brown ferruginous gravels; clear wavy boundary; moderately rapid permeability; pH 5.30.
C1	25-55	Yellowish red (5 YR 4/6), reddish brown (5YR4/4); sandy loam; moderate, fine, sub angular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few pores; many round angular cobbles and gravels; rapid permeability; clear smooth boundary; pH 6.0.
C2	55 - 90	Reddish brown (5YR4/4), Reddish brown (5YR4/4); sandy clay loam; moderate, medium to coarse, sub angular blocky; slightly hard, friable, slightly sticky and slightly plastic; few pores; moderately rapid permeability; many round and angular cobbles; clear wavy boundary; pH 6.5.
C3	90-188	Weathered granitic gneiss

SITE 2 - POIKAIKARAIPATTY

Site View

Profile view

Site Characteristics:

Soil type - Madukkur loamy sand; Location Mr. K. Paramasivam - Poikaikaraipatty well site No. 69/5, centre of field; Geographical land scape - upper terrace; Aspect - south; Slope - B; Erosion - e_3; Ground water table 25 m; Drainage - moderate; Salt and alkali - nil; Mode formation Secondary; Parent material - Weathered granitic gneiss; Climate - Mean annual temperature - 32°c, mean winter temperature 32°c and mean summer temperature - 32.3°c, and mean annual rainfall - 800 mm; Nature cover - Prosopis, Acacia sp, grasses; Soil profile group - VII; Higher categories - Alfisol; Genetically related soil series - Irugur and Madukkur.

Pedon Features:

Horizon	Depth (cm)	Description
A11	0-20	Yellowish red (5YR 5/8), reddish brown (5YR 4/4); loamy sand; massive; loose, friable, non-sticky and non-plastic; few fine roots; many pores; ferruginous gravels; abrupt and irregular boundary; pH 6.0
A12	20-60	Dark brown (7.5YR 4/4), reddish brown (5YR4/4): loamy sand; massive; loose, friable, non-sticky and non-plastic; few fine roots; many pores; abrupt and irregular boundary; pH 6.2.
$B21_t$	60-90	Dark red (2.5 YR 3/6), red (2.5 YR 3/6); sandy clay loam; weak, coarse, sub-angular blocky; hard, friable, sticky and plastic; many thin clay skins on ped faces; few fine tubular pores; few, medium roots; moderately rapid permeability; few round cobbles; diffuse smooth boundary; pH 6.4.
C1	90-150	Reddish brown (2.5YR 4/4), red (2.5YR 3/6); loamy sand; massive; loose, very friable, non sticky and non-plastic; common tubular pores; many fine grass roots; few round cobbles; excessively rapid permeability; clear smooth boundary; pH 6.8.
$C2_{ca}$	150 +	Weathered granitic gneiss

SITE 3 : KALLANTHIRI

Site view

Profile view

Site characteristics:

Soil type - Kallanthiri sandy loam; Location - Mr. Vivekannandam Bose's field, 10 m west of the Kallanthiri rice mill - centre of the field - Kallanthiri; Geographical land scape- lower terrace; Aspect - south; Slope - B; Erosion - e_2; Ground water table - 6 m; Drainage - well drained; salt, alkali - nil; Mode of formation secondary; Parent material - weathered granitic gneiss; Climate - mean annual temperature - 33°c, mean winter temperature - 28.3°c, mean summer temperature - 35°c and mean annual rainfall 820 mm; Nature cover grasses, weeds, Babul and Neem; Profile group - I; Higher categories - Entisol; Genetically related soil series Noyyal.

Pedon Features

Horizon	Depth (cm)	Description
Ap	0-15	Very dark grey (5YR 3/1), very dark greyish brown (2.5Y 3/2); sandy loam; moderate, medium, sub angular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many fine tubular pores; many fine roots; moderately rapid permeability; clear smooth boundary; pH 7.2
A12	15-35	Light browinsh grey (2.5YR 6/2), dark greyish brown (2.5 YR 4/2); sandy loam; fine, weak, sub angular blocky; slightly hard, very friable, slightly sticky and non- plastic; few, fine roots; moderately rapid permeability; abrupt smooth boundary; pH 7.4.
C1	35-130	Dark brown (7.5YR 4/4), dark brown (7.5YR 4/4); sandy loam; medium, fine, sub angular blocky; slightly hard, Very friable, slightly sticky and non - plastic; few fine roots; few round stones; abrupt smooth boundary; pH 7.6.
C2	130-165	Strong brown (7.5YR 5/6), dark brown (7.5YR 4/4); loamy sand; medium, fine, sub angular blocky; loose, very friable, non- sticky and non -plastic; few round stones; clear smooth boundary; pH 7.7
C3	165-200	Strong brown (7.5 YR 5/6), dark brown (7.5 YR 4/4); sand; single grained; very friable, gritty, non sticky and non plastic; very fine roots; many round stones; excessive permeability; clear wavy boundary; pH 7.8.
C4	200 +	Weathered granitic gneiss

SITE 4 – MATHOOR

Site view

Site Characteristics

Soil type - Anaiyur sandy clay loam; Location Mr. I. Ponnaian Ambalam, at the centre of the R.S. No 76F/1 field - Mathoor; Geographical land scape - basin; Aspect - south; Slope - B; Erosion - e_2; Ground water – 5 m; Drainage - moderately well drained; Salt and alkali - moderate; Mode of formation - secondary; Parent material - weathered granitic gneiss; Climate - mean annual temperature - 34°c, mean winter temperature - 29°c, mean annual rainfall – 800 mm; Nature cover - Neem, Cynodan and Acacia; Profile group - III; Higher categories - Alfisol; Genetically related soil series - Padugai, Alathur and kalathur series.

Pedon Features

Horizon	Depth (cm)	Description
Ap	0-25	Light grey (5 YR 7/1), grey (5 YR 5/1); sandy clay loam; weak, coarse, sub angular blocky; hard, firm, sticky and plastic; continuous moderate skins, many fine tubular pores; many roots; moderately rapid permeability; clear wavy boundary; pH - 7.1.
$B21_t$	25-125	Light brownish grey (2.5 YR 6/2), light brownish grey (2.5 YR 6/2); sandy clay ; moderate , medium angular blocky; hard, firm, very sticky and very plastic; few , medium roots ; many thick clay skins on ped faces ; slow permeability; abrupt smooth boundary; pH - 10.1.
$C1_t$	125-200	Grey (5 YR 7/1), light brownish grey (2.5 YR 6/2); sandy clay loam ; moderate , medium sub angular blocky; hard, firm, very sticky and very plastic; few tubular pores ; moderately slow permeability; abrupt smooth boundary; pH 8.8.
Cca	200 +	Parent material (Weathered Granitic gneiss)

SITE -5. – ARAMPANOOR

Site view

Profile view

Site Characteristics

Soil type - Anaiyur clay loam; Location Mr. I Pitchai's field centre -0.6 km from Sundaresanpatty - Arampanoor ; Geographical land scape - basin; Aspect - south; Slope - B; Erosion - e_2; Ground water - 15m; Drainage –poor ; Salt and alkali – calcareous nature ; Mode of formation - secondary; Parent material - weathered granitic gneiss; Climate - mean annual temperature - 35°c, mean winter temperature - 29°c, mean annual rainfall – 80 mm; Nature cover - Neem, prosopis and Acacia; Profile group - III; Higher categories - Alfisol; Genetically related soil series - Palathurai and Peelamedu series .

Pedon Features

Horizon	Depth (cm)	Description
Ap	0-15	Dark grey (10 YR 4/1), Very dark greyish brown (10 YR 3/2); clay loam; moderate , medium , sub angular blocky; hard, very firm, very sticky and very plastic; many fine roots; few pores ;very cracks of 1 cm width ; slow permeability; clear smooth boundary; pH - 7.8.
$B21_t$	15-35	Yellowish brown (10YR5/6), brown (10 YR 5/3); sandy clay ;moderate , medium angular blocky; very hard, firm, very sticky and very plastic; many , fine roots ; few pores ; violent effervescence with dilute HCl ; slow permeability; clear smooth boundary; pH -8.2.
$B22_t$	35-80	Pale yellow (5 YR8/3), Pale yellow (5 YR8/3); sandy clay ;moderate , fine ,sub angular blocky; very hard, very firm, very sticky and very plastic; many fine pores ; many fine pores violent effervescence with dilute HCl ; lime concretions ; slow permeability; many thick clay skins ; clear smooth boundary; pH 8.3.
C1ca	80+	Kankar layer

SITE -6. – KARUNKALAKUDI

Site view

Profile view

Site Characteristics:

Soil type – Karungalagudi clay loam ; Location : Mr. S. Kasilingam's field R.S. No. 108/4 C centre of the field –Karungalagudi ; Geographical landscape-basin; Erosion-e_l; Slope-B; Aspect-south; Ground water 15 m; Mode of formation- secondary; Parent material -weathered granitic gneiss; climate- mean annual temperature 35°c, mean winter temperature 28°c, mean annual rainfall – 800 mm; Nature Cover: Neem, Projopis and calotropis ; Profile group - IV; Higher categories Alfisol; Genetically related soil series- Palaviduthi.

Pedon Features

Horizon	Depth (cm)	Description
AP	0-40	Dark greyish brown (10YR4/2), dark greyish brown (10YR4/2);clay loam; moderate, medium, sub angular blocky; very hard, very firm, very sticky and very plastic; many fine roots; many pores; vertical cracks of 2 cm of width; slow permeability; clear smooth boundary; pH 8.2.
$B21_t$	40-95	Dark greyish brown (10YR4/2), dark greyish brown (10YR4/2); sandy clay; moderate, fine, angular blocky; very hard, very firm, very sticky and very Plastic; many fine roots; many fine pores; strong effervescence with dilute HCl; slow permeability; thick many clay skins on ped faces; clear wavy boundary; pH 8.4.
C1	95-125	White (2.5Y8/2), white(2.5Y8/2); sandy clay loam; weak, coarse, sub angular blocky; hard, firm, sticky and plastic; many fine tubular pores; many roots; moderately rapid permeability; clear wavy boundary; pH 8.4.
$C2_{ca}$	125+	Weathered granitic gneiss

SITE 7- KADKSHIVANENDAL

Site Characteristics:

Soil type - Kadkshivanendal sandy clay loam:- Location : 0.6 km from Kadkshivanondal to Narasingam road ;Location south 50 metres-centre Mangalakudi. field; Geographical landscape-basin rim; Erosion-e_l; Slope-B; Aspect-south; Ground water 100 m; Mode of formation- secondary; Parent material -weathered granitic gneiss; climate mean annual temperature 32°c, mean winter temperature 27°c, mean annual rainfall – 790 mm; Nature Cover- Neem and Cyprus; Profile group - III; Higher categories Alfisol; Genetically related soil series- Vyalogam.

Pedon Features

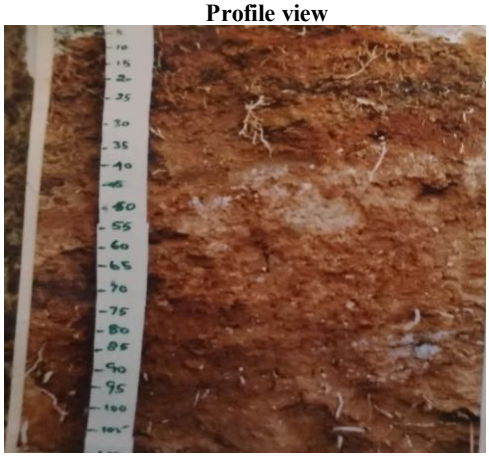
Horizon	Depth (cm)	Description
AP	0 - 25	Yellowish brown (10YR5/4), dark yellowish (10YR4/4); sandy clay loam; weak,

		medium, sub-angular blocky breaking to crumb; and slightly hard, friable, slightly sticky fine abundant gravels; abundant non-plastic; fine many rapid permeability; roots; pores; abrupt smooth boundary; pH 8.3
A12	25-40	yellowish red (5YR5/8), Yellowish red (5YR4/6); sandy loam; medium, moderate, sub angular blocky ; loose, vey friable , non sticky and non plastic;very fine roots;moderately rapid permeability ; clear wavy boundary ; pH 8.4.
B21 t	40-155	Reddish brown (7.5 YR 6/6), strong brown (7.5 YR 5/6); Sandy clay loam; moderate ,coarse, sub angular blocky; slightly hard ,firm , slightly sticky and plastic; patchy thin clay films on ped faces; very few fine roots; moderately rapid permeability; clear smooth boundary ; pH 8.5.
B22t	155-180	Yellowish brown (10 YR 5/4) , brown (10YR 4/3) ; sandy clay loam ; moderate .coarse, sub angular blocky ; hard , firm , sticky and plastic; few thin clay skins on ped faces ; moderate permeability ;pH 8.5.
C1	180+	Weathered granitic gneiss.

SITE 8- UTHANKUDI

Site view

Profile view



Site Characteristics:

Soil type - Uthangudi sandy clay ; Location 0.6 km from Ulaganeri villakku – Tatankulam west - Centre of the field – Uthangudi ; Gographical landscape – basin rim ; Aspect – south ; slope-B; Erosion –e_2 ; Ground water -10 m ; Drainage –well drained ; Alkali –Nil ; Mode of formation- secondary ; Parent materials – weathered granitic gneiss ; Climate – mean annual Temperature -39^{o}C , mean annual temperature – 39^{o}C , mean winter temperature -30^{o}C ; mean annual rainfall -800 mm ; Nature cover – Neem and prosopis ; Profile group –III; higher categories – Padugai .

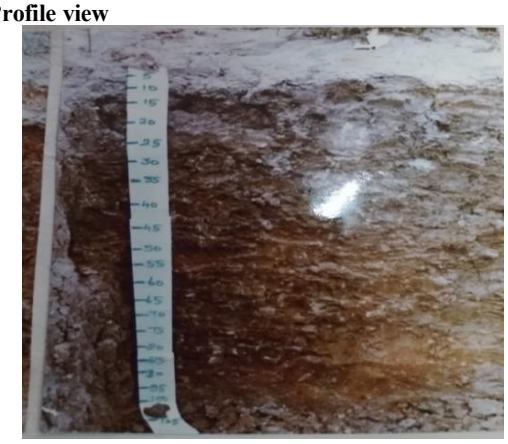
Pedon Features

Horizon	Depth (cm)	Description
AP	0-15	Olive (5Y3/2), greyish brown (2.5 YR 3/2) ; sandy clay ; moderate ,medium , sub angular blocky; hard , firm, very sticky and very plastic; many fine roots ; fine pores ; surface hard crusting ; slow permeability ; slight effervescence with dilute HCL ; clear smooth boundary ; pH 8.2.
A12	15-21	Yellowish brown (7.5 YR 5/8) , dark yellowish brown (10YR 5/8) ; loamy sand ;massive; loose , friable , non –sticky and non plastic; fine pores ; slight effervescence with dil HCl; clear smooth boundary ; rapidly permeable ; pH 8.7.
A13	21-50	Brown (10YR5/3) , dark brown (10YR 4/4) ; loamy sand ; massive ; loose , friable , non sticky and non plastic ; very few roots ; moderate to high permeability ; clear smooth boundary ; pH 8.2.
B1t	50-70	Yellowish brown (10 YR 5/6) , dark brown (10 YR 4/4) ; clay loam; moderate, medium , sub angular blocky ;hard, very firm , very sticky and very plastic ; many roots ; few moderately thick clay skins on ped faces ; Clear smooth boundary ; pH 8.7.
C1	70-150	Reddish brown (5 YR 4/4) , yellowish brown (5YR 4/6) ; sandy clay loam ; moderate ,medium ,sub angular blocky ; hard, firm , slightly sticky and slightly plastic ; moderately permeable ; few roots and pores ; clear wavy boundary ; pH 8.7.
C2	150+	Weathered granitic gneiss .

SITE :9 - LAKE AREA

Site view

Profile view



Site Characteristics:

Soil type – Padugai clay loam ; Location -25 m east of Mr. T. Ravendran 's house , centre of the field , Lake area ; Geographical landscape –alluvial fan ; Aspect –south ;slope - B; Erosion- e_l; Ground water table - 12 m; Drainage - well drained; Salt, alkali - nil; Mode of formation - secondary; Parent material - weathered granitic gneiss; climate - mean annual temperature - 33°c, Mean Summer temperature - 39°c, mean winter temperature - 29.2°c, mean annual rainfall - 820 mm; Nature cover – Neem and Prosopis ; Profile group - I; Higher categories – Entisol ; Genetically related series - Noyyal series and Anaiyur series etc.

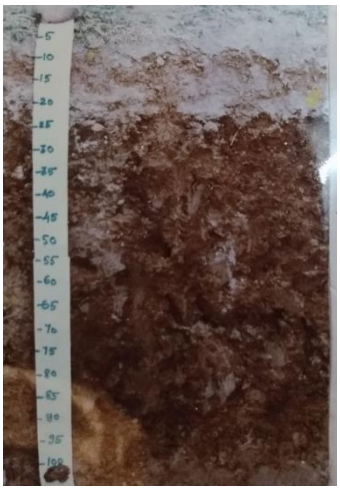
Pedon Features:

Horizon	Depth (cm)	Description
Ap	0-15	Olive grey (5Y5/2), olive (5Y5/3); clay loam; moderate, medium, sub angular blocky; hard, firm, sticky, and plastic ; few fine roots; many pores; abrupt and irregular boundary; pH 9.2.
A12	15-25	Greyish brown (2.5Y5/2), red (2.5YR4/4); clay loam; moderate, medium, sub angular blocky; hard, firm, sticky, and plastic; few fine roots; many pores; abrupt and irregular boundary; pH 8.6.
C1	25-60	Pale olive (5Y6/3), olive grey (5Y5/2); clay; moderate, medium, angular blocky; very hard, very firm, very sticky and very plastic; fine roots; fine pores; slow permeability; clear smooth boundary; pH 8.6.
C2	60-175	Olive grey (5Y5/2), pale olive (5Y6/3); clay; platy; hard, firm, very sticky and very plastic; few fine roots; many kankar nodules; slow permeability; clear smooth boundary; pH 8.2.
C3	175	Mixed alluvium

SITE 10 – VANDIYUR

Site view

Profile view



Site Characteristics:

Soil type- Padugai clay loan; Location Mr. Ulagappan's field - Vandiyur 200 m from Vaigai river bank; Geographical landscape - alluvial fan; Elevation - 122 m MSL; slope - B; Aspect - south; erosion - e_2; Ground water table 10 m; Drainage - well drained; Salt hazard- nil; Mode of formation - secondary; Parent material- mixed alluvium; climate - mean annual temperature - 36°c, mean summer temperature - 39°c, mean winter temperature - 25°c ,mean annual rainfall – 830 mm; Nature cover - Acacia, Neem and Pungam; Profile group - 1; Higher categories - Entisol; Genetically related soil series - Noyyal.

Pedon features

Horizon	Depth (cm)	Description
AP	0-16	olive grey (5Y 4/2), olive grey (5Y 4/2); clay loam; moderate, medium, sub angular blocky; hard, very firm, very sticky very plastic; many roots; few thin clay skins on ped faces; moderate slow permeability; clear smooth boundary; pH 8.2.
A12	16-31	Pale yellow (5 Y 8/3), pale yellow (5 Y 8/3); loamy sand; massive; loose, friable, non sticky and non-plastic; few fine roots; clear smooth boundary; pH 8.5.
C1	31-76	Very dark greyish brown (2.5Y3/2), very dark greyish brown (2.5Y 3/2); clay; moderate medium, angular blocky; hard, very firm, very sticky and very plastic; moderate permeability; few roots and few pores; clear wavy boundary; pH 8.7.
C2	76-200	Mixed alluvium

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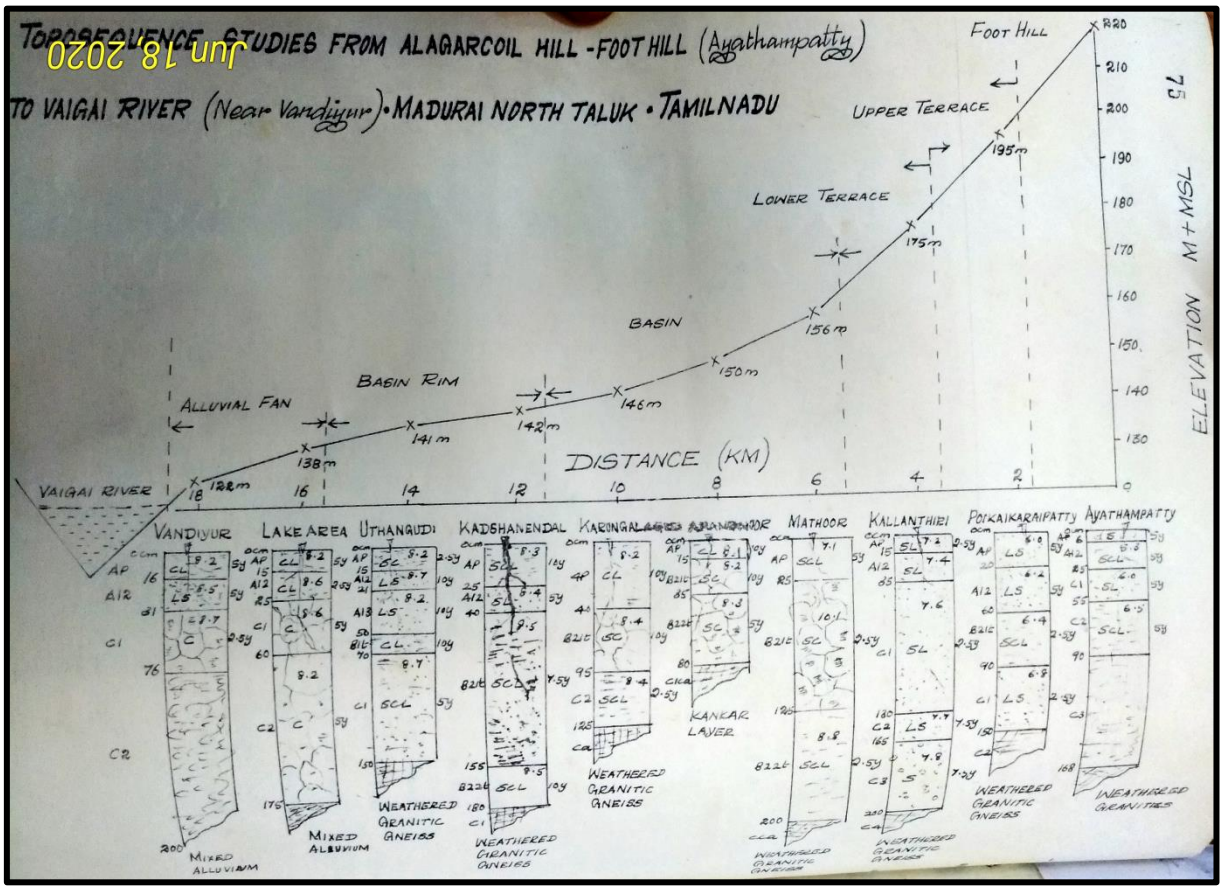

Fig -2. Catenary sequence of pedons from Algar hill's toe slope to Vaigai river

The catenary sequence figure of pedons from Alagar hill's toe slope to Vaigai river is given in Figure 2 . Based on the above profiles morphological characteristics at different elevations, the sites 1, 2 and 3 fall under foot hill , upper terrace and lower terrace positions respectively. The sites 4, 5 and 6 are distributed in basin positions, while the sites 7 and 8 come under basin rim level. The sites 9 &10 are coming under the natural land division of alluvial fan according to the criteria given by Storie (1964) . The parent material is classified as weathered granitic gneiss from foot hill to basin rim position position (sites 1-8), while in alluvial fan position , the parent material is of mixed alluvium.

3.1.1. Soil Depth

The effective depth in pedons of the transect ranges from 70 to 200 cm . In the foot hill , upper terrace and lower terrace positions , the solum depth ranges from 70 to 180 cm. In the alluvial fan position, it ranges from 175 to 200 cm. Generally , there is a trend of increasing solum depth with decrease in elevation from foot hill to alluvial fan position. The deviations in soil depth pattern are found in the places near rock out crops like Elephant hillock and Ambalakaranpatty hillock speaks the local disturbances for topofunction to operate on soil formation (Subramanian ,1988).

3.1.2. Soil Colour

The colour of the soil profiles has wide variations in surface and sub surface horizons. The surface (first and second horizon) colour ranges from 2.5 YR to 5 Y under moist condition. The sub surface horizons (third and fourth horizons) colour ranges from 2.5 YR to 2.5 Y under moist condition. Most colours of the soils in the transect reddish brown from foot hill to basin rim position might be due to the release of iron oxides (Arun Prasad *et al.*,1989). In alluvial fan position, the colour of the profile is pale yellow to olive . In places of local depressions like in Mathoor site, the colour of the soil is grey to light brownish grey and might be due to poor drainage in low lands (Curi and Franzmeir , 1984).In places of sandy alluvial deposits, the colour is white to dark greyish brown. In the foot hill and upper terrace positions, the colour of the soil is reddish brown (5 YR 4/4) almost throughout the solum.

3.1.3. Soil Texture

The textural class of the surface horizons in the transect ranges from sandy to sandy clay, while that in sub-surface horizons ranges from loamy sand to sandy clay. There is a general increase in fineness of texture both in surface and sub-surface soils in the transect from foot hill to alluvial fan positions. The foot hill and upper terrace profiles are coarse textured in surface and medium texture in sub-surface. The lower terrace profile is sandy loam in the whole solum. The basin level profiles are medium textured in surface and fine textured in sub surface. The basin rim position ranges from sandy clay loam to sandy clay in surface. In alluvial fan position, the soil profiles have clay loam in surface and loamy sand to clay loam in sub surface.

3.1.4. Soil Structure

The structures of the soil profiles range vary widely in the surface of the pedons in the transect. In the sub surface it ranges from massive to angular blocky. In the foot hill, upper terrace and lower terrace positions, the sub-surface structure is mostly sub-angular blocky. In basin position, the sub surface structure is angular blocky in the argillic horizons (Bt horizon). In basin rim position, the sub surface structure is sub angular blocky to massive and in alluvial fan position, it is mostly massive (Peer Mohamed ,1988).

3.1.5. Horizon Boundary

The Lower boundary of Ap horizon in the pedons of the transect ranges from abrupt to clear in the foot hill upper terrace and lower terrace positions, (the lower boundary of Ap horizon are clear wavy, abrupt and irregular) clear smooth respectively. In the basin level pedons, the lower boundary of the Ap horizon is mostly clear smooth. In basin rim pedons, it is abrupt smooth to clear smooth. In alluvial fan position, it ranges from abrupt irregular to clear smooth.

3.1.6. Soil Consistency

The consistency in diagnostic sub-surface horizon has wide variation in the transect. It varies from light consistency to heavy characteristics. It ranges from loose, friable, non sticky, and non-plastic to very hard, very firm, very sticky and very plastic. In the foot hill, upper terrace and lower terrace levels, it ranges from loose friable, non-sticky and non-plastic to slightly hard, friable, slightly sticky and slightly plastic. In site 5 and 6 (basin position), the consistency is generally very hard, firm to very firm, very sticky and very plastic. In basin rim position (site 7 and 8) the consistency is loose, friable to very friable, non-plastic and non-sticky. In alluvial fan level pedons, it ranges from loose, friable, non-sticky and non-plastic to very hard, very firm, very sticky and very plastic. Generally, there is an increasing heaviness of consistency with decrease in elevation from foot hill to alluvial fan position of this transect line, excepting for 3, 7 and 8, which are influenced by sites specific environment like alluvial sandy deposits and near by rock out crop influences.

3.1.7. Soil Concretions

With regard to concretions present in pedons of the transect line studied, the concretions are ferruginous gravels in foot hill and upper terrace positions. Lime concretions in basin position and no concretions in lower terrace pedons are specific features in this transect. In basin level pedons, there are abundant lime concretions. In basin rim position, the lime nodules are clearly noticed. While in alluvial fan position, lime nodules are present especially in lower layers.

3.1.8. Clay skins:

The clay skins in sub-surface horizon are absent in pedon sites 1, 3, 9 and 10. In site 2, there is thin clay skin in ped faces of Bt horizon. In basin position pedons, many thick clay skins on the ped faces of Bt horizon are noticed significantly. In basin rim position, many thin to moderately thick clay skins in ped faces are noticed. As such generally, there is formation of progressively thick clay skins in pedons as the elevation decreases due to maximal stage of pedogenesis (Karan singh *et al* ., 1991).

3.1.9. Internal Drainage

Considering the internal drainage of the pedons in the transect, the foot hill, upper terrace and lower terrace are well to excessively drained. In basin level pedon, the internal drainage ranges from poor to moderately and in basin rim position, well to moderately drained. In the case of alluvial fan position pedon, moderate to well drained conditions to are noticed. As general observation, the relatively upland positions are excessively drained, having a decreased drainability with decrease in elevation up to alluvial fan position.

3.1.10 . Soil Reaction /pH

In the case of soil reaction of the pedons in the transect, the foot hill, upper terrace and lower terrace positions have slight acidity to neutral pH values. In the basin position, the pH ranges from 7.1 to 10. 1 with near alkali condition in sub-soil. In basin rim position, the values of the pH are slightly alkaline in surface and near alkali in sub soil. In alluvial fan position, the pedons are mostly alkali in reaction. As elevation decreases, there is generally increase in pH and progressive alkalinity from foot hill to alluvial fan position. The horizons (master and sub- horizons) present in the pedons of the transect , reveal that there is a general progress of pedogenesis with decrease in elevation from the foot hill to rim positions and no profile development basin in alluvial fan level soil.

Considering the horizonisations, the foot-hill soil does not have Bt horizons. The lower terrace (site3) also do not have Bt horizons. The basin level pedons (site 4. 5 and 6) have well developed Bt horizons. The basin rim position also has Bt horizons. In low lying area, as elevation decreases from foot hill to the alluvial fan position, there is progressive occurrence of kankar nodules/concretions indicated by Ci_{ca} and $C2_{ca}$.

Based on the detailed investigation made , the relatively shallow soils in upper terrace and basin rim lands can accept only shallow rooted crops for profitable agriculture . The alluvial lands subjected to periodical floods in Vaigai river will have to be protected by adequate flood control measures to prevent damage crop and valuable lands.

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