Ife Journal of Agric Vol. 4 Nos 1 & 2 (1982)

The characteristics of two soil toposequences on basement complex in the Federal Capital Territory of Nigeria.

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Abstract

Morphological, physical, chemical and mineralogical characteristics of Gwagwa and Kau soil toposequences, were studied. These toposequences are representative of the Basement Complex soils of the Federal Capital Territory of Nigeria.

The soils are light-textured and moderately acidic. They have low organic matter and low effective CEC but high base saturation. Kaolinite is the most abundant clay mineral. The upland soils which have reddish hues are classified as Alfisols but the soils in the valley bottom and interfluvial depressions with brownish to yellowish hues are classified as Entisols or Inceptisols.

The Gwagwa profiles have gravel layers or stonelines probably formed by pedimentation processes. The Kau toposequence is characterised by rock outcrops associated with colluvial footslope plains.

Introduction

The Federal Capital Territory, defined by the coordinates $8^{o}25'$ and $9^{o}25'$ N and $6^{o}45'$ and $7^{o}45'$ E, has a total area of roughly $8000 km^2$. It is located in the Middle Belt, an area which extends east – west across the country and corresponds approximately to the southern Guinea Savanna of Keay (1948).

The region has a rather mild climate with a mean annual rainfall ranging between 1100 and 1600 mm, and maximum and minimum monthly daily temperature means of 32^{o} and 18^{o}C respectively. The vegetation of the area consists mostly of a thick grass undergrowth with shrubs and open canopy trees, a community otherwise described as Park Savanna.

About half of the territory consists of plains with gently undulating to rolling relief and occasional isolated wooded hills. The other half has massive rocky outcrops and very rugged ranges of hills. Most of the territory is underlain by crystalline Basement Complex rocks of pre-Cambrian age. Only a small fraction located in the southwestern part is underlain by Cretaceous sandstone (Adeleye and Dessauvegie, 1970) (Fig. 1).

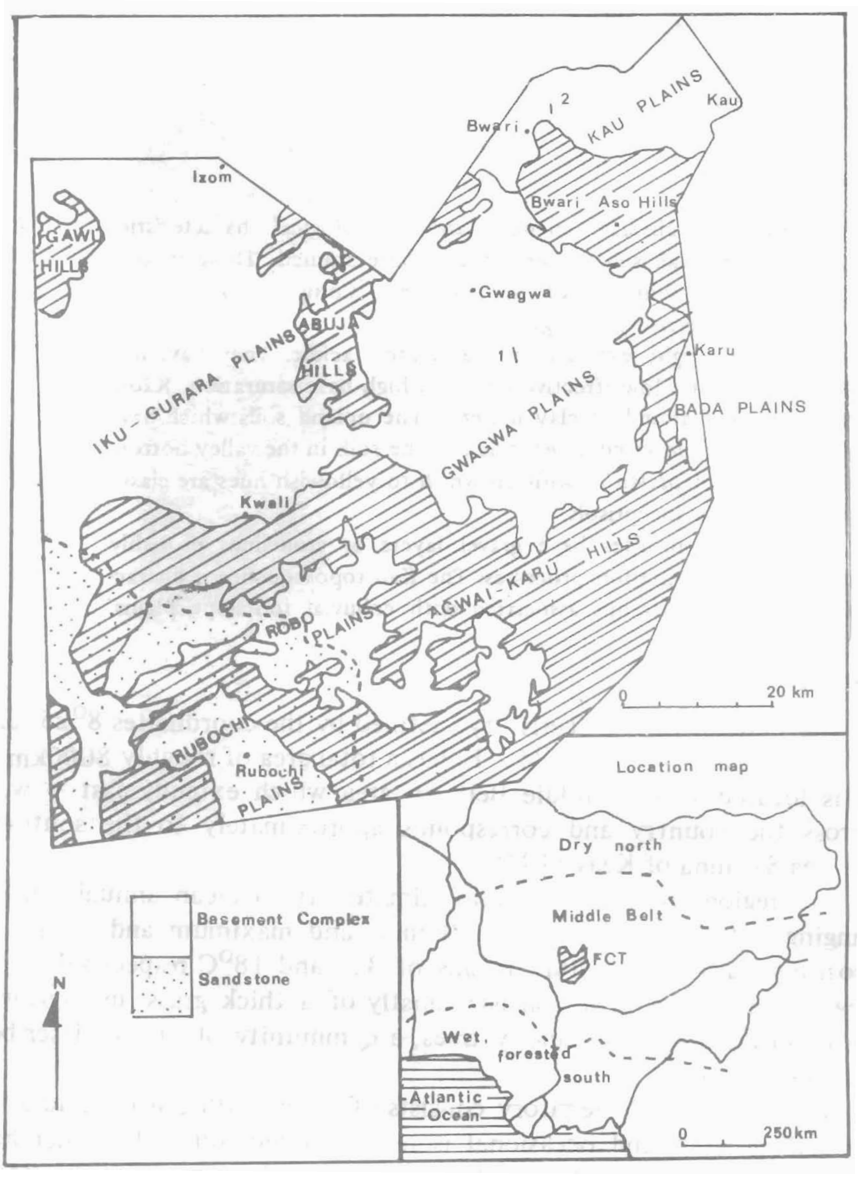


Fig. 1: Physiographic regions of the Nigerian Federal Capital Territory.

One of the investigations recently carried out in the territory was a reconnaissance soil survey (Fagbami *et al.*, 1977). This paper gives an account of the characteristics of two soil toposequences which are common in the area. A toposequence, originally called a Catena by Milne (1935), is a topographically related group of soils from the summit of an interfluve to the valley bottom. The toposequences which are located in the Gwagwa and Kau plains (Fig. 1) are respectively referred to as Gwagwa and Kau toposequences.

The Gwagwa toposequence is located on one of the plains that are characterised by gently undulating relief. The soils are derived from intermediate crystalline rocks, the parent materials being mainly colluvium on the interfluves and alluvium and/or colluvium in the valleys. The four profiles of the toposequence are shown in Fig. 2a. The sola are moderately deep, ranging from 150 to 200 cm above the weathering rock of C horizon.

The Kau plains are more mature and stand at an elevation of 600m with abundant massive as well as ground-level rock outcrops (ruwares). The Kau toposequence with three profiles (5 to 7) is located on a pediment which consists of an upper part of young soils and very steep slope at the toe of an outcrop. Below this is the lower half that is gently sloping towards the valley (Fig. 2b). The profiles selected represent a full range of soils on the pediments.

Materials and Methods

The profiles were described and sampled according to the procedures outlined in the Soil Survey Manual (Soil Survey Staff, 1951). The soil samples were airdried and passed through 2-mm sieve. The particle-size analysis was done by Bouyoucos (1951) hydrometer method while the pH was determined in 1:2 soils: water suspension using a pH meter. Organic matter was determined by dichromic oxidation (Walkley and Black, 1934), total N by the micro-Kjeldahl method (Jackson, 1964) and available P by the Bray P-1 method (Bray and Kurtz, 1945). The exchangeable bases were displaced by neutral NH_40Ac and the diplaced Ca, K and Na in the extract determined by flame photometry, and Mg on atomic absorption spectrophotometer. Exchange acidity was extracted with 1N KCl and (Al and H) estimated by titration (McLean, 1965). The effective cation exchange capacity (ECEC) was taken as the sum of exchangeable bases and exchange acidity.

Two horizons (a surface and a subsurface) from each profile were chosen for mineralogical studies. The surface soils were pretreated with

H_2O_2 and clay separation done on all the samples according to Jackson's (1969) method. The clay fraction, Ca-saturated, was mounted on glass slides, air-dried and used to run x-ray diffractograms on Philips Norelco diffractometer using Ni - filtered Cuk and radiation.

Results and Discussion

Morphological properties

The morphological properties of the seven profiles are summarised in Table 1. The Gwagwa toposequence with profiles 1 to 4 is the most frequent in the territory (Fig. 2a). Its upper members are well drained as evidenced by the reddish hues (2.5YR) in the subsurface horizons and brownish hues (5YR to 7.5YR) in the surface horizons. The hues become yellower in the lower slope and valley bottom profiles as the moisture level increases and drainage becomes poorer. There is also a corresponding decrease of the chroma. The upper members do not show any colour mottling but the lower members become increasingly mottled with depth.

The Kau toposequence is characteristic of areas with outcrops associated with colluvial footslope plains (Fig. 2b). At the toe of the outcrops, shallow soils (Inceptisols) are developed on deeply weathered granitic gneiss bedrock. Erosion is active at this position, washing surface soil materials into the colluvial footslope plain below. The upper members have dark brown surface horizons but the subsurface horizons have reddish hues, high chromas and low values (Table 1). The valley floor soils have colours ranging from very dark greyish brown to dark brown, the colour depending on the nature of the sediment at a particular horizon. The beddings shown in the arrangement of the horizons and the structural and textural differences between the horizons, all point to a continuing active sedimentation process in the alluvial valley floor.

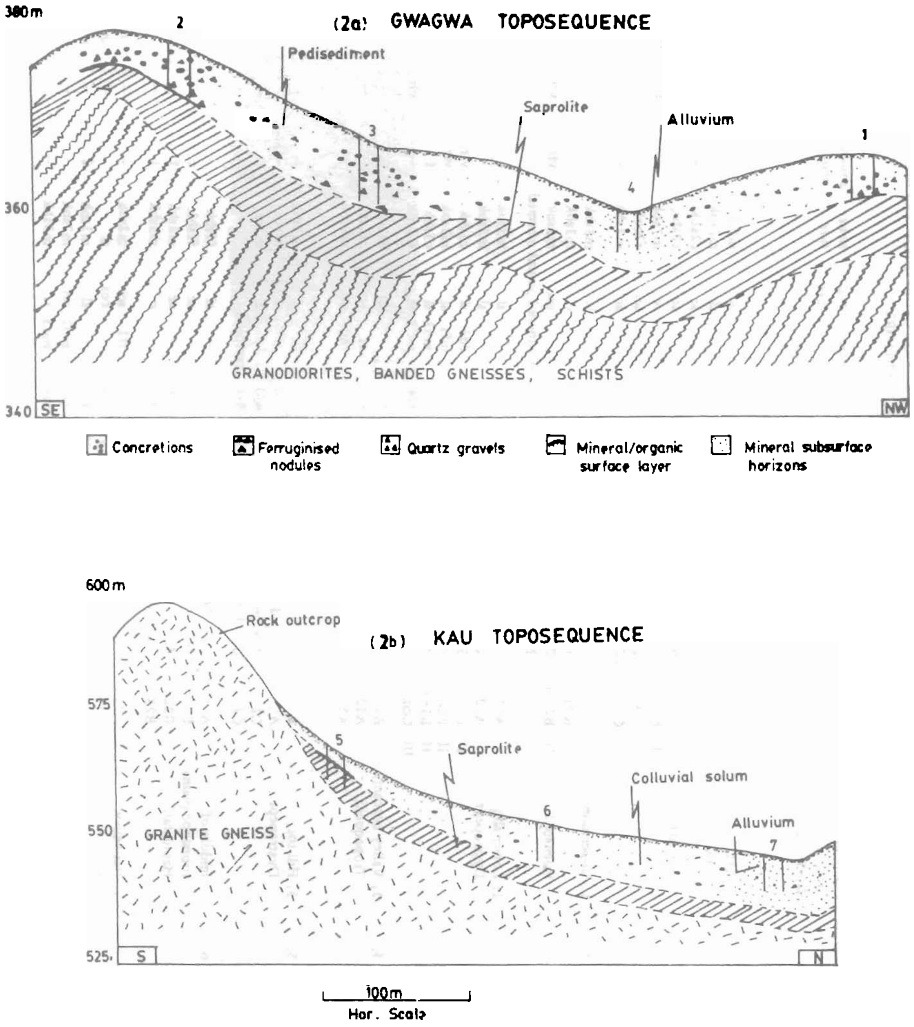


Fig. 2: Schematic Diagrams of the Gwagwa and Kau Toposequences

TABLE 1 – SOIL MORPHOLOGY AND CLASSIFICATION OF TWO TOPOSEQUENCES FROM THE NIGERIAN FEDERAL CAPITAL TERRITORY

Profile	*Slope class, Topographic position and clasification*	*Horizon*	*Depth (cm)*	*Boundary*	*Munsell colour (moist)*	*Mottles*	*Texture*	*structure*	*concretions*	*Ferruginised modules*	*Other components*
				Gwagwa Toposequen e							
1.	A12	A11	0 - 15	gs	7.5YR 4/2	–	ls	m2sbk	–	–	
	1; Crest	A12	15 - 30	gw	5 YR 4/6	–	sl	m2sbk	–	–	
		II B21t	30 - 60	ws	2.5YR 4/6	–	sc	c2abk	–	–	
	Paleustalf	II B22t	60 - 100	cw	2.5YR 4/6	–	sc	c2abk	–	–	
		III B 2t	100 - 120	cw	2.5YR 4/6	–	sc	m2abk	a	a	fine quartz
		III B 3	120 - 170	gs	2.5YR 4/6	–	scl	c2abk	–	–	
		III C	170 - 200+	–	2.5YR 4/6	–	sc	m2abk	–	–	
2.	1; Upper slope;	A	0 - 10	cs	5 YR 3/4	–	ls	m3sbk	–	–	
		B 2t	10 - 70	cw	2.5YR 3/6	–	c	m3sbk	–	–	
	Paleustalf	II B2tcn	70 - 130	gs	2.5YR 4/6	–	gsc	m3sbk	vfr.	vfr.	50% quartz gravels
		II C	130 - 190	–	2.5YR 4/6	Weathered parent material					
3.	1; Lower slope;	A11	0 - 15	as	7.5YR 3/2	–	sl	m3sbk	–	–	
	Dystropept	A12	15 - 30	cs	7.5 YR 4/4	–	sl	m2sbk	–	–	
		II B1	30 - 75	gs	7.5YR 4/4	fd3	sl	c3sbk	vfr.	–	
		II B2cn	75 - 120	gs	10 YR 5/4	mf1	sl	m3sbk	vfr.	–	
		II B3cm	120 - 150	cs	10 YR 5/4	md3	sl	c3sbk	f	–	
		III Ccm	150 - 190+	–	10 YR 5/4	md3	sl	m3sbk	–	vfr.	
4.	1; Valley bottom;	A11	0 - 40	cs	10 YR 3/4	–	sil	m2sbk	–	–	
	Tropaquent	A12	40 - 60	gs	10 YR 4/4	cf	scl	m2sbk	–	–	
		A13	60 - 80+	–	5 YR 4/6	md3	scl	m2sbk	–	–	
				Kau toposequence							
5.	3; Hill toe;	A	0 - 15	cs	5 YR 3/3	–	sl	m1sbk	–	–	
	Dystropept	AC	15 - 38	cir	5 YR 4/4	–	sl	m1cr	–	–	
		C1	38 - 65	cir	10 YR 4/6	–	sl	m1cr	–	–	
		C2	65 - 180+	–	5 YR 8/1	saprolite					
6.	2; middle of footslope plains Haplustalf	A	0 - 16	cw	10 YR 3/3	–	sl	f1sbk	–	–	
		B21t	16 - 48	cs	5 YR 4/6	–	sc	f2sbk	f	–	
		B22t	48 - 98	gs	5 YR 4/6	–	sc	m2sbk	f	–	
		B23t	98 - 130	–	5 YR 4/3	–	c	m3sbk	f	–	
7.	1; flat valley floor Arent	A11	0 - 30	cw	10 YR 3/2	ff1	scl	m2sbk	–	–	frequent quartz gravels
		A12	30 - 50	cw	10 YR 4/3	–	cos	0	–	–	
		Ab	50 - 70	cw	10 YR 4/2	–	sl	m1sbk	f	–	
		B2tb	70 - 120	cw	10 YR 4/3	md2	scl	m2sbk	–	–	
		Ab	120 - 170	–	10 YR 5/6	md3	sc	m3abk	–	–	

Physical characteristics

The particle size distribution is given in Table 2 and the textural class indicated in Table 1. The upper members of the interfluvial slope soils of the Gwagwa toposequence have coarse textured surface horizons whereas the surface horizons of the lower slope members are finer-textured. This textural variation with topography is similar to the description of the slope transport given by Ruhe and Walker (1968). The depth of the surface horizon is also affected by the slope transport. The depth increases from the crest to the valley bottom soils, the variation following generally the gradient of colluviation. As shown in Fig. 3, the clay content in this toposequence increases with depth indicating a downward movement from the surface horizons and an accumulation in the B horizons. This feature is more pronounced in the upper than in the lower members of the toposequence.

In the Kau toposequence, the slope transport effect is not as apparent as in the Gwagwa toposequence. The erosion of the hill toe soils (profile 5) in the Kau toposequence and the deposition on the footslope plain soils (profile 6) are evident in the character of the profiles. Clay accumulation in the B horizon occurs in the footslope profiles but is absent in the hill toe slope soils. The absence of B horizon in the hill toe soils and the development of Bt horizons in the footslope plain profiles are indicative of an active erosion on the hill toe and stable nature of the footslope plain. This would allow the process of pedogenesis and therefore clay illuviation to proceed uninterrupted in the footslope plain position.

All the intefluvial slope profiles of the Gwagwa plains are characterised by the presence of gravel layers. In the Kau toposequence, such gravel layers are absent except in the footslope profiles where a few iron and manganese concretionary gravels are encountered in the B horizons. The gravel layers which are composed of concretions, ferruginised nodules, quartz gravels and stones may be regarded as the equivalent of the stone lines (Sharpe, 1938) that have been described in the soils of Basement Complex of southwestern Nigeria (Nye, 1954; Burke and Durotoye, 1970 Folster, 1969; Ojanuga and Lee, 1973; Ojanuga and Wirth, 1977) and other tropical and non-tropical soils (Ruhe, 1956, 1959, Ollier, 1967).

Although many hypotheses have been advanced to explain the formation of stone lines (Sharpe, 1938; Nye, 1954; Smyth and Montgomery, 1962 and Ollier, 1967), pedimentation process is regarded as the most acceptable (Charter, 1949; Ruhe, 1956; Folster, 1969; Burke and Durotoye, 1970; Ojanuga and Wirth, 1977). In this process, the stone line is thought to result from a combined process of cyclical erosion and sedimentation, the erosion exposing a sheet of a gravel mantle which is subsequently buried by the sedimentation of fine-textured materials.

TABLE 2 – PARTICLE–SIZE DISTRIBUTION IN TWO SOIL TOPOSEQUENCES OF THE NIGERIAN FEDERAL CAPITAL TERRITORY.

Profile No.	*Depth cm*	*Sand*	*Silt %*	*Clay*	*Silt/ Clay + Silt*	*Clay activity ECEC x 100% Clay*
Gwaga toposequence						
1.	0 – 15	85.4	7.6	7.0	0.52	26.4
	15 – 30	75.0	8.0	17.0	0.32	7.9
	30 – 60	44.6	8.6	47.0	0.15	3.4
	60 – 100	43.4	7.6	49.0	0.13	2.4
	100 – 120	44.0	10.0	46.0	0.18	2.4
	120 – 170	59.0	10.0	31.8	0.24	2.8
	170 – 200	47.4	11.6	41.0	0.22	3.1
2.	0 – 10	74.0	13.0	13.0	0.50	20.0
	10 – 70	40.4	10.6	49.0	0.18	2.4
	70 – 130	55.4	13.6	31.0	0.51	4.6
	130 – 190	49.0	14.0	37.0	0.27	4.3
3.	0 – 15	74.4	13.0	12.6	0.51	19.0
	15 – 30	78.0	10.0	12.0	0.45	12.7
	30 – 75	74.0	8.0	18.0	0.31	12.8
	75 – 120	66.0	16.0	18.0	0.47	8.1
	120 – 150	70.0	13.0	17.0	0.43	7.3
	150 – 190	69.0	16.0	15.0	0.52	8.5
4.	0 – 40	49.4	28.0	22.6	0.55	15.6
	40 – 60	59.4	20.0	20.6	0.49	6.5
	60 – 80	53.4	20.0	26.6	0.43	5.3
Kau toposequence						
5.	0 – 15	68.0	19.0	13.0	0.59	27.9
	15 – 38	59.0	24.0	17.0	0.77	10.5
	38 – 65	65.0	22.0	13.0	0.63	23.5
	65 – 180	75.0	20.0	5.0	0.80	55.0
6.	0 – 16	73.4	15.0	11.6	0.56	18.8
	16 – 48	46.4	15.0	38.6	0.28	8.2
	48 – 98	32.4	13.0	54.6	0.19	5.7
	98 – 130	37.4	14.0	48.6	0.22	5.9
7.	0 – 30	53.4	22.0	24.6	0.47	18.3
	30 – 50	91.4	4.0	4.6	0.47	31.7
	50 – 70	68.4	15.0	16.6	0.47	17.7
	70 – 120	52.4	19.0	28.6	0.40	12.5
	120 – 170	65.4	2.0	36.6	0.05	8.3

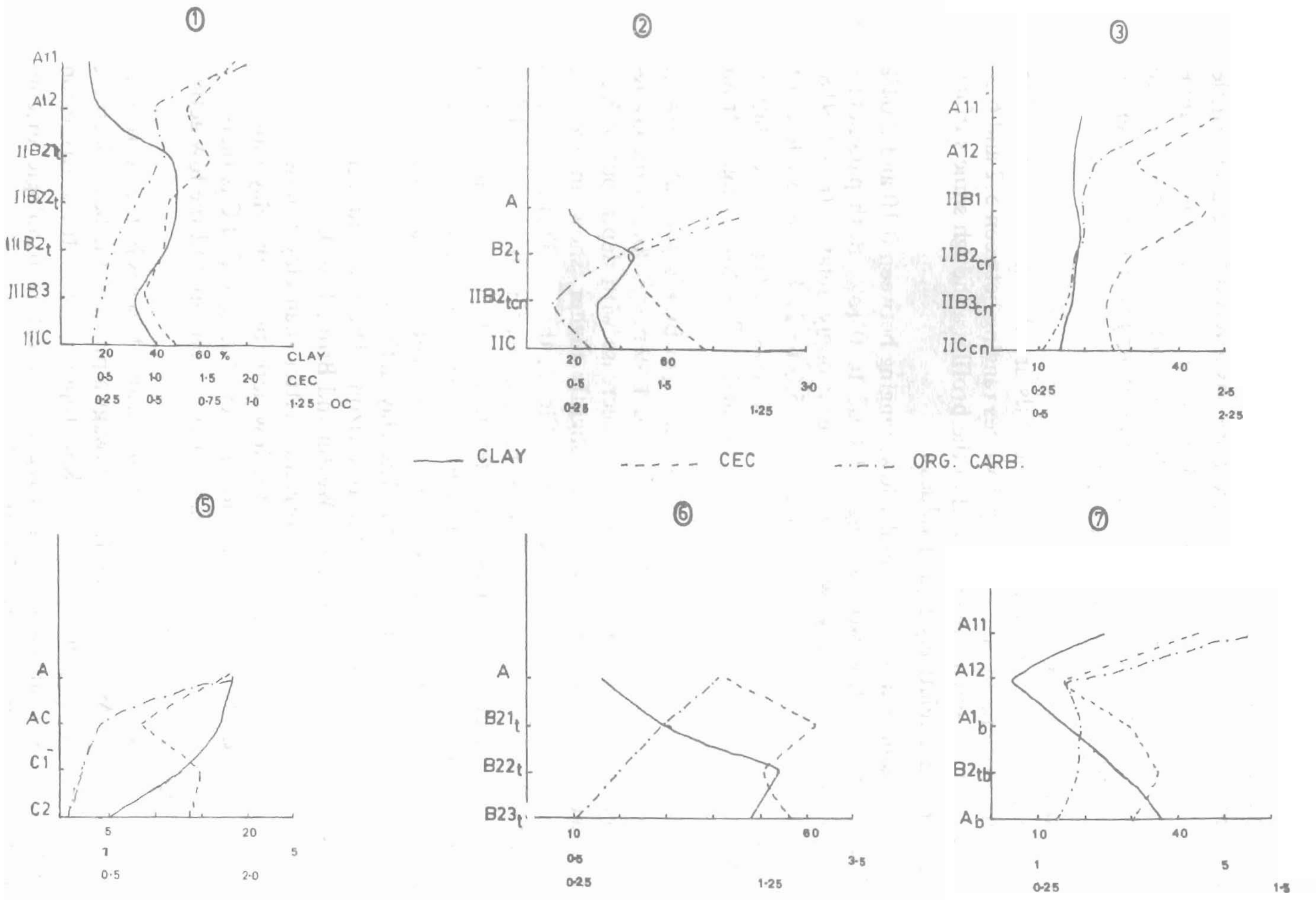


Fig. 3: Clay, CEC and organic carbon distribution in the soil profiles.

In the Gwagwa plains, the pedimentation process may have produced the present landscape. The surface horizons covering the gravel mantle are transported sediments. Whereas the quartz fraction may be remnants of resistant quartz veins in the bedrock, the concretions are thought to be particles of disintegrating interfluvial summit laterites (Ahn, 1970; Burke and Durotoye, 1970).

Chemical characteristics

The chemical characteristics of the soils are shown in Table 3. The soils are moderately acidic, the pH values ranging between 5.2 and 6.3. They tend to remain constant within the profiles although some surface horizons have relatively higher values.

The organic carbon is generally low, ranging between 0.10 and 2.04% Total N is also low with a range of 0.02 to 0.15%. Both parameters which decrease rapidly with depth are strongly related ($r = 0.918$, $P < 0.001$). The C/N ratio ranges from 5.0 to 21.8. The low level of organic matter may be attributed to the savanna type of vegetation which leaves little litter in the soil. Available P is low, ranging from 0.7 to 5.8 ppm.

The effective cation exchange capacity (ECEC) is generally low in the soils with a rnage between 0.089 and 4.49 meq/100g. In the Gwagwa toposequence, the ECEC tends to decrease with depth but in Kau toposequence, the values which are slightly higher, show an irregular distribution pattern. As illustrated in Fig. 3, the distribution patterns of ECEC and organic matter are similar, indicating that the ECEC is more associated with organic matter than with clay content. Both properties (Organic matter and ECEC) are strongly related ($r = 0.448$, $P < 0.01$). However, there is no correlation between clay content and ECEC ($r = -0.133$, $P > 0.05$). The clay activity (ECEC x 100/clay) is low, being below 12 in all the B horizons. The low values show that the soils are strongly weathered (Westin and Brito, 1969).

The greater contribution of organic matter than clay fraction to the ECEC may be accounted for by the low activities of the clay minerals, which are mainly kaolinitic as shown later. The low ECEC is therefore attributed to the rather low organic matter content and the low activities of the clay minerals.

The relative abundance of the exchangeable bases is in the decreasing order of Ca > Mg > K > Na. In the Gwagwa profiles, the bases decrease generally with depth but in the Kau toposequence, the distribution pattern of exchangeable Ca is irregular indicating lithologic discontinuity especially in profile 7 at the valley bottom.

TABLE 3 – CHEMICAL CHARACTERISTICS OF TWO SOIL TOPOSEQUENCES OF THE NIGERIAN FEDERAL CAPITAL TERRITORY

Depth cm	PH in H_2O	Ca	Mg	K	Na	Exch. acidity	ECEC	Base Sat. %	Org. Carbon	Total N	C/N ratio	Available P ppm
		meq/100g										
				Gwagwa toposequence –			Profile 1					
0 - 15	6.3	1.08	0.54	0.13	0.10	0.00	1.85	100.0	1.02	0.08	12.7	2.8
15 - 30	5.8	0.55	0.33	0.19	0.21	0.10	1.34	92.5	0.50	0.05	10.0	0.5
30 - 60	5.5	0.60	0.49	0.26	0.14	0.12	1.61	92.6	0.55	0.05	11.0	2.8
60 - 100	5.3	0.35	0.29	0.22	0.12	0.18	1.16	84.5	0.37	0.04	9.2	2.1
100 - 120	5.6	0.33	0.29	0.26	0.12	0.08	1.10	92.2	0.27	0.03	9.0	2.0
120 - 170	5.5	0.30	0.25	0.12	0.10	0.12	0.89	86.5	0.22	0.03	7.3	1.7
170 - 200	5.5	0.38	0.37	0.24	0.14	0.12	1.25	90.4	0.18	0.03	6.0	1.2
							Profile 2					
0 - 10	6.3	1.40	0.75	0.26	0.09	0.10	2.60	96.2	1.05	0.07	15.0	2.5
10 - 70	5.6	0.45	0.29	0.18	0.12	0.14	1.18	88.1	0.51	0.05	10.2	2.2
70 - 130	5.6	0.70	0.25	0.12	0.24	0.12	1.45	91.6	0.15	0.03	5.0	1.7
130 - 190	5.5	0.75	0.45	0.12	0.12	0.14	1.58	91.6	0.17	0.03	5.6	0.3
							Profile 3					
0 - 15	5.6	1.07	0.89	0.13	0.12	0.30	2.39	88.9	2.04	0.15	13.6	5.3
15 - 30	5.7	0.53	0.69	0.20	0.10	0.20	1.52	89.4	1.11	0.06	18.5	1.7
30 - 75	5.9	0.53	0.73	0.25	0.08	0.10	2.31	95.9	0.94	0.05	19.0	0.7
75 - 120	5.7	0.49	0.65	0.10	0.15	0.20	1.46	87.9	0.87	0.04	21.8	0.8
120 - 150	5.5	0.34	0.59	0.18	0.14	0.30	1.24	80.6	0.80	0.04	20.0	1.3
150 - 190	5.8	0.29	0.71	0.16	0.12	0.10	1.28	92.8	0.54	0.03	18.0	1.2
							Profile 4					
0 - 40	5.5	1.95	0.99	0.23	0.19	0.16	3.52	95.5	1.49	0.13	11.4	2.7
40 - 60	5.2	0.55	0.36	0.08	0.17	0.18	1.34	86.5	0.41	0.04	10.3	1.0
60 - 80	5.2	0.55	0.35	0.11	0.21	0.18	1.40	87.1	0.34	0.03	11.3	1.2
				Kau toposequence –			Profile 5					
0 - 15	6.0	2.05	1.07	0.26	0.17	0.08	3.63	97.8	1.97	0.11	17.9	2.8
15 - 38	5.7	1.10	0.21	0.17	0.19	0.12	1.79	93.3	0.43	0.04	10.8	0.9
38 - 65	6.4	2.10	0.45	0.14	0.24	0.12	3.05	96.1	0.23	0.04	5.8	0.6
65 - 180	6.5	1.85	0.45	0.10	0.23	0.12	2.75	95.6	0.10	0.02	5.8	0.7
							Profile 6					
0 - 16	5.9	1.10	0.58	0.21	0.17	0.12	2.18	94.5	1.02	0.10	10.2	5.8
16 - 48	5.4	0.75	1.79	0.19	0.21	0.22	3.16	93.0	0.74	0.06	12.3	5.3
48 - 98	5.6	1.20	0.47	0.28	0.38	0.22	2.55	92.4	0.50	0.05	10.0	4.4
98 - 130	6.0	1.50	0.60	0.20	0.42	0.14	2.86	95.1	0.28	0.03	9.3	3,4
							Profile 7					
0 - 30	5.6	2.60	1.15	0.28	0.22	0.24	4.49	94.7	1.46	0.12	12.1	3.0
30 - 50	5.8	0.70	0.27	0.18	0.17	0.14	1.46	90.4	0.41	0.03	13.7	2.0
50 - 70	5.9	1.80	0.66	0.16	0.19	0.12	2.93	95.9	0.48	0.05	9.6	2.0
70 - 120	5.7	2.20	0.23	0.17	0.19	0.08	3.57	97.8	0.47	0.05	9.4	2.9
120 - 170	5.6	1.85	0.63	0.17	0.17	0.20	3.02	93.4	0.35	0.03	11.7	1.7

The percentage base saturation is high, being above 80% in all the horizons, and this may be attributed to the presence of weatherable basic materials.

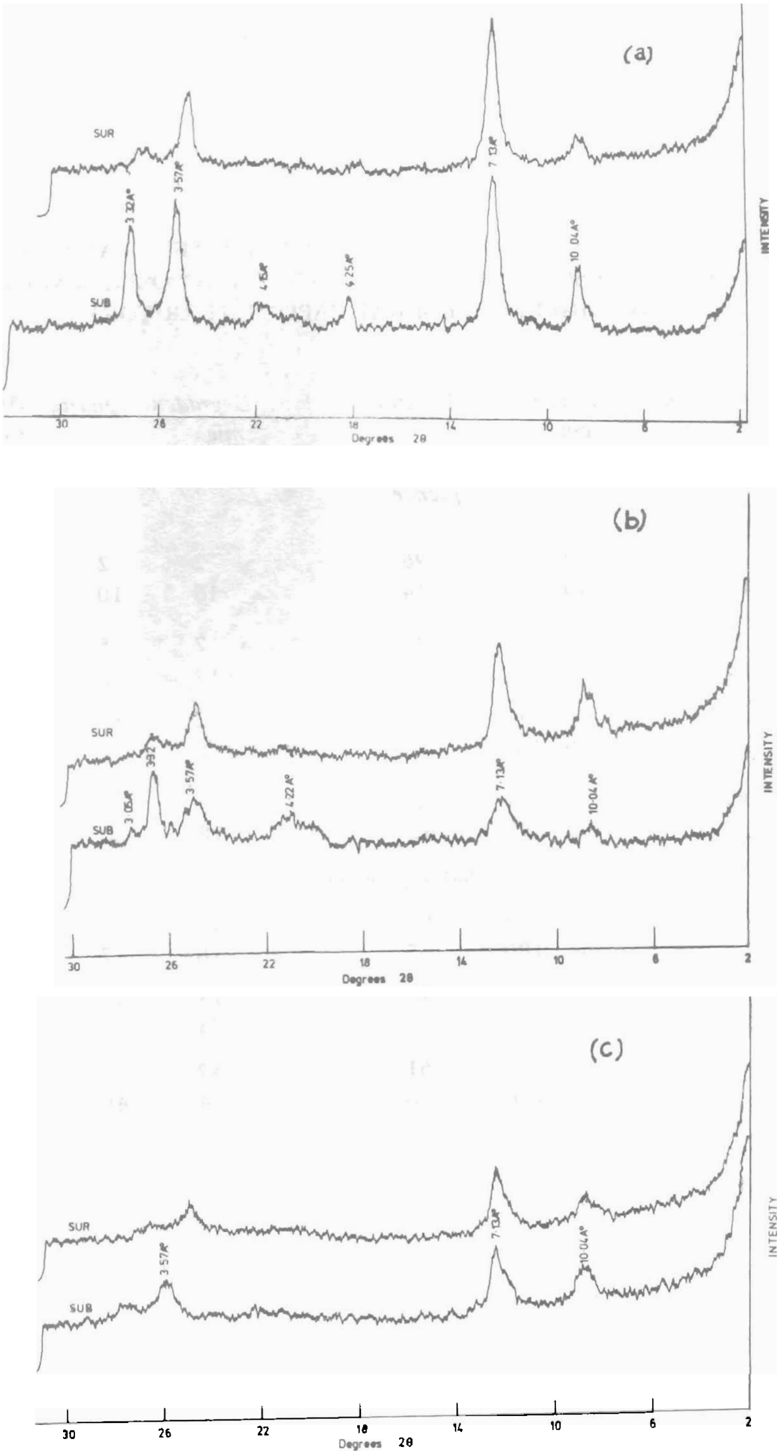
Clay Mineralogy

The X-ray diffractograms with strong peaks at $7.13A^{o}$ and $3.57A^{o}$ show that kaolinite is the dominant clay mineral in all the profiles. Representative diffraction patterns are shown in Fig. 4. Some strong peaks at $10.00A^{o}$ and $5.00A^{o}$ are also identified indicating the presence of some micaceous clays. Other minerals identified in the clay fraction include quartz, anorthite (profile 7) and cristobalite (profile 2). The approximate percentages of the different minerals estimated from the diffractograms are summarised in Table 4. Although micaceous clay is identified in both toposequences, it forms on the average a higher proportion of clay minerals in Kau toposequence soils; indicating a more juvenile nature of this toposequence. The dominance of the kaolinite clay over the double layered clay types, however, indicates generally strong weathering of all the soils.

Classification

The upper members of the interfluvial slopes and the stable colluvial footslope plain soils associated with granitic outcrops are classified as Alfisols. Since the region has an Ustic moisture regime, they are Ustalfs and because they do not have any of the following characteristics – Duripan, a continuous plinthite phase and a Natric horizon, nor qualify to be classified as Rhodustalfs, they have been classified as Haplustalfs or Paleustalfs.

The soils at the hill toe of the granitic outcrops and depressions on the interfluvial slopes are Inceptisols. Since they are better drained than the Aquept and therefore cannot by classified as such, they are classified as Dystropepts.



· Fig. 4: X-ray diffractograms of the clay fractions of profiles 2 (a), 6 (b) and 7 (c), (SUR = Surface horizon; SUB = subsoil horizon).

TABLE 4 – PERCENT CONTENT OF MINERALS IN THE CLAY FRACTIONS OF A AND SUBSOIL HORIZONS OF TWO SOIL TOPOSEQUENCE OF THE NIGERIAN FEDERAL CAPITAL TERRITORY.

Profile	*Horizon*	*Depth cm*	*Kaolinite*	*Degraded mica*	*Quartz*	*Anorthite*	*Cristobalite*
			Gwagwa toposequence				
1	A11	0 - 15	96	2	2		
	IIB22t	60 - 100	74	16	10		
2	A	0 - 10	83	12	5		
	IIC	130 - 190	63	17	16		4
3	A11	0 - 15	74	12	14		
	IIICcn	150 - 190	84	8	8		
4	A11	0 - 4	87	4	9		
	A13	60 - 80	62	18	20		
			Kau toposequence				
5	A	0 - 15	90	10	–		
	C2	65 - 180	75	18	7		
6	A	0 - 30	76	14	10		
	B22t	98 - 130	69	23	8		
7	A11	0 - 16	61	32	7		
	Ab	120 - 170	50	4	40		6

They valley bottom alluvial soils are all classified as Entisols. Profile 4 is a Tropaquept but profile 7 is an Arent because of the disorderly arrangement of the horizons, attributed to the episoidal deposition of materials that vary with the period of deposition.

Conclusion

The studies of the two toposequences reveal the general characteristics of the soils in the territory. The soils are friable and light textured. The low content of the fine fractions (silt plus clay) indicates satisfactory engineering qualities providing a good road base. The abundance of rock outcrops especially in Kau toposequence would however constitute obstructional problems for the use of machinery.

The soils are slightly acidic with low organic matter, CEC and avialable phosphorus. Although the base saturation is high, exchangeable bases are low and the dominant clay type is kaolinite. The soils are therefore inherently low in fertility status.

Acknowledgements

We wish to thank Professor A. Mabogunje for affording one of us the opportunity of participating in the soil survey project that formed the basis of this paper. We also wish to acknowledge the contributions of Drs. O. Areola, J. Valette, V.O. Banjoko and K.E. Jaiyeola in carrying out the soil survey.

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