XIth International Training Forum

Zambia, July 15 - Aug 1 1985

R. Moormann.

~~20/7~~ 1: Comments Zambia Pedons

20/7	6:	Pedon 001	Mufulira	→ 1	Typic Kandiustult.
20/7	11:	Pedon 002	Misamfu red	→ 3	20/7
20/7	16:	003	Misamfu	→ 2	
21/7	21:	004	Katito	→ 4	21/7
22/7	26:	005	Malashi	→ 5	22/7
24/7	31:	006	Mukumbi	→ 8	→ 24/7
	36:	007	Mushemi		
23/7	41:	008	Mushemi, acid	→ 6	→ 23/7
24/7	46:	009	Mpongwe	→ 7	→ 24/7
	51:	010	Mufulira		
	55:	011	Shilenda		
	60:	012	Mutanda		
29/7	65:	013	Chelston	→ 14	
25/7	70:	014	Kafue: vertisol	→ 10	
26/7	75:	015	Nakambala	→ 11	
28/7	80:	016	Choma	→ 13	
27/7	85:	017	Kabuyu	→ 12	
	90:	018	Kande		
	95:	019	Mangango		
25/7	100:	020	Liteta	— 9	

30/7 _Mollisol_ – Paleustoll – Makeni 15
e: not: Udic

United States Department of Agriculture
Soil Conservation Service

Midwest National Technical Center
Federal Building, Room 345
100 Centennial Mall North
Lincoln, NE 68508-3866

FTS 541-5363; Commercial 402-471-5363

June 10, 1985

Dr. F. R. Moormann
Soil Department
State University of Vtrecht
PO Box 80.021 3508 TA
Utrecht, the Netherlands

Dear Frank

SUBJECT: Zambia CP84-FN132

Attached is a copy of the data from the pedons SMSS sampled in Zambia. I have been told you will be attending the workshop there in July and you may find the data interesting.

Many of the pedons will have Kandic horizons. I did not run them using your program so you may want to do that.

I would appreciate any comments you have on the data. I classified all of them by existing Soil Taxonomy and by the ICOMLAC proposal. I feel the ICOMLAC proposal works well for many of them.

Sincerely,

JOHN M. KIMBLE
Research Soil Scientist
National Soil Survey Laboratory

Attachments

cc: (w/o attachments)
H. Eswaran, Project Coordinator, SMSS PO Box 2890, Washington, DC
J. Witty, National Leader for Soil Taxonomy, SCS, Washington, DC
R. Meyer, USAID, Washington, DC
R. W. Arnold, Director, Soil Survey, SCS, Washington, DC
C. S. Holzhey, Head, NSSL, MNTC, SCS, Lincoln, NE

Pedon	Page	
1	6	K
2	16	
20/7 3	11	Ka
21/7 4	21	O?
22/7 5	26	O
23/7 6	41	Ka
7	46	Oa
24/7 8	31	Ka
9	100	
25/7 10	70	
11	75	
26/7		
27/7 12	85	
28/7 13	80	Ka
14	65	Ka Rhodic

From Murtha & Williams : manuscript 1985 for Geoderma
Ustic moisture regime $T_s = T_{ambiant} + 4°$
Udic " " $T_s = T_{amb} + 2°$

8394

United States Department of Agriculture

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FTS 541-5363; Commercial 402-471-5363

Subject: SOI - Zambia (CP84-FN132)

Date: June 10, 1985

To: Donald C. Hallbick
State Soil Scientist
1831 Assembly St., Room 950
Strom Thrumond Federal Bldg.
SCS, Columbia, SC 29201

File code: 430-13-5

Attached are the data and descriptions for the pedons you sampled in Zambia. I have made comments on the classifications of each pedon based on the laboratory data. Would you please review my comments and make any changes or corrections that are needed.

Many of the pedons fall into the ICOMLAC kandic proposal and will be of interest to both that committee and the Oxisol committee.

JOHN M. KIMBLE
Research Soil Scientist

Attachments

cc:
C. S. Holzhey, Head, NSSL, MNTC, SCS, Lincoln, NE
R. W. Arnold, Director, Soils, SCS, Washington, DC
R. Meyer, USAID, Washington, DC
H. Eswaran, Project Coordinator, SMSS, PO Box 2890, Washington, DC
J. Witty, Nat'l. Leader for Soil Taxonomy, Sois, SCS, Washington, DC
S. Boul, Soil Science Dept., North Carolina State Univeristy, PO Box 5907, Raleigh, NC

COMMENTS ON ZAMBIA PEDONS

by John M. Kimble

May 29, 1985

In all my classifications I am assuming the moisture regime and temperature regions in the sampled as classification are correct.

Pedon: S84FN-990-001, Mufulira series
Sampled as: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
Comments: There is a clay distribution for an argillic horizon and there are 99% resistant minerals present. Data supports the classification of the pedon as a Paleustult. There are no subgroups set up for this great group. The CEC/100g clay is <24 meq which would support using the oxic subgroup. DTA did not show >50% kaolinitc. Mineralogical family would be mixed. My classificaiton is a clayey, mixed, isohyperthermic Oxic Paleustult.

Using the proposed Kandi criteria--I came up with a Typic Kandiustult.

Pedon: S84FN-990-002, Misanfer Red series
Sampled as: Clayey, kaolinitic, isohyperthermic Typic Haplustox
Comments: This pedon has the clay distribution of an argillic horizon; however, no clay skins were discribed. Thin section has not been completed to date. My feeling is the pedon has an argillic horizon and I would classify a fine-loamy, siliceous isohyperthermic Paleustult. There are less than 10% weatherable minerals present and the clay does not drop by 20% from the maximum. The clay distribution does not suggest an Oxisol to me. At present there are no subgroups for this great group--Oxic would seem to fit.

This pedon would have a Kandic horizon under the ICOMLAC proposal which I feel is better than the present classificaiton as a Paleustult. It would be a Typic Kandiustult.

Pedon: S84FN-990-003, Misamfu series
Sampled as: Clayey, kaolinitic, isohyperthermic Typic Haplustox
Comments: This pedon also has the clay distribution for an argillic horizon and less than 10% weatherable minerals. No clay skins were described. Will need to see thin sections to be sure if there are any. Pedon would qualify as an Oxisol if we assume there is not an argillic horizon. Classification would then be fine-loamy, siliceous isohyperthermic Typic Haplustox.

10 - → too gradual for a kandic hor.

Pedon would have a Kandic horizon under the ICOMLAC proposal. It would be a Typic Kandiustult. No

For the first three pedons the ICOMLAC proposal seems to be an improvement over the present system. It removes the problem of clay skins and take in the low activity nature of these pedons.

Pedon: S84FN-990-004, Katito series
Sampled as: Clayey, kaolinitc, isohyperthermic Oxic Paleustult.
Comments: Data would support sampled as classification. Pedon would be a Typic Kandiustult under the ICOMLAC proposal.

No kandic! > 90%. No

Pedon: S84FN-990-005, Malashi series
Sampled as: Clayey, kaolinitc, isohyperthermic Oxic Paleustult
Comments: The pedon meets the clay increase for an argillic horizon. There is a dispersion problem in the third horizon using 15-bar water X 2.5 we get 54% clay. My next problem is mineralogical family, problem applies to many of the pedons and it is are they oxidic or not? Ratio of Fe_2O_3 + Gibbsite/clay is >0.2 but most would seem to have >90% quartz. In many all we know is % resistant and do not know % quartz. For this pedon I come out mixed if we assume greater than 90% quartz. My classification would then be clayey, mixed, isohyperthermic Oxic Paleustalt. Base saturation is too high for Ultisol

By the ICOMLAC proposal this pedon would have a Kandic horizon with more than 40% clay in the top 18 cm which would then key pedon out as an Oxisol. Classification would then be Tropeptic Haplustox.

correct OK

No kandic taxon; > 50% clay

Pedon: S84FN-990-006, Mukumbi series
Sampled as: Clayey, kaolinitic, isohyperthermic Oxic Paleustalf
Comments: Data supports the sampled as classification. This pedon would also have a kandic horizon. It just does not meet the >20% drop in clay so it is a Kandiustalf in the Typic subgroup.

Kandic > 90%

Pedon: S84FN-990-007, Mushemi series
Sampled as: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
Comments: The base saturation is too high for an Ultisol. The pedon has a a good argillic horizon. My classificaiton is clayey, kaolinitic, isohyperthermic Oxic Paleustalf.

Pedon would also have a kandic horizon by ICOMLAC proposal a Typic Kandiustalf.

Kandic > 90%

Pedon: S84FN-990-008, Musheni Acid series
Sampled as: Fine-loamy, siliceous, isohyperthermic Ultic Haplustox
Comments: Weighted average for control section is 32.2% clay. The base saturation is high in this pedon which would make it an Eutrutox. My classifcation is a fine-loamy, siliceous, isohyperthermic Typic Eutrustox.

Pedon again would have a kandic horizon and would be a Typic Kandiustalf.

Yes > 90%

Pedon: S84FN-990-009, Mpongwe series
Sampled as: Clayey, kaolinitic, isohyperthermic Typic Eutrustox
Comments: The pedon has the clay increase for a kandic and/or argillic horizon. I would classify the pedon as a fine, mixed, isohyperthermic Typic Haplustox. Using the ICOMLAC proposal the pedon has a kandic horizon. It has >40% clay in the top 18 cm (45.5%) after mixing. Classification would still be the same even with the kandic horizon. Pedon could be oxidic if all the resistent are not quartz, I assumed they were.

prob for kandic < 75%

Pedon: S84FN-990-010, Mufulira series
Sampled as: Clayey, kaolinitic, isohyperthermic Typic Haplustox
Comments: The pedon has the clay increase for an argillic and/or kandic horizon. The clay in the pedon is much less than the field estimate. Data would support a classificaiton as a fine-loamy, siliceous, isohyperthermic Typic Haplustox. Under the ICOMLAC proposal pedon would have a kandic horizon and I would classify as a Typic Kandiustult.

Too gradual for kandic

No kandic prob. > 90%

Pedon: S84FN-990-011: Shilenda series
Sampled as: Clayey, kaolinitic, isohypethermic Oxic Paleustult
Comments: Pedon has clay distribution of argillic and/or kandic horizon and the charge for a kandic horizon. Weighted average for control sediton is 34.4% clay make pedon fine-loamy. The data would support a classification as a fine-loamy, siliceous, isohyperthermic, Oxic Paleustult. Under ICOMLAC proposal pedon would be a Typic Kandiustult.

Yes > 90%

Pedon: S84FN-990-012, Mutanda series
Sampled as: Clayey, kaolinitic, isohyperthermic Typic Haplustox
Comments: Data would support the sampled as classification. Pedon does not meet clay increase for an Kandic horizon it would for an argillic in 30 cm. A rough plot says increase is not with in 15 cm I did not run it by Frank Mormans program.

Correct

No kandic. 4 horizons!

Pedon: S84FN-990-013, Chelston series
Sampled as: Clayey, kaolinitic, isohyperthermic Oxic Paleustalf
Comments: The top of the argillic horizon and/or kandic horizon would be at 24 cm where it meets the clay increase. The the weighted clay percent in they top 50 cm of this horizon is 34.2% clay therefore it is fine-loamy. My classification would be a fine-loamy, siliceous, isohyperthermic Oxic Paleustalf. Using ICOMLAC it would be a Typic Kandiustalf.

no kandic (>90%) Too gradual
argillic > 90%

Pedon: S84FN-990-014, Kajhe series
Sampled as: Fine, montmorillonitic, isohyperthermic Udic Chromustart
Comments: Data would support the sampled as classification accept for mineralogy which would be mixed.

OK

Pedon: S84FN-990-015, Nakambala series
Sampled as: Clayey, mixed, isohyperthermic Typic Paleustalf
Comments: Data supports the sampled as classificaiton. Using 16 mg by NH_4OAc_1 pH7 this pedon would not have a kandic horizon. Nor would it meet the ECEC requirement.

OK

Pedon: S84FN-990-016, Choma series
Sampled as: Fine-loamy, siliceous, isothermic Oxic Paleustult
Comments: Base saturation is too high for Ultisol. Data would then support a classifcation as a fine-loamy, mixed, isothermic Oxic Paleustalf. Under ICOMLAC it would be a Typic Kandiustalf.

* marginally too high, and decreasing with depth. It is an ~~ultisol~~ alfisol, but could be grouped with ultisols if regionally dominant

Pedon: S84FN-990-017, Kabuyu series
Sampled as: Mixed, isohyperthermic Typic Ustipsamment
Comments: Data would support the sampled as classification. There is a question to presence of kandic horizon in the lower part. It does not look like the clay increase would occur within 15 cm so I feel there is not a kandic horizon. If there are clay skins there may be an argillic starting at 54 cm. There is a 3% clay increase with in 30 cm. Comments please!

no kandic > 90%
no argillic > 90%

Met

Pedon: S84FN-990-018, Kande series
Sampled as: Sandy, siliceous, isohyperthermic Aeric Tropohumod ?
Comments: Data would support sampled as classification. Not a real Typical Spodosol but it makes it under the existing criteria.

Met

Pedon: S84FN-990-019, Mangango series
Sampled as: Clayey, kaolinitic, isohyperthermic, Oxic Palestult
Comments: Data supports sampled as classification. Pedon would have a kandic horizon and classify under ICOMLAC as a Typic Kandistult.

no kandic, but an argillic

Pedon: S84FN-990-020, Liteta series
Sampled as: Very fine, mixed, isohyperthermic Udic Paleustoll
Comments: Data support sampled as classification.

Oh color = ± marginal in A.

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

photo nr 6

001

PROFILE IDENTIFICATION ZAMBIA 001 MUFULIRA

MUFULIRA

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	10 CM	16.5 %
2	10 CM	20 CM	29.1 %
3	20 CM	43 CM	45.3 %
4	43 CM	71 CM	48.1 %
5	71 CM	125 CM	53.3 %

22 18 10 x 18.5
10 x 29.5
10

KANDIC HORIZON (starting) BETWEEN 23 AND 38 CM

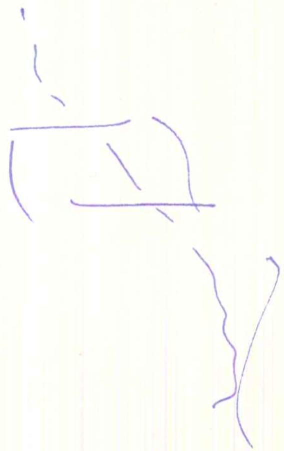
CLAY CONTENT AT TOP: 32.7 %
AT BOTTOM: 43.1 %
DIFFERENCE: 10.4 %
RATIO: 1.32

Typic kandiustalf.

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 9.9 CM (25.7 - 35.5 CM)

CLAY CONTENT AT TOP: 34.5 %
AT BOTTOM: 41.3 %
DIFFERENCE: 6.9 %
RATIO: 1.20

Dystric Nitosol



HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH PROBABILITY BETWEEN 75 AND 90%

TESTSTATISTIC = 1.282 WITH STUDENT'S
DISTRIBUTION (DF 2)

Typic(?) Kandiustult.

MUFULIRA

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTULT

S 84FN-990 -001 DATE 05/31/85 SAMPLE NO. 84P2778-2783
PEDON NO. 84P 507
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE SAND .05 -.25	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRAGS WEIGHT 2 -5	COARSE FRAGS WEIGHT 5 -20	COARSE FRAGS WEIGHT 20 -75	COARSE FRAGS WEIGHT .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842778	1S	0- 10	A	16.7	10.2	73.1	8.7		3.8	6.4	12.7	34.7	21.5	3.8	0.4	--	--	--	60	--
842779	2S	10- 20	AB	29.1	10.6	60.3	15.7		3.9	6.7	11.7	28.0	16.6	3.7	0.3	--	--	--	49	--
842780	3S	20- 43	BT1	45.3	8.6	46.1	25.9		3.1	5.5	10.3	20.3	12.2	2.9	0.4	--	--	--	36	--
842781	4S	43- 71	BT2	48.1	8.8	43.1	27.8		3.2	5.6	9.8	18.8	11.0	3.0	0.5	--	--	--	33	--
842782	5S	71-132	BT3	53.3	8.1	38.6	29.5		3.1	5.0	9.3	16.5	9.3	2.9	0.6	--	--	--	29	--
842783	6S	132-153	BT4	49.4	8.9	41.7	27.0		3.3	5.6	10.0	19.0	9.9	2.3	0.5	TR	--	--	32	--

SAMPLE NO.	HZN NO.	ORGN C	TOTAL N	EXTR P	TOTAL S	DITH-CIT EXTRACTABLE FE	DITH-CIT EXTRACTABLE AL	DITH-CIT EXTRACTABLE MN	CEC	RATIO/CLAY 15 BAR	ATTERBERG LIMITS - LL	ATTERBERG LIMITS - PI	BULK DENSITY - FIELD MOIST	BULK DENSITY - 1/3 BAR	BULK DENSITY - OVEN DRY	COLE WHOLE SOIL	WATER CONTENT - FIELD MOIST	WATER CONTENT - 1/10 BAR	WATER CONTENT - 1/3 BAR	WATER CONTENT - 15 BAR	WRD WHOLE SOIL
		6A1C	6B3A		6R3A	6C2B	6G7A	6D2A	8D1	8D1	4F1	4F	4A3A	4A1D	4A1H	4D1	4B4	4B1C	4B1C	4B2A	4G1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - - ->				CM/CM
842778	1	0.85	0.053			1.5	0.2	TR	0.22	0.41		NP		1.47	1.54	0.016			10.8	6.8	0.06
842779	2	0.57	0.042			1.8	0.3	TR	0.15	0.33				1.50	1.55	0.011			14.3	9.7	0.07
842780	3	0.37	0.033			2.1	0.4	--	0.11	0.32	37	16		1.47	1.52	0.011			18.2	14.5	0.05
842781	4	0.28				2.1	0.4	--	0.10	0.32				1.45	1.50	0.011			20.0	15.4	0.07
842782	5	0.20				2.3	0.5	--	0.10	0.32				1.32	1.37	0.012			21.1	16.8	0.06
842783	6	0.18				2.2	0.4	--	0.09	0.32	39	15		1.28	1.32	0.010			18.9	16.0	0.04

*** CONTINUATION ON NEXT PAGE ***

(⅓ – 15 b water) × bulk density at ⅓ bar

Kandic between 24 and 39 (26.6 – 36.9)
prob 75/90 stat 1.183.

MUFULIRA S 84FN-990 -001 DATE 05/31/85 PEDON NO. 84P 507 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY AL 6H5A	EXTR AL 6G9A	(- - - -CEC - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842778	1	0.2	0.4	TR	0.2	0.8	4.1	0.8	4.9	3.7	1.6	50	16	22				4.1	4.3	5.1
842779	2	--	0.3	TR	0.3	0.6	4.5	1.1	5.1	4.3	1.7	65	12	14				4.0	4.2	5.1
842780	3	--	0.3	TR	0.2	0.5	5.7	1.7	6.2	5.1	2.2	77	8	10				4.0	4.2	4.9
842781	4	--	0.2	TR	0.2	0.4	5.4	1.6	5.8	4.8	2.0	80	7	8				4.0	4.2	5.1
842782	5	--	0.2	TR	0.2	0.4	5.9	1.8	6.3	5.3	2.2	82	6	8				4.0	4.3	5.0
842783	6	--	0.1	TR	0.1	0.2	5.4	2.5	5.6	4.6	2.7	93	4	4				4.0	4.3	5.4

< 35 < 50 ΔpH = -1.4

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I	7A2I	7A2I	7A2I	7A3	7A3	7B1A	7B1A
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842778	1								
842779	2								
842780	3	KK 5	MI 2	GE 1		KK37		99	WE 1
842781	4	KK 5	MI 2	GE 1		KK49		99	WE 1
842782	5								
842783	6								

FAMILY CONTROL SECTION: DEPTH 20- 70 PCT CLAY 47 PCT .1-75MM 34

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GE GOETHITE WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

8

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<-PCT->									<-RELATIVE AMOUNTS->					<-PCT->			
84P2778	1																			
84P2779	2																			
84P2780	3	FNES	99	RE99	WE 1							KK 5	MI 2	GE 1			KK37		1.2	4.6
84P2781	4	FNES	99	RE99	WE 1							KK 5	MI 2	GE 1			KK49		1.2	4.7
84P2782	5																			
84P2783	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE RE = RESISTANT MINERALS MI = MICA WE = WEATHERABLE MINERALS KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

001

Print date: 06-03-1985

SERIES: Mufulira NSSL ID #: 84P0507
SOIL SURVEY # S83-FN-990-001
LOCATION: Misamfu Reg. Res., St. 8 km N of Kasama NOP Zambia. Pit located about 250 m E of station headquarters.
LATITUDE: 10-10- -S LONGITUDE: 031-10- -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
GEOMORPHIC POSITION: summit interfluve
MICRORELIEF:
SLOPE CHARACTERISITICS: .5% plane, southeast facing ELEVATION: 1384 m MSL
PRECIPITATION: 1360 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 19.8, SUM: 20.0, WIN: 17.0
SOIL TEMPERATURE: ANN: 22.5, SUM: 22.1, WIN: 20.5
DRAINAGE: Well drained LAND USE:
RUNOFF: Moderate
FAMILY CONTROL SECTION: 20 to 70 cm
PARENT MATERIAL: residuum from metamorphic-acidic material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult → implied ! ; no oxic in key Typic Paleustult.
WEATHER STATION: MISAMF
DIAGNOSTIC HORIZONS: 20 to 153 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and C. Kalima SAMPLE DATE: 11/83

Typic Kandiustult

Termite mounds occur at a distance of 10 to 15 m from the pit. Cracks 2 to 3 mm wide extend from the base of the AB horizon downwards 80 to 100 cm apart. Common termite chambers 4 to 5 in diameter connected by 1 cm channels.

A--0 to 10 cm; dark yellowish brown (10YR 4/4) sandy loam; dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, slightly sticky, nonplastic; many fine roots throughout and common medium roots throughout; many very fine and fine interstitial pores; medium acid; clear smooth boundary.
In Ah AB Bw1 and Bw2 common termite chambers generally 4 to 5 cm in diameter inter connected by channels about 1 cm in diameter.
84P2778

AB--10 to 20 cm; reddish yellow (7.5YR 6/6) sandy clay; strong brown (7.5YR 4/6) moist; moderate fine and medium subangular blocky structure; hard, very sticky, plastic; few patchy distinct-thin brown to dark brown (7.5YR4/4) organic coats on faces of peds; common fine roots throughout and few medium roots throughout; many fine and medium continuous tubular and common very fine and fine interstitial pores; strongly acid; clear smooth boundary.
Amount of chambers decrease with depth.
84P2779

Bt1--20 to 43 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 4/6) moist; weak fine and medium subangular blocky structure; hard, very sticky, plastic; few patchy faint-thin brown to dark brown (7.5YR4/4) organic coats on faces of peds; very few very fine roots throughout and very few fine and medium roots throughout; common fine and medium continuous tubular and few very fine and fine interstitial pores; strongly acid; gradual smooth boundary.
Cracks 2 to 3 mm wide extend from the base of the AB horizon downwards 80 to 100 cm apart.
84P2780

- cycle of 15 years for Micro breaking down

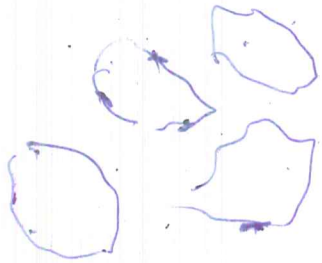
10

Bt2--43 to 71 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; weak fine and medium subangular blocky structure; hard, slightly sticky, plastic; few patchy faint-thin clay films on horizontal faces of peds and clay films between sand grains; very few fine roots throughout; few to common fine and medium continuous tubular and few very fine and fine interstitial pores; extremely acid; diffuse smooth boundary.
84P2781

weak, patchy cutans, etc
Better a kandic

Bt3--71 to 132 cm; reddish yellow (7.5YR 6/6) clay; yellowish red (5YR 5/8) moist; weak medium subangular blocky structure; slightly hard, slightly sticky, plastic; very few fine roots throughout; few to common fine and medium continuous tubular and few very fine and fine interstitial pores; extremely acid; diffuse smooth boundary.
84P2782

Bt4--132 to 153 cm; reddish yellow (5YR 7/8) clay; yellowish red (5YR 5/6) moist; weak coarse granular structure; slightly hard, slightly sticky, plastic; very few fine roots throughout; few to common fine and medium continuous tubular and few very fine and fine interstitial pores; extremely acid.
84P2783



PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

Rhodic ~~Ferr~~ Kandiustult

002

MISAMFU

PROFILE IDENTIFICATION ZAMBIA 002 MISAMFU

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	16 CM	17.0 %
2	16 CM	37 CM	26.5 %
3	37 CM	63 CM	31.7 %
4	63 CM	95 CM	32.7 %
5	95 CM	125 CM	28.9 %

~~possible~~ ~~Kandiplo~~ not.

KANDIC HORIZON BETWEEN 21 AND 36 CM

CLAY CONTENT AT TOP: 22.6 %
AT BOTTOM: 27.9 %
DIFFERENCE: 5.3 %
RATIO: 1.23

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 12.9 CM (22.5 - 35.4 CM)

CLAY CONTENT AT TOP: 23.0 %
AT BOTTOM: 27.5 %
DIFFERENCE: 4.6 %
RATIO: 1.20

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH PROBABILITY BETWEEN 75 AND 90%

TESTSTATISTIC = 1.026 WITH STUDENT'S
DISTRIBUTION (DF 2)

V

MISAMFU RED

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC TYPIC HAPLUSTOX

S 84FN-990 -002 DATE 05/31/85 SAMPLE NO. 84P2784-2789
PEDON NO. 84P 508
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002-.05	SAND .05-2	FINE LT .0002	CO3 LT .002	FINE SILT .002-.02	COARSE SILT .02-.05	VF SAND .05-.10	F SAND .10-.25	M SAND .25-.50	C SAND .5-1	VC SAND 1-2	WEIGHT 2-5	WEIGHT 5-20	WEIGHT 20-75	WEIGHT .1-75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842784	1S	0- 16	A	17.0	6.0	77.0			2.5	3.5	10.6	38.0	23.1	4.9	0.4	--	--	--	66	--
842785	2S	16- 37	BA	26.5	5.5	68.0			2.2	3.3	8.3	31.7	21.6	5.5	0.9	TR	--	--	60	--
842786	3S	37- 63	BW1	31.7	6.0	62.3			2.4	3.6	9.0	29.4	19.0	4.3	0.6	TR	--	--	53	--
842787	4S	63- 95	BW2	32.7	5.9	61.4			2.2	3.7	8.8	29.3	18.0	4.8	0.5	TR	--	--	53	--
842788	5S	95-124	BW2	28.9	5.7	65.4			2.2	3.5	9.0	29.9	20.5	5.5	0.5	--	--	--	56	--
842789	6S	124-148	BW3	26.6	5.7	67.7			2.3	3.4	8.8	32.7	20.6	4.9	0.7	TR	--	--	59	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	15 BAR 8D1	LL 4F1	PI 4F	FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	WHOLE SOIL 4D1	FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842784	1	1.22	0.067			2.6	0.3	TR	0.26	0.39	18	2		1.33	1.36	0.007			10.4	6.7	0.05
842785	2	0.48	0.030			3.0	0.3	--	0.10	0.33	21	8		1.42	1.45	0.007			12.2	8.7	0.05
842786	3	0.30	0.023			3.1	0.3	--	0.07	0.32				1.39	1.42	0.007			13.2	10.1	0.04
842787	4	0.19				3.2	0.3	--	0.07	0.31	24	10		1.34	1.37	0.007			12.7	10.2	0.03
842788	5	0.15				3.0	0.3	--	0.06	0.33				1.34	1.36	0.005			12.8	9.4	0.05
842789	6	0.12				3.0	0.3	--	0.06	0.33				1.35	1.37	0.005			12.2	8.9	0.04

*** CONTINUATION ON NEXT PAGE ***

654
2
1308

Kandic between 21 - 36 cm
Thinnest 22.4 - 35.2
Prop 75-90%, Slaking 1.117

12

MISAMFU RED S 84FN-990 -002 DATE 05/31/85 PEDON NO. 84P 508 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842784	1	1.5	0.8	TR	0.1	2.4	4.2		6.6	4.5			36	53				4.6	4.9	5.7
842785	2	0.5	0.5	TR	TR	1.0	2.8	0.3	3.8	2.6	1.3	23	26	38				4.7	4.8	5.4
842786	3	TR	0.6	TR	0.1	0.7	2.7		3.4	2.3			21	30				4.7	4.9	5.7
842787	4	--	0.3	TR	TR	0.3	3.2		3.5	2.3			9	13				4.4	4.6	5.6
842788	5	--	0.2	TR	TR	0.2	2.6		2.8	1.7			7	12				4.3	4.5	5.7
842789	6	--	0.1	TR	--	0.1	2.6		2.7	1.5			4	7				4.3	4.5	5.6

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - - -)(- - - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -)(- -<2U - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL 7B1A	DOM RES 7B1A	WEATH
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->				
842784	1									
842785	2	KK 5	VR 1	GE 1	MI 1	KK33		99		WETR
842786	3									
842787	4	KK 5	GE 2	MI 1	VR 1	KK42		98		WE 2
842788	5									
842789	6	KK 5	GE 2	MI 1	VR 1	KK34				

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 31 PCT .1-75MM 54

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE VR VERMICULITE GE GOETHITE MI MICA WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

13

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA	RE	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	MINERALOGY: X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2784	1																			
84P2785	2	FNES	99	RE99	WE<1							KK 5	VR 1	GE 1	MI 1		KK33		0.4	7.8
84P2786	3																			
84P2787	4	FNES	98	RE98	WE 2							KK 5	GE 2	MI 1	VR 1		KK42		0.4	6.8
84P2788	5																			
84P2789	6											KK 5	GE 2	MI 1	VR 1		KK34		0.4	6.4

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE RE = RESISTANT MINERALS MI = MICA VR = VERMICULITE WE = WEATHERABLE MINERALS

KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

14

Print date: 06-03-1985

SERIES: Misamfu Red NSSL ID #: 84P0508
SOIL SURVEY # S83-FN-990-002
LOCATION: Miasmfu Reg. Res. St. 8 km N of Kasama NOP Zambia. Pit locacted about 650 m NW of station headquarters.
LATITUDE: 10-10- -S LONGITUDE: 031-10- -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
GEOMORPHIC POSITION: summit interfluve
MICRORELIEF:
SLOPE CHARACTERISITICS: .5% plane ELEVATION: 1384 m MSL
PRECIPITATION: 1360 mm Ustic moisture regime PERMEABILITY: Rapid
AIR TEMPERATURE: ANN: 19.8, SUM: 20.0, WIN: 17.0
SOIL TEMPERATURE: ANN: 22.5, SUM: 22.1, WIN: 20.5
DRAINAGE: Well drained LAND USE:
RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from metamorphic-acidic material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Typic Haplustox
WEATHER STATION: MISAMF
DIAGNOSTIC HORIZONS: 0 to 16 cm Ochric 37 to 148 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren and L. Bustness SAMPLE DATE: 11/83
1. Described when dry. 2. Think is within range of oxisols.

A—0 to 16 cm; reddish brown (5YR 4/4) sandy loam; dark reddish brown (5YR 3/3) moist; weak fine and medium crumb structure; slightly hard, nonsticky, plastic; many fine roots throughout and few medium roots throughout; many very fine and fine interstitial and tubular and common fine to coarse continuous tubular pores; clear smooth boundary.
84P2784

BA—16 to 37 cm; red (2.5YR 4/8) clay; red (2.5YR 4/6) moist; massive parting to strong very fine granular; hard, very sticky, plastic; common fine roots throughout; common to many very fine and fine interstitial and tubular and few to common fine and medium continuous tubular pores; clear wavy boundary.
84P2785

Bw1—37 to 63 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; massive parting to strong very fine granular; slightly hard, very sticky, plastic; common fine roots throughout and few medium and coarse roots throughout; common to many very fine and fine interstitial and tubular and few fine to coarse continuous tubular pores; diffuse smooth boundary.
In Bw1 and Bw2 horizons few termite chambers occur inter-connected by channels of 2 to 3 mm wide and conneceted with the surface by channels 5 to 10 mm wide. Some of these vertical channels are partly filled and lined.
84P2786

Bw2—63 to 124 cm; red (2.5YR 4/8) sandy clay; dark red (2.5YR 3/6) moist; massive parting to strong very fine granular; soft, very sticky, plastic; few fine and medium roots throughout; many very fine and fine interstitial and tubular and few fine to coarse continuous tubular pores; gradual smooth boundary.
Horizon split for sampling 63 to 95cm No. 2787 and 95 to 124 cm No. 2788.
84P2787

This is a kandiustult?

15

Bw3--124 to 148 cm; red (2.5YR 5/8) sandy clay; dark red (2.5YR 3/6) moist; massive parting to strong very fine granular; soft, very sticky, plastic; very few fine and medium roots throughout; many very fine and fine interstitial and tubular and very few fine and medium continuous tubular pores.
84P2789

PROGRAM: SEARCH FOR ~~KANDIC~~ ARGILLIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

003

MISAMFU

PROFILE IDENTIFICATION ZAMBIA 003 MISAMFU - FOR ARGILLIC HORIZON

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	10 CM	18.3 %
2	10 CM	21 CM	18.8 %
3	21 CM	48 CM	24.7 %
4	48 CM	80 CM	29.9 %
5	80 CM	119 CM	29.7 %

Argillic distribution but no clear cutoffs.

~~KANDIC~~ ARGILLIC HORIZON BETWEEN 16 AND 46 CM

CLAY CONTENT AT TOP: 19.5 %
AT BOTTOM: 27.2 %
DIFFERENCE: 7.7 %
RATIO: 1.39

No kandic, prob. > 75-90% ; too gradual

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 15.8 CM (22.6 - 38.4 CM)

CLAY CONTENT AT TOP: 21.3 %
AT BOTTOM: 25.5 %
DIFFERENCE: 4.2 %
RATIO: 1.20

Try again with hor 2 - 5 or 1 - 4

HYPOTHESIS THAT THERE IS AN ~~KANDIC~~ ARGILLIC HORIZON IS TRUE WITH MORE THAN 90% PROBABILITY

TESTSTATISTIC = 13.568 WITH STUDENT'S DISTRIBUTION (DF 2)

MISAMFU

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC TYPIC HAPLUSTOX

S 84FN-990 -003 DATE 05/31/85 SAMPLE NO. 84P2790-2795
PEDON NO. 84P 509
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) 2 -5	5 -20	20 -75	>2MM WEIGHT .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842790	1S	0- 10	A	18.3	3.7	78.0			1.4	2.3	7.5	33.1	30.3	6.7	0.4	TR	--	--	70	--
842791	2S	10- 21	AB	18.8	3.6	77.6			1.3	2.3	7.2	36.5	28.1	5.5	0.3	TR	--	--	70	--
842792	3S	21- 48	BW1	24.7	2.6	72.7			0.3	2.3	7.1	33.5	26.6	5.1	0.4	--	--	--	66	--
842793	4S	48- 80	BW2	29.9	2.7	67.4			0.5	2.2	7.2	28.8	25.1	5.9	0.4	--	--	--	60	--
842794	5S	80-119	BW3	29.7	2.8	67.5			0.5	2.3	7.4	29.3	24.6	5.8	0.4	--	--	--	60	--
842795	6S	119-146	BW4	32.6	4.0	63.4			1.1	2.9	8.5	28.1	21.5	4.8	0.5	--	--	--	55	--

SAMPLE NO.	HZN NO.	ORGN TOTAL C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	RATIO/CLAY CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842790	1	1.50				1.1	0.2	TR	0.30	0.39	20	4		1.36	1.44	0.019			11.6	7.1	0.06
842791	2	0.81				1.1	0.2	TR	0.16	0.36				1.37	1.41	0.010			10.4	6.8	0.05
842792	3	0.39				1.2	0.2	--	0.08	0.32	19	4		1.44	1.44	--			13.7	8.0	0.08
842793	4	0.26				1.3	0.2	--	0.06	0.32				1.38	1.41	0.007			11.6	9.5	0.03
842794	5	0.18				1.2	0.2	--	0.05	0.31	27	12		1.36	1.39	0.007			11.6	9.2	0.03
842795	6	0.15				1.4	0.3	--	0.05	0.32				1.29	1.36	0.018			13.2	10.5	0.03

*** CONTINUATION ON NEXT PAGE ***

fine loamy family -

×100 = CEC
100 clay

without hor 1
no kandic
prob 75-90
test stat. 1.126

No kandic (too gradual)
Prob. (5 hor) 75 and 90
Test stat = 1.602

17

MISAMFU S 84FN-990 -003 DATE 05/31/85 PEDON NO. 84P 509 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SAT- SUM 5C3	BASE SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH KCL IN 8C1G	PH CACL2 .01M 8C1F	PH H2O 1:1 8C1F
		<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842790	1	1.3	1.3	TR	0.2	2.8	5.1		7.9	5.5			35	51				4.8	4.9	5.9
842791	2	--	0.2	TR	0.1	0.3	4.6	1.1	4.9	3.1	1.4	79	6	10				4.2	4.2	5.2
842792	3	--	0.2	TR	--	0.2	3.2	0.7	3.4	1.9	0.9	78	6	11				4.0	4.3	5.0
842793	4	--	0.2	TR	--	0.2	2.6	0.6	2.8	1.8	0.8	75	7	11				4.2	4.3	5.1
842794	5	--	0.1	TR	--	0.1	2.6	0.6	2.7	1.4	0.7	86	4	7				4.2	4.4	5.4
842795	6	--	0.1	TR	--	0.1	2.8	0.6	2.9	1.7	0.7	86	3	6				4.5	4.6	5.5

SAMPLE NO.	HZN NO.	MINERALOGY CLAY X-RAY <2U 7A2I	7A2I	7A2I	7A2I	DTA <2U 7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842790	1								
842791	2								
842792	3	KK 5	GE 2	VR 1		KK34		99	WE 1
842793	4								
842794	5	KK 5	GE 2	GI 1		KK58	GITR	99	WETR
842795	6								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 28 PCT .1-75MM 62

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GE GOETHITE VR VERMICULITE WE WEATH MIN GI GIBBSITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

18

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
		<-PCT->											<-RELATIVE AMOUNTS->					<-PCT->			
84P2790	1																				
84P2791	2																				
84P2792	3	FNES	99	RE99	WE 1								KK 5	GE 2	VR 1			KK34		0.2	3.7
84P2793	4																				
84P2794	5	FNES	99	RE99	WE<1								KK 5	GE 2	GI 1			KK58	GI<1	0.3	3.8
84P2795	6																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE RE = RESISTANT MINERALS VR = VERMICULITE WE = WEATHERABLE MINERALS KK = KAOLINITE

GI = GIBBSITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

19

Print date: 06-03-1985

SERIES: Misamfu NSSL ID #: 84P0509
SOIL SURVEY # S83-FN-990-003
LOCATION: Misamfu Reg. Res. St. 8 km N of Kasama NOP Zambia. Pit located about 400 m S of station headquarters.
LATITUDE: 10-10- -S LONGITUDE: 031-10- -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
GEOMORPHIC POSITION: summit interfluve
MICRORELIEF:
SLOPE CHARACTERISITICS: .5% plane, southeast facing ELEVATION: 1384 m MSL
PRECIPITATION: 1360 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 19.8, SUM: 20.0, WIN: 17.0
SOIL TEMPERATURE: ANN: 22.5, SUM: 22.1, WIN: 20.5
DRAINAGE: Well drained LAND USE:
RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from metamorphic-acidic material
CLASSIFICATION: Fine-loamy, siliceous, isohyperthermic Typic Haplustox
WEATHER STATION: MISAMF
DIAGNOSTIC HORIZONS: 0 to 10 cm Ochric 21 to 146 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren and L. Bustness SAMPLE DATE: 11/83
1. Described when dry. 2. Data standard acid. 3. Feel is within range of Oxisols. 4. Has less clay and less red than site 2.

A--0 to 10 cm; brown to dark brown (7.5YR 4/2) sandy loam; dark brown (7.5YR 3/2) moist; weak fine and medium crumb structure; slightly hard, nonsticky, plastic; many fine roots throughout and few medium roots throughout; many fine and medium continuous tubular and many very fine interstitial pores; clear smooth boundary.
84P2790

AB--10 to 21 cm; brown (7.5YR 5/4) sandy loam; strong brown (7.5YR 4/6) moist; I fine and medium subangular blocky structure; slightly hard, nonsticky, plastic; common fine and medium roots throughout and few very coarse roots throughout; many fine and medium continuous tubular and many very fine interstitial pores; clear smooth boundary.
84P2791

Bw1--21 to 48 cm; reddish yellow (7.5YR 6/6) sandy clay loam; yellowish red (5YR 5/6) moist; massive parting to strong very fine granular; slightly hard, slightly sticky, plastic; common fine to coarse roots throughout; many fine and medium continuous tubular and many very fine interstitial pores; clear smooth boundary.
84P2792

Bw2--48 to 80 cm; reddish yellow (7.5YR 6/6) sandy clay loam; yellowish red (5YR 5/6) moist; massive parting to strong very fine granular; slightly hard, slightly sticky, plastic; few fine to coarse roots throughout; few to common fine and medium continuous tubular and many very fine interstitial pores; gradual smooth boundary. In Bw2 and Bw3 horizons chambers oftermites and burrows of beetles occur. Also two bird nests occur in these horizons.
84P2793

Bw3--80 to 119 cm; reddish yellow (7.5YR 6/6) sandy clay; yellowish red (5YR 5/6) moist; massive parting to strong very fine granular; soft, very sticky, plastic; few

no clay skins

no clay skins

fine and medium roots throughout; very few fine and medium continuous tubular and many very fine and fine interstitial pores; gradual smooth boundary.
In Bw3 horizon locally a pan like layer occurs due to termite activity.
84P2794

Bw4--119 to 146 cm; reddish yellow (7.5YR 6/6) sandy clay; yellowish red (5YR 5/8) moist; massive parting to strong very fine granular; soft, slightly sticky, plastic; very few fine and medium roots throughout; very few fine and medium continuous tubular and many very fine and fine interstitial pores.
84P2795

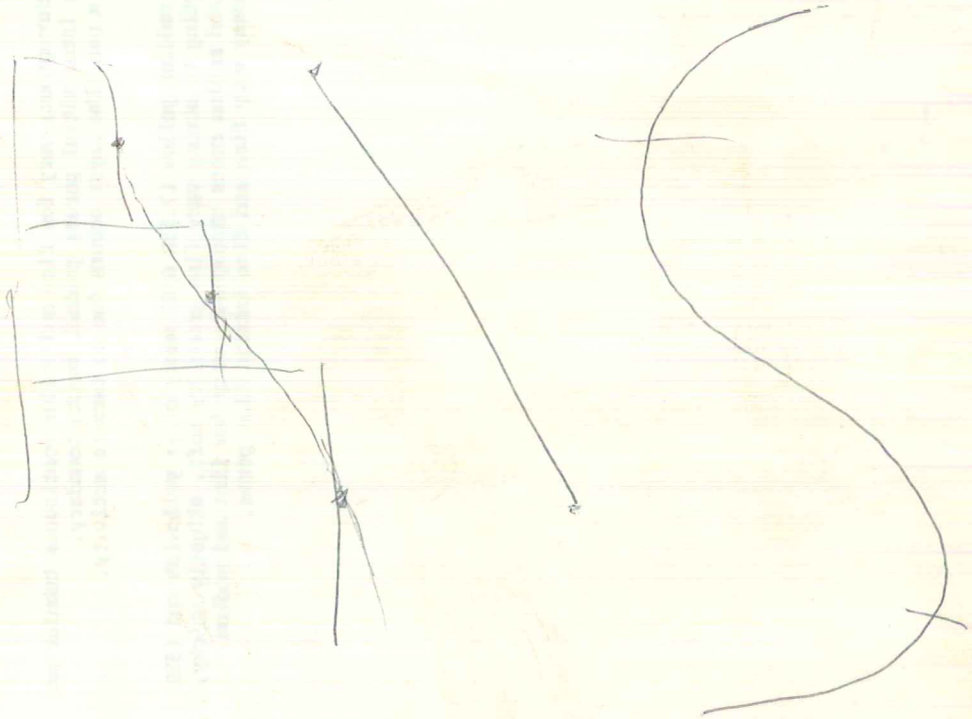
Farm:

- cattle
- maize
- wheat

no lime but single superphosph.

High rainfall not advantage in seeding time

30/40 acres of wheat



PROGRAM: SEARCH FOR ~~KANDIC~~ ARGILLIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED
4TH DEGREE POLYNOMIAL

004 KATITO

PROFILE IDENTIFICATION ZAMBIA 004 KATITO FOR ARGILLIC HORIZON

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	10 CM	36.3 %
2	10 CM	20 CM	39.2 %
3	20 CM	46 CM	46.5 %
4	46 CM	77 CM	48.7 %
5	77 CM	123 CM	50.3 %

ARGILLIC
NO ~~KANDIC~~ HORIZON FOUND

HYPOTHESIS THAT THERE IS NO ~~KANDIC~~ ARGILLIC HORIZON IS TRUE
WITH ~~LESS THAN~~ 75% PROBABILITY

TESTSTATISTIC = 0.121 WITH STUDENT'S
DISTRIBUTION (DF 2)

Photos 9 (profile) and
" 10 vegetation
miombo woodland.

upper limit 49 cm
lower limit 162 cm

21

storage cap $\frac{1}{3}$ - 15 bar water x bulk density x depth in cm
✓ sum water of all horizons

KATITO

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTULT

S 84FN-990 -004 DATE 05/31/85 SAMPLE NO. 84P2796-2801
PEDON NO. 84P 510
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002-.05	TOTAL SAND .05-2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002-.02	SILT COARSE .02-.05	SAND VF .05-.10	SAND F .10-.25	SAND M .25-.50	SAND C .5-1	SAND VC 1-2	COARSE FRACTIONS(MM) WEIGHT 2-5	5-20	20-75	.1-75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842796	1S	0- 10	A1	36.3	4.9	58.8			2.7	2.2	4.7	24.5	24.9	4.3	0.4	--	--	--	54	--
842797	2S	10- 20	A2	39.2	4.5	56.3			2.4	2.1	4.5	22.3	24.2	4.6	0.7	TR	--	--	52	--
842798	3S	20- 46	BA	46.5	4.5	49.0			2.4	2.1	4.2	19.4	20.4	4.5	0.5	--	--	--	45	--
842799	4S	46- 77	BT1	48.7	4.2	47.1			2.0	2.2	3.9	17.8	20.3	4.4	0.7	TR	--	--	43	--
842800	5S	77-123	BT2	50.3	4.5	45.2			1.9	2.6	4.4	18.0	18.5	3.6	0.7	TR	--	--	41	--
842801	6S	123-143	BT3	52.6	4.7	42.7			2.4	2.3	4.7	16.9	17.1	3.6	0.4	--	--	--	38	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	RATIO/CLAY CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY - FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT - FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WHOLE SOIL 4C1	WRD Slow. Cap.
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM	
842796	1	1.20	0.069			2.2	0.3	0.1	0.12	0.36	29	12		1.32	1.40	0.020			18.7	13.0	0.08	0.8
842797	2	0.95	0.054			2.3	0.3	0.1	0.10	0.32				1.33	1.39	0.015			15.0	12.6	0.03	0.3
842798	3	0.66	0.041			2.4	0.3	0.1	0.08	0.29	32	14		1.38	1.41	0.007			16.7	13.6	0.04	1.04
842799	4	0.44				2.5	0.3	TR	0.06	0.28				1.36	1.39	0.007			17.7	13.8	0.05	1.51
842800	5	0.28				2.5	0.3	TR	0.06	0.29	34	13		1.24	1.27	0.008			18.3	14.6	0.05	2.36
842801	6	0.22				2.7	0.4	TR	0.06	0.29				1.20	1.23	0.008			18.3	15.3	0.04	~~1.66~~
																						0.8

*** CONTINUATION ON NEXT PAGE ***

No argillic,
less than 15%
Test stat. = 0.121

No kandic
> 20% prob
Test stat 4.114
Too gradual

KATITO S 84FN-990 -004 DATE 05/31/85 PEDON NO. 84P 510 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH - - - KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1	ΔpH
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->									
842796	1	TR	0.3	TR	0.2	0.5	6.9	1.1	7.4	4.4	1.6	69	7	11				4.2	4.5	5.1	-0.9
842797	2	--	0.2	TR	0.1	0.3	6.1	1.2	6.4	4.1	1.5	80	5	7				4.2	4.4	5.1	-0.9
842798	3	--	0.2	TR	0.1	0.3	5.5	1.0	5.8	3.9	1.3	77	5	8				4.2	4.3	5.1	-0.9
842799	4	--	0.3	TR	--	0.3	5.0	0.8	5.3	3.1	1.1	73	6	10				4.2	4.4	5.2	-1.0
842800	5	--	0.2	TR	0.2	0.4	3.9	0.6	4.3	2.8	1.0	60	9	14				4.4	4.4	5.4	-1.0
842801	6	--	TR	TR	0.1	0.1	4.5	0.7	4.6	3.1	0.8	88	2	3				4.2	4.4	5.4	-1.2

low ΔpH

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842796	1	
842797	2	
842798	3	KK 5 GE 2 KK52
842799	4	KK 5 GE 2 KK61 99 TR
842800	5	KK 5 GE 1 KK61 99 TR
842801	6	

FAMILY CONTROL SECTION: DEPTH 46- 96 PCT CLAY 49 PCT .1-75MM 42

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GE GOETHITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

23

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL / SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY / CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2796	1																			
84P2797	2																			
84P2798	3											KK	5	GE	2		KK	52	0.2	5.1
84P2799	4	FNES	99	QZ	82	QC	17	FE	1			KK	5	GE	2		KK	61	0.2	5.3
84P2800	5	FNES	99	QZ	82	QC	17	FE	1			KK	5	GE	1		KK	61	0.2	5.0
84P2801	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE KK = KAOLINITE FE = IRON OXIDES QC = CLAY-COATED QUARTZ QZ = QUARTZ

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

24

Print date: 06-03-1985

SERIES: Katito NSSL ID #: 84P0510
SOIL SURVEY # S83-FN-990-004
LOCATION: Mbala State Ranch about 11 km SSE of Mbala Nop Zambia.
LATITUDE: 08-57- -S LONGITUDE: 312-7 - -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
GEOMORPHIC POSITION: shoulder interfluve
MICRORELIEF:
SLOPE CHARACTERISITICS: .5% plane ELEVATION: 1800 m MSL
PRECIPITATION: 1250 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 19.7, SUM: 20.0, WIN: 18.1
DRAINAGE: Well drained LAND USE:
STONINESS:
FAMILY CONTROL SECTION: 46 to 96 cm
PARENT MATERIAL: residuum
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
WEATHER STATION: MBALA
DIAGNOSTIC HORIZONS: 0 to 20 cm Ochric 46 to 143 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and L. Bustness SAMPLE DATE: 11/83

To be discussed: If clay skins are clear. this may go with Alfisols.

1. Pedon would classify as Oxic Paleustult if subgroups are analogous tosubgroups of the Haplustults. Probably leandic.

Vandic

A—0 to 10 cm; yellowish red (5YR 5/6) sandy clay; dark reddish brown (5YR 3/4) moist; moderate fine and medium GR structure; slightly hard, slightly sticky, plastic; many fine and medium roots throughout and few coarse roots throughout; many fine void between rock fragments and many fine and medium continuous tubular pores; clear smooth boundary.
84P2796

A2—10 to 20 cm; yellowish red (5YR 5/8) sandy clay; yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, slightly sticky, plastic; many fine and medium roots throughout and few roots throughout; many very fine and fine interstitial and tubular pores; clear smooth boundary.
84P2797

BA—20 to 46 cm; red (2.5YR 5/8) clay; red (2.5YR 4/8) moist; weak coarse and very coarse subangular blocky structure parting to weak medium subangular blocky; slightly hard, slightly sticky, plastic; few patchy distinct-thin reddish brown (2.5YR4/4) organic coats in root channels and/or pores; common fine and medium roots throughout and very few coarse roots throughout; many very fine and fine interstitial and few to common fine and medium continuous tubular pores; gradual smooth boundary.
84P2798

Bt1—46 to 77 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; slightly hard, slightly sticky, plastic; common discontinuous faint-thin red (2.5YR4/8) clay films on vertical faces of peds; common fine roots throughout; many very fine and fine interstitial and few to common fine and medium continuous tubular pores; gradual smooth boundary.
84P2799

Bt2—77 to 123 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, slightly sticky, plastic; common patchy faint-thin red (2.5YR4/8)

25

clay films on vertical faces of peds; common fine roots throughout; many very fine and fine interstitial and common medium and coarse continuous tubular pores; gradual smooth boundary.
84P2800

Bt3--123 to 143 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; weak medium and coarse subangular blocky structure; soft, slightly sticky, plastic; few patchy faint-thin red (2.5YR4/8) clay films on vertical faces of peds; few fine roots throughout; many very fine and fine interstitial and few fine and medium continuous tubular pores.
84P2801

cutans, if present, are < 1%.

26

19/6/85

Tropepts Entisols Oxisol new proposal

MALASHI

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OPXIC PALEUSTULT

S 84FN-990 -005 DATE 05/31/85 SAMPLE NO. 84P2802-2807
PEDON NO. 84P 511
PROJECT NO. 84P 97

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

	-1--	-2--	-3--	-4--	-5--	-6--	-7--	-8--	-9--	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				(- - -TOTAL - - -)(- -CLAY- -)(- -SILT- -)(- - - - - -SAND- - - - - - -)(-COARSE FRACTIONS(MM)-)(>2MM)																	
				CLAY	SILT	SAND	FINE	CO3	FINE	COARSE	VF	F	M	C	VC	- - - - WEIGHT - - - -				WT
SAMPLE	HZN	DEPTH	HORIZON	LT	.002	.05	LT	LT	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	PCT OF
NO.	NO.	(CM)		.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	WHOLE
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->			SOIL
842802	1S	0- 8	AP	46.8	24.3	28.9	15.5		15.8	8.5	9.2	12.3	4.5	1.6	1.3	1	--	--	21	1
842803	2S	8- 23	BT1	58.9	19.3	21.8	20.5		12.6	6.7	7.0	8.7	3.1	1.3	1.7	1	--	--	16	1
842804	3S	23- 61	BT2	34.5	22.9	42.6	12.5		14.4	8.5	8.5	12.8	8.3	7.3	5.7	1	--	--	35	1
842805	4S	61- 94	BT3	46.4	30.6	23.0	16.2		20.2	10.4	8.7	8.0	2.9	1.6	1.8	1	--	--	15	1
842806	5S	94-120	BT4	42.8	33.1	24.1	15.6		21.3	11.8	9.7	8.6	2.8	1.3	1.7	1	--	--	15	1
842807	6S	120-154	BT4	43.0	32.3	24.7	17.5		19.6	12.7	9.5	7.7	2.5	1.5	3.5	1	--	--	16	1

		ORGN	TOTAL	EXTR	TOTAL	(- - DITH-CIT - -)				(RATIO/CLAY)	(ATTERBERG)		(- BULK DENSITY -)			COLE	(- - -WATER CONTENT - - -)			WRD
		C	N	P	S	EXTRACTABLE				15	- LIMITS -		FIELD	1/3	OVEN	WHOLE	FIELD	1/10	1/3	15	WHOLE
SAMPLE	HZN					FE	AL	MN	CEC	BAR	LL	PI	MOIST	BAR	DRY	SOIL	MOIST	BAR	BAR	BAR	SOIL
NO.	NO.	6A1C	6B3A		6R3A	6C2B	6G7A	6D2A	8D1	8D1	4F1	4F	4A3A	4A1D	4A1H	4D1	4B4	4B1C	4B1C	4B2A	4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - - ->				CM/CM
842802	1	1.84	0.104			12.0	0.6	0.1	0.21	0.36	36	14		1.33	1.43	0.024			25.5	16.9	0.11
842803	2	1.04	0.063			12.7	0.7	0.1	0.14	0.31	38	12		1.41	1.41	--			24.0	18.0	0.08
842804	3	0.46	0.031			13.7	1.1	0.1	0.37	0.63				1.30	1.34	0.010			24.4	21.6	0.04
842805	4	0.28				12.9	0.7	0.1	0.11	0.39	40	10		1.23	1.26	0.008			24.8	18.3	0.08
842806	5	0.27				13.2	0.6	0.1	0.10	0.44				1.23	1.26	0.008			24.2	18.8	0.07
842807	6	0.18				14.2	0.7	0.1	0.10	0.44				1.23	1.27	0.011			25.2	19.1	0.07

*** CONTINUATION ON NEXT PAGE ***

This is on basic

clay figures are improbable.

Horizon 3 = CEC abberation

clay - CEC - Base saturation - photo 14 - Too fine.

Oxisol.

MALASHI S 84FN-990 -005 DATE 05/31/85 PEDON NO. 84P 511 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A	MG 5B5A	NA 5B5A	K 5B5A	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4- OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SAT- SUM 5C3	BASE SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH (- - - KCL IN 8C1G	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842802	1	4.6	1.5	TR	0.5	6.6	6.8		13.4	10.0			49	66				5.6	5.6	6.4
842803	2	1.9	0.8	TR	0.2	2.9	6.6		9.5	8.3			31	35				5.2	5.1	6.0
842804	3	0.9	0.5	TR	0.2	1.6	12.3		13.9	12.6			12	13				5.2	5.2	6.0
842805	4	1.6	0.6	TR	0.2	2.4	4.6		7.0	4.9			34	49				5.7	5.6	6.0
842806	5	1.6	0.7	TR	0.2	2.5	4.2		6.7	4.3			37	58				5.9	5.9	6.0
842807	6	1.4	0.7	TR	0.2	2.3	3.8		6.1	4.1			38	56				6.1	6.0	6.1

SAMPLE NO.	HZN NO.	(- - - - - - - - - MINERALOGY - - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - - -)(- - -) -) (- - - - - X-RAY - - - - -)(- -DTA - -) TOTAL DOM (- - - - - - <2U - - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842802	1	
842803	2	KK 5 GI 2 GE 1 KK42 GI 4 99 WE 1
842804	3	
842805	4	KK 4 GI 2 HE 2 GE 1 KK40 GI 4 99 WETR
842806	5	
842807	6	

FAMILY CONTROL SECTION: DEPTH 8- 58 PCT CLAY 42 PCT .1-75MM 29

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GI GIBBSITE GE GOETHITE WE WEATH MIN HE HEMATITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

28

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL / SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY / CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2802	1																			
84P2803	2	VFS	99	RE99	WE 1							KK 5	GI 2	GE 1			KK42	GI 4	0.2	13.9
84P2804	3																			
84P2805	4	VFS	99	RE99	WE<1							KK 4	GI 2	HE 2	GE 1		KK40	GI 4	0.2	15.7
84P2806	5																			
84P2807	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE RE = RESISTANT MINERALS WE = WEATHERABLE MINERALS KK = KAOLINITE
HE = HEMATITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

29

Print date: 06-03-1985

SERIES: Malashi NSSL ID #: 84P0511
SOIL SURVEY # S83-FN-990-005
LOCATION: Malashi Res. Subst. 3 km NE of Mpika NOP Zambia. Pit located about 500 m SW of the office.
LATITUDE: 11-52- -S LONGITUDE: 031-23- -E
PHYSIOGRAPHY: in
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1360 m MSL
PRECIPITATION: 1070 mm Ustic moisture regime PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 18.9, SUM: 19.8, WIN: 15.0
SOIL TEMPERATURE: ANN: 22.1, SUM: 22.6, WIN: 19.4
DRAINAGE: Well drained LAND USE:
STONINESS:
FAMILY CONTROL SECTION: 8 to 58 cm
PARENT MATERIAL: residuum from sandstone-siltstone material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult — will become an Oxisol
WEATHER STATION: MPIKA
DIAGNOSTIC HORIZONS: 0 to 8 cm Ochric 8 to 154 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and L. Bustness SAMPLE DATE: 11/83
Thought to be Ultisol due to clay increase and probable clay films.

Ap--0 to 8 cm; red (2.5YR 4/6) clay; 35 (2.5YR 3/5) moist; strong fine subangular blocky structure parting to strong medium subangular blocky parting to strong coarse subangular blocky; slightly hard, slightly sticky, plastic; many fine and medium roots throughout; many fine continuous tubular and few medium continuous tubular pores; very few to few fine rounded ironstone nodules; clear smooth boundary. Many very fine interstitial irregular pores.
84P2802

Bt1--8 to 23 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; strong fine subangular blocky structure parting to strong medium subangular blocky parting to strong coarse subangular blocky; slightly hard, slightly sticky, plastic; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; many fine and medium roots throughout; common fine and medium continuous tubular and many very fine interstitial pores; very few to few fine rounded ironstone nodules; clear wavy boundary.
Coats may not be clay films but pressure faces. Need to check also next three layers.
84P2803

Bt2--23 to 61 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; strong fine subangular blocky structure parting to strong medium subangular blocky parting to strong coarse subangular blocky; slightly hard, slightly sticky, plastic; many discontinuous distinct-thin clay films on vertical and horizontal faces of peds common fine and medium roots throughout; common fine continuous tubular and many very fine interstitial pores; very few to few fine rounded ironstone nodules; clear smooth boundary.
84P2804

Bt3--61 to 94 cm; red (2.5YR 4/8) clay; dark red (2.5YR 3/6) moist; strong coarse subangular blocky structure; hard, slightly sticky, plastic; many continuous distinct-thin clay films on vertical faces of peds; common discontinuous distinct-thin clay films on horizontal faces of peds; common fine and medium roots

throughout; few to common fine continuous tubular and common very fine interstitial pores; very few to few fine rounded ironstone nodules; 1 percent pebbles from sandstone; gradual smooth boundary.
84P2805

Bt4—94 to 154 cm; red (2.5YR 4/6) clay; dark red (2.5YR 3/6) moist; moderate coarse subangular blocky structure parting to strong fine and medium subangular blocky; slightly hard, slightly sticky, plastic; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; common fine and medium roots throughout; few fine continuous tubular and many very fine and fine interstitial pores; very few to few fine rounded ironstone nodules; 1 percent pebbles from sandstone.
Clod samples between 100 and 120 cm and between 130 and 145 cm. Split for sampling 94 to 120 No. 2806 and 120 to 154 No. 2807.
84P2806

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

006
MUKUMBI

PROFILE IDENTIFICATION ZAMBIA 006 MUK.

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	8 CM	11.8 %
2	8 CM	27 CM	13.7 %
3	27 CM	45 CM	29.3 %
4	45 CM	83 CM	46.5 %
5	83 CM	124 CM	41.1 %

Pedon 488

KANDIC HORIZON BETWEEN 23 AND 38 CM

CLAY CONTENT AT TOP: 18.9 %
AT BOTTOM: 31.8 %
DIFFERENCE: 12.9 %
RATIO: 1.68

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 5.3 CM (27.6 - 32.8 CM)

CLAY CONTENT AT TOP: 23.1 %
AT BOTTOM: 27.7 %
DIFFERENCE: 4.6 %
RATIO: 1.20

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH MORE THAN 90% PROBABILITY

TESTSTATISTIC = 13.715 WITH STUDENT'S
DISTRIBUTION (DF 2)

31

Pedon 8

MUKUMBI

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTALF

S 84FN-990 -006 DATE 05/31/85 SAMPLE NO. 84P2808-2813
PEDON NO. 84P 512
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002 -.05	SAND -2	FINE LT .0002	CO3 LT .002	FINE .002	COARSE .02 -.05	VF .05 -.10	F .10 -.25	M .25 -.50	C .5 -1	VC 1 -2	2 -5	5 -20	20 -75	.1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842808	1S	0- 8	A	11.8	6.9	81.3			2.5	4.4	11.8	31.7	29.4	7.3	1.1	TR	--	--	69	TR
842809	2S	8- 27	AB	13.7	7.0	79.3			2.4	4.6	11.3	29.6	28.2	7.9	2.3	1	--	--	68	1
842810	3S	27- 45	BA	29.3	6.5	64.2			2.5	4.0	8.1	19.9	24.1	10.0	2.1	1	--	--	57	1
842811	4S	45- 83	BT1	46.5	5.5	48.0			2.3	3.3	6.1	14.0	17.4	7.5	3.0	1	--	--	42	1
842812	5S	83-124	BT2	41.1	10.8	48.1			5.3	5.5	7.5	15.7	14.9	6.3	3.7	3	TR	--	42	3
842813	6S	124-158	BT3	37.3	13.8	48.9			6.6	7.2	10.5	14.6	13.4	7.3	3.1	7	1	--	43	8

SAMPLE NO.	HZN NO.	ORGN TOTAL C	TOTAL N	EXTR P	TOTAL S	DITH-CIT EXTRACTABLE FE	AL	MN	CEC	RATIO/CLAY 15 BAR	ATTERBERG LIMITS - LL	PI	BULK DENSITY - FIELD MOIST	1/3 BAR	OVEN DRY	COLE WHOLE SOIL	WATER CONTENT - FIELD MOIST	1/10 BAR	1/3 BAR	15 BAR	WRD WHOLE SOIL
		6A1C	6B3A		6R3A	6C2B	6G7A	6D2A	8D1	8D1	4F1	4F	4A3A	4A1D	4A1H	4D1	4B4	4B1C	4B1C	4B2A	4C1
		<- - - - - - PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842808	1	1.01	0.063			0.6	0.1	TR	0.30	0.38	16	2		1.37	1.43	0.014			11.1	4.5	0.09
842809	2	0.31	0.031			0.7	0.1	TR	0.18	0.31				1.50	1.54	0.009			7.6	4.3	0.05
842810	3	0.25	0.022			1.1	0.2	TR	0.09	0.29				1.56	1.60	0.008			12.2	8.4	0.06
842811	4	0.20				1.4	0.3	--	0.08	0.29	37	18		1.48	1.50	0.004			15.8	13.5	0.03
842812	5	0.15				1.4	0.3	--	0.07	0.33				1.36	1.40	0.010			16.8	13.4	0.05
842813	6	0.12				2.0	0.3	--	0.08	0.37	35	14		1.30	1.32	0.005			18.4	13.7	0.06

*** CONTINUATION ON NEXT PAGE ***

Typic Kandiustalf

Yes > 90% probable
Est Hab 13.7

MUKUMBI S 84FN-990 -006 DATE 05/31/85 PEDON NO. 84P 512 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842808	1	1.9	0.5	TR	0.2	2.6	1.9		4.5	3.5			58	74				4.9	5.1	5.9
842809	2	0.6	0.3	TR	--	0.9	2.4	0.2	3.3	2.5	1.1	18	27	36				4.4	4.8	5.5
842810	3	0.9	0.4	TR	0.1	1.4	1.4	0.2	2.8	2.5	1.6	13	50	56				4.5	4.9	5.4
842811	4	1.4	0.8	TR	0.2	2.4	2.3		4.7	3.7			51	65				4.9	5.2	5.6
842812	5	1.1	0.8	TR	0.2	2.1	1.5		3.6	2.9			58	72				5.6	5.8	6.1
842813	6	0.9	0.7	TR	0.4	2.0	1.6		3.6	2.8			56	71				5.8	5.9	6.0

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842808	1	
842809	2	
842810	3	
842811	4	KK 5 MI 2 GE 2 GI 1 KK53 GITR 95 WE 5
842812	5	
842813	6	KK 5 MI 2 GE 2 GI 1 KK57 GITR

FAMILY CONTROL SECTION: DEPTH 45- 95 PCT CLAY 45 PCT .1-75MM 43

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GE GOETHITE GI GIBBSITE WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

33

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2808	1																			
84P2809	2																			
84P2810	3																			
84P2811	4	FNES	95	RE95	WE 5							KK 5	MI 2	GE 2	GI 1		KK53	GI<1	0.5	4.3
84P2812	5																			
84P2813	6											KK 5	MI 2	GE 2	GI 1		KK57	GI<1	0.6	4.5

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE RE = RESISTANT MINERALS MI = MICA WE = WEATHERABLE MINERALS

KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Print date: 06-03-1985

SERIES: Mukumbi NSSL ID #: 84P0512
SOIL SURVEY # S83-FN-990-006
LOCATION: Mulungushi farm about 19 km N of Kabwe CEP Zambia. Pit located about 1300 m S of the farmhouse.
LATITUDE: 14-18- -S LONGITUDE: 028-31- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1150 m MSL
PRECIPITATION: 950 mm Ustic moisture regime PERMEABILITY: Moderately slow
AIR TEMPERATURE: ANN: 20.1, SUM: 21.2, WIN: 16.6
SOIL TEMPERATURE: ANN: 23.9, SUM: 24.1, WIN: 20.8
DRAINAGE: Somewhat poorly drained LAND USE:
RUNOFF: Slow
FAMILY CONTROL SECTION: 45 to 95 cm
PARENT MATERIAL: residuum from gniess material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustalf
WEATHER STATION: KABWE
DIAGNOSTIC HORIZONS: 0 to 8 cm Ochric 45 to 124 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and P. Woode SAMPLE DATE: 11/83
Probably kandic. In BA Bt1 and Bt2 horizons termite chambers from 3 to 6 cm in size generally elepsoidic shaped connected by channels of .5 to 1 cm in diameter. These channles and chambers usually have lined walls and surrounding

A--0 to 8 cm; brown (10YR 5/3) sandy loam; very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, nonsticky, nonplastic; common fine and medium roots throughout; many fine and medium continuous tubular and many fine void between rock fragments pores; clear smooth boundary.
84P2808

AB--8 to 27 cm; light yellowish brown (10YR 6/4) sandy clay loam; brown (7.5YR 5/4) moist; weak massive structure; slightly hard, slightly sticky, plastic; few fine and medium roots in mat at top of horizon and very few very coarse roots in mat at top of horizon; common fine and medium continuous tubular and common fine interstitial pores; very few medium and coarse rounded ironstone nodules; gradual smooth boundary.
84P2809

BA--27 to 45 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; weak massive structure; slightly hard, very sticky, very plastic; few patchy faint-thin organic coats between sand grains; very few fine roots throughout; few to common fine to coarse continuous tubular and few fine interstitial pores; very few medium and coarse roundedironstone nodules; clear smooth boundary.
84P2810

Bt1--45 to 83 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; slightly hard, very sticky, very plastic; few continuous distinct-thin clay films in root channels and/or pores; few patchy faint-thin clay films on vertical faces of peds; very few I roots throughout; few to common fine to coarse continuous tubular and common fine and medium void between rock fragments pores; very few medium and coarse rounded ironstone nodules; clear smooth boundary.
84P2811

Bt2--83 to 124 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, slightly sticky, plastic; few patchy faint-thin clay films on vertical faces of peds; very few fine roots throughout; few to common fine to coarse continuous tubular and common fine and medium void between rock fragments pores; very few medium and coarse rounded ironstone nodules; clear smooth boundary.
A few cracks occur about 1 mm wide starting at the base of the AB horizon. Distance between cracks is 1 to 1.5 m.
84P2812

Btc--124 to 158 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; soft, very sticky, very plastic; few patchy faint-thin clay films between sand grains; very few fine roots throughout; few fine and medium continuous tubular and common to many fine and medium void between rock fragments pores; few to common medium and coarse rounded ironstone nodules and few coarse irregular ironstone nodules.
Colour of concretions (10YR 7/6) and (2.5YR 5/8) both when dry.
84P2813

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

PROFILE IDENTIFICATION ZAMBIA 007 MUSH.

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	14 CM	7.0 %
2	14 CM	48 CM	8.3 %
3	48 CM	61 CM	24.6 %
4	61 CM	94 CM	45.8 %
5	94 CM	137 CM	38.8 %

KANDIC HORIZON BETWEEN 28 AND 43 CM

CLAY CONTENT AT TOP: 10.2 %
AT BOTTOM: 22.6 %
DIFFERENCE: 12.4 %
RATIO: 2.22

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 4.8 CM (33.6 - 38.4 CM)

CLAY CONTENT AT TOP: 14.4 %
AT BOTTOM: 18.4 %
DIFFERENCE: 4.0 %
RATIO: 1.28

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH MORE THAN 90% PROBABILITY

TESTSTATISTIC = 2.997 WITH STUDENT'S
DISTRIBUTION (DF 2)

007
Mushemi

36

MUSHEMI

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTULT

S 84FN-990 -007 DATE 05/31/85 SAMPLE NO. 84P2814-2819
PEDON NO. 84P 513
PROJECT NO. 84P 97

ZAMBIA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	WEIGHT 5 -20	WEIGHT 20 -75	WEIGHT .1-75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842814	1S	0- 14	AP	7.0	8.9	84.1			2.6	6.3	13.1	35.2	29.7	5.5	0.6	TR	--	--	71	--
842815	2S	14- 48	E/A	8.3	10.7	81.0			3.2	7.5	13.2	34.1	26.8	6.1	0.8	TR	--	--	68	--
842816	3S	48- 61	BT1	24.6	8.0	67.4			2.4	5.6	10.0	24.5	25.7	6.4	0.8	TR	--	--	57	--
842817	4S	61- 94	BT2	45.8	6.2	48.0			2.0	4.2	6.5	17.2	18.5	5.4	0.4	TR	--	--	41	--
842818	5S	94-137	BT3	38.8	8.7	52.5			2.7	6.0	9.2	21.3	15.9	5.1	1.0	TR	--	--	43	TR
842819	6S	137-169	BT4	46.9	6.2	46.9			2.1	4.1	6.5	18.1	17.2	4.4	0.7	TR	--	--	40	--

SAMPLE NO.	HZN NO.	ORGN C	TOTAL N	EXTR P	TOTAL S	DITH-CIT EXTRACTABLE FE	DITH-CIT EXTRACTABLE AL	DITH-CIT EXTRACTABLE MN	RATIO/CLAY CEC	RATIO/CLAY 15 BAR	ATTERBERG LIMITS - LL	ATTERBERG LIMITS - PI	BULK DENSITY FIELD MOIST	BULK DENSITY 1/3 BAR	COLE OVEN DRY	WHOLE SOIL	WATER CONTENT FIELD MOIST	WATER CONTENT 1/10 BAR	WATER CONTENT 1/3 BAR	WATER CONTENT 15 BAR	WRD WHOLE SOIL
		6A1C	6B3A		6R3A	6C2B	6G7A	6D2A	8D1	8D1	4F1	4F	4A3A	4A1D	4A1H	4D1	4B4	4B1C	4B1C	4B2A	4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842814	1	0.60	0.034			0.4	0.1	TR	0.36	0.36				1.45	1.46	0.002			6.0	2.5	0.05
842815	2	0.24	0.018			0.4	0.1	TR	0.18	0.37				1.54	1.55	0.002			5.0	3.1	0.03
842816	3	0.24	0.021			0.8	0.2	TR	0.13	0.32	22	9		1.65	1.68	0.006				7.8	
842817	4	0.24				1.3	0.2	TR	0.12	0.31				1.56	1.63	0.015			20.5	14.3	0.10
842818	5	0.12				1.1	0.2	--	0.10	0.31	33	14		1.54	1.62	0.017			18.3	11.9	0.10
842819	6	0.15				1.3	0.2	--	0.12	0.31				1.44	1.48	0.009			14.8	14.4	0.01

*** CONTINUATION ON NEXT PAGE ***

Vandic > 90% between 28-43
Thinner 33.6 – 38.4
Sfed. 2.997 (DF 2)

37

MUSHEMI S 84FN-990 -007 DATE 05/31/85 PEDON NO. 84P 513 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH- KCL IN 8C1G	CACL2 .01M 1:2 8C1F	H2O 1:1 8C1F
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842814	1	1.5	0.8	TR	0.1	2.4	0.7		3.1	2.5			77	96				5.1	5.1	5.8
842815	2	0.8	0.3	TR	0.1	1.2	0.3		1.5	1.5			80	80				4.7	5.0	5.7
842816	3	1.4	0.8	TR	0.1	2.3	1.2	0.2	3.5	3.2	2.5	8	66	72				4.3	4.7	5.4
842817	4	2.0	1.8	TR	0.2	4.0	2.4		6.4	5.4			62	74				4.8	5.1	5.8
842818	5	1.4	1.3	TR	0.2	2.9	1.6		4.5	3.7			64	78				5.4	5.7	5.9
842819	6	1.7	1.9	TR	0.2	3.8	1.6		5.4	5.4			70	70				5.5	5.7	6.1

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - -)(- - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -)(- -<2U - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842814	1								
842815	2								
842816	3	KK	5	MI 3	MT 2	GE 1	KK45	99	FKTR
842817	4								
842818	5	KK	5	MI 2	GE 2		KK52		
842819	6								

FAMILY CONTROL SECTION: DEPTH 48- 98 PCT CLAY 40 PCT .1-75MM 46

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA MT MONTMORILL GE GOETHITE FK POTAS-FELD

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY (OPTICAL / SAND/SILT) FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	MINERALOGY (X-RAY / CLAY) 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
84P2814	1																				
84P2815	2																				
84P2816	3	FNES	99	QZ98	OP 2	TM<1	FK<1	QC<1					KK 5	MI 3	MT 2	GE 1		KK45		0.6	5.2
84P2817	4																				
84P2818	5												KK 5	MI 2	GE 2			KK52		0.8	3.2
84P2819	6																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE OP = OPAQUES QC = CLAY-COATED QUARTZ QZ = QUARTZ TM = TOURMALINE
FK = POTASSIUM FELDSPAR MI = MICA MT = MONTMORILLONITE KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

39

Print date: 06-03-1985

SERIES: Mushemi NSSL ID #: 84P0513
SOIL SURVEY # S83-FN-990-007
LOCATION: Kabwe Reg. Res. St. 8 km N of Kabwe CEP Zambia. Pit located near entrance gate.
LATITUDE: 14-25- -S LONGITUDE: 028-30- -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1170 m MSL
PRECIPITATION: 950 mm Ustic moisture regime PERMEABILITY: Moderately slow
AIR TEMPERATURE: ANN: 20.1, SUM: 20.4, WIN: 16.6
SOIL TEMPERATURE: ANN: 23.9, SUM: 24.1, WIN: 20.8
DRAINAGE: Moderately well drained LAND USE:
RUNOFF: Moderate
FAMILY CONTROL SECTION: 48 to 98 cm
PARENT MATERIAL: residuum from sandstone-shale material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
DIAGNOSTIC HORIZONS: 0 to 14 cm Ochric 48 to 169 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and C. English SAMPLE DATE: 11/83
Probably kandic

Ap--0 to 14 cm; grayish brown (10YR 5/2) loamy sand; very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots throughout; many fine and medium continuous tubular and many fine interstitial pores; clear smooth boundary.
84P2814

E/A--14 to 48 cm; light yellowish brown (10YR 6/4) and gray (10YR 5/1) sandy loam; yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) moist; massive; slightly hard, slightly sticky, nonplastic; few fine and medium roots throughout and few coarse roots throughout; many fine and medium continuous tubular and common fine interstitial pores; clear wavy boundary.
84P2815

Bt1--48 to 61 cm; reddish yellow (7.5YR 7/6) clay; strong brown (7.5YR 5/6) moist; massive; very hard, very sticky, very plastic; few patchy faint-thin clay films in root channels and/or pores; very few fine roots throughout and very few coarse roots throughout; common fine and medium continuous tubular and few fine interstitial pores; clear smooth boundary.
84P2816

Bt2--61 to 94 cm; reddish yellow (7.5YR 7/6) clay; strong brown (7.5YR 5/6) moist; very few to few fine distinct yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; hard, very sticky, very plastic; few patchy faint-thin clay films on vertical faces of peds; very few fine roots throughout; common fine to coarse continuous tubular and few fine interstitial pores; gradual smooth boundary.
84P2817

Bt3--94 to 137 cm; reddish yellow (7.5YR 6/6) clay; strong brown (7.5YR 5/6) moist; very few to few fine distinct yellowish red (5YR 5/8) mottles; moderate massive structure; hard, very sticky, very plastic; few patchy faint-thin clay films on vertical faces of peds; very few fine roots throughout; common fine to coarse continuous tubular and few fine interstitial pores; clear smooth boundary.

84P2818

Bt4—137 to 169 cm; yellow (10YR 7/6) clay; reddish yellow (7.5YR 6/6) moist; very few to few medium distinct reddish yellow (5YR 6/8) mottles; weak massive structure; slightly hard, very sticky, plastic; few patchy faint-thin clay films in root channels and/or pores; few fine and medium continuous tubular and common fine interstitial pores.
84P2819

- main maize / tobacco soils
- Trouble with H; only now liming

- compaction when disc-ploughed
"pan"? like in Gray Podzolic
- erosion follows
- All outcrops are sugary sandstones + quartzites

= Ripping for cutting the pan. —

= Private farmer:
<u>Rotation</u> maize — soybean — grassland.
Cost of opening an acre = 200 <u>kw.</u> / 190 $
Ticks major problem for cattle

<u>In present</u> classification:
<u>both</u> oxic and ultic

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

008 Musheni, ACID

PROFILE IDENTIFICATION ZAMBIA 008 MUSH.

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	11 CM	7.3 %
2	11 CM	34 CM	5.9 %
3	34 CM	61 CM	19.9 %
4	61 CM	99 CM	37.0 %
5	99 CM	125 CM	35.9 %

KANDIC HORIZON BETWEEN 23 AND 38 CM

CLAY CONTENT AT TOP: 10.7 %
AT BOTTOM: 26.1 %
DIFFERENCE: 15.4 %
RATIO: 2.44

pedon 6

INNEST HORIZON FULFILLING CONDITIONS
ICKNESS 3.8 CM (28.9 - 32.8 CM)

AY CONTENT AT TOP: 16.4 %
AT BOTTOM: 20.4 %
FERENCE: 4.0 %
IO: 1.24

invalid because of mistake in bar 3

POTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
H MORE THAN 90% PROBABILITY

TSTATISTIC = 5.397 WITH STUDENT'S
RIBUTION (DF 2)

0.04
0.02

4

kandiustalf

less acid than 007 but lower Base saturation

MUSHENI, ACID

SAMPLED AS: FINE-LOAMY, SILICEOUS, ISOHYPERTHERMIC ULTIC HAPLUSTOX

S 84FN-990 -008 DATE 05/31/85

SAMPLE NO. 84P2820-2825
PEDON NO. 84P 514
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .002 -.05	-3-- TOTAL SAND .05 -2	-4-- CLAY FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7-- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS(MM) WEIGHT 2 -5	-14- COARSE FRACTIONS(MM) WEIGHT 5 -20	-15- COARSE FRACTIONS(MM) WEIGHT 20 -75	-16- COARSE FRACTIONS(MM) .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
				<- PCT OF <2MM (3A1)											->	<- PCT OF <75MM(3B1)			->	
842820	1S	0- 11	A	7.3	7.4	85.3	0.04		2.5	4.9	11.4	34.6	27.3	9.3	2.7	TR	--	--	74	TR
842821	2S	11- 34	EA	5.9	7.1	87.0	0.03		2.1	5.0	12.7	39.5	23.5	8.7	2.6	TR	--	--	74	TR
842822	3S	34- 61	EB	19.9	7.1	73.0	0.02		2.1	5.0	10.2	30.7	20.4	8.5	3.2	TR	--	--	63	TR
842823	4S	61- 99	BW1	37.0	5.2	57.8	0.02		1.5	3.7	7.0	21.7	17.1	8.4	3.6	TR	--	--	51	TR
842824	5S	99-151	BW2	35.9	5.6	58.5			1.7	3.9	7.2	21.8	17.4	9.3	2.8	TR	--	--	51	TR
842825	6S	151-174	BW3	36.5	6.5	57.0			1.6	4.9	9.4	23.2	14.2	7.5	2.7	TR	--	--	48	TR

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	DITH-CIT EXTRACTABLE AL 6G7A	DITH-CIT EXTRACTABLE MN 6D2A	(RATIO/CLAY) CEC 8D1	(RATIO/CLAY) 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A3A	BULK DENSITY 1/3 BAR 4A1D	BULK DENSITY OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	WATER CONTENT 1/3 BAR 4B1C	WATER CONTENT 15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- PCT OF <2MM						->			PCT <0.4MM		<- G/CC		->	CM/CM	<- PCT OF <2MM			->	CM/CM
842820	1	1.60	0.082		2.10/1.18	0.3	0.1	0.1	0.70	0.58		NP		1.56	1.57	0.002			6.7	4.2	0.04
842821	2	0.26	0.016			0.2	TR	TR	0.15	0.39				1.55	1.56	0.002			5.0	2.3	0.04
842822	3	0.23	0.017			0.4	0.1	TR	0.08	0.31				1.60	1.61	0.002			8.2	6.1	0.03
842823	4	0.13				0.7	0.2	--	0.07	0.30	37	21		1.60	1.64	0.008			13.6	11.0	0.04
842824	5	0.10				0.7	0.1	--	0.07	0.30				1.51	1.54	0.007			13.1	10.7	0.04
842825	6	0.09				0.7	0.2	--	0.08	0.29	33	16		1.44	1.47	0.007			13.2	10.6	0.04

*** CONTINUATION ON NEXT PAGE ***

Photo 15 of pit with ~~Harry~~ Hari
16 of vegetation
17 Pit

>90% lest flat 5.397

23 -38
3.8 cm! ~~28.9~~ - 32.8 cm! wrong

MUSHENI, ACID S 84FN-990 -008 DATE 05/31/85 PEDON NO. 84P 514 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH KCL IN 8C1G	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842820	1	4.0	0.7	TR	0.5	5.2	1.5		6.7	5.1			78	100				5.7	5.7	6.6
842821	2	0.6	0.2	TR	0.2	1.0	--		1.0	0.9			100	100				5.2	5.4	6.3
842822	3	0.5	0.6	TR	0.5	1.6	0.6		2.2	1.6			73	100				5.2	5.6	6.2
842823	4	0.6	0.7	TR	0.3	1.6	1.9	0.3	3.5	2.7	1.9	16	46	59				4.4	4.8	5.2
842824	5	0.5	0.5	TR	0.3	1.3	1.9		3.2	2.5			41	52				4.4	4.7	5.6
842825	6	0.7	0.6	TR	0.2	1.5	1.9		3.4	2.9			44	52				4.7	4.9	5.8

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -)(- - -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -)(- -<2U - -) 7A2I 7A2I 7A2I 7A2I <- RELATIVE AMOUNTS ->	7A3 7A3 <- - - - -PCT - - - ->	7B1A 7B1A TOTAL DOM RES WEATH
842820	1			
842821	2			
842822	3			
842823	4	KK 5 MI 3 GE 1	KK54	95 WE 5
842824	5			
842825	6	KK 5 MI 3 GE 1	KK56	

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 27 PCT .1-75MM 58

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GE GOETHITE WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

43

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY RELATIVE AMOUNTS 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3 K2O 6Q3A	FE 6C7A
			<-PCT->									<-RELATIVE AMOUNTS->					<-PCT->		
84P2820	1																		
84P2821	2																		
84P2822	3																		
84P2823	4	FNES	95	RE95	WE 5							KK 5	MI 3	GE 1			KK54	0.8	4.0
84P2824	5																		
84P2825	6											KK 5	MI 3	GE 1			KK56	1.1	2.5

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE RE = RESISTANT MINERALS MI = MICA WE = WEATHERABLE MINERALS KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

44

Print date: 06-03-1985

SERIES: Mushemi Acid NSSL ID #: 84P0514
SOIL SURVEY # S83-FN-990-008
LOCATION: Shrosbee's farm 10 km SE of Mkushi CEP Zambia. Pit located about 4 km E of the farmhouse.
LATITUDE: 13-40- -S LONGITUDE: 029-29- -E
PHYSIOGRAPHY: Upland slope in plateaus or tablelands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1330 m MSL
PRECIPITATION: 930 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 20.1, SUM: 21.2, WIN: 15.9
SOIL TEMPERATURE: ANN: 23.9, SUM: 24.1, WIN: 20.8
DRAINAGE: Well drained LAND USE:
STONINESS: CLASS 9 RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from metamorphic-acidic material
CLASSIFICATION: Fine-loamy, siliceous, isohyperthermic Ultic Haplustox
WEATHER STATION: KABWE
DIAGNOSTIC HORIZONS: 0 to 11 cm Ochric 11 to 34 cm Albic 61 to 174 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren C. English and P. Woode SAMPLE DATE: 11/83
Close to clayey family when average 25 to 100 cms control section. Probably kandic

A--0 to 11 cm; grayish brown (10YR 5/2) sandy loam; very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, nonsticky, nonplastic; many fine roots throughout and few medium roots throughout; many fine and medium continuous tubular and many fine and medium void between rock fragments pores; clear smooth boundary.
84P2820

EA--11 to 34 cm; very pale brown (10YR 7/3) sandy loam; brown to dark brown (10YR 4/3) moist; massive parting to strong very fine granular; slightly hard, nonsticky, nonplastic; common fine roots throughout and very few medium roots throughout; common fine and medium continuous tubular and many fine interstitial pores; gradual smooth boundary.
84P2821

EB--34 to 61 cm; pink (7.5YR 7/4) sandy clay loam; brown (7.5YR 5/4) moist; massive parting to strong very fine granular; slightly hard, slightly sticky, plastic; very few fine roots throughout; common medium and coarse continuous tubular and many fine interstitial pores; clear smooth boundary.
Cracks of about 0.5 to 1 cm wide occur from the base of the EA down to Bw3. Distance between cracks is 60 to 150 cm.
84P2822

Bw1--61 to 99 cm; reddish yellow (7.5YR 7/6) clay; strong brown (7.5YR 5/6) moist; massive parting tostrong very fine granular structure; slightly hard, nonsticky, nonplastic; very few fine roots throughout; few medium and coarse continuous tubular pores; gradual smooth boundary.
84P2823

Bw2--99 to 151 cm; reddish yellow (7.5YR 7/6) clay; strong brown (7.5YR 5/6) moist; massive parting to strong very fine granular; hard, very sticky, plastic;

very few fine roots throughout; very few medium and coarse continuous tubular pores; gradual smooth boundary.
84P2824

BW3—151 to 174 cm; reddish yellow (7.5YR 7/6) clay; yellowish red (5YR 5/6) moist; massive parting to strong very fine granular; slightly hard, very sticky, plastic; very few medium and coarse continuous tubular pores; very few very fine and fine irregular gibbsite concretions.
White crystals probably gibbsite occurs locally near cracks.
84P2825

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

PROFILE IDENTIFICATION ZAMBIA 009 MPONGWE

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	7 CM	35.2 %
2	7 CM	24 CM	52.1 %
3	24 CM	42 CM	56.4 %
4	42 CM	74 CM	56.9 %

KANDIC HORIZON BETWEEN 10 AND 25 CM

CLAY CONTENT AT TOP: 44.2 %
AT BOTTOM: 54.6 %
DIFFERENCE: 10.4 %
RATIO: 1.24

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 11.3 CM (11.8 - 23.1 CM)

CLAY CONTENT AT TOP: 45.4 %
AT BOTTOM: 53.4 %
DIFFERENCE: 8.0 %
RATIO: 1.18

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH LESS THAN 75% PROBABILITY

TESTSTATISTIC = 0.473 WITH STUDENT'S
DISTRIBUTION (DF 1)

009
MPONGWE

7 x 35.2 = 246.4
45.5 + 11 x 52.1 = 573.1

819.5 : 18 = 45.5

Ok for oxisol
because 0-18 cm
removed = 40 : 45.5
Also Prob. for kandic
is below 75 %.

9
+ 30
39

MPONGWE

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC TYPIC EUTRUSTOX

S-84FN-990 -009 DATE 05/31/85 SAMPLE NO. 84P2826-2831
PEDON NO. 84P 515
PROJECT NO. 84P 97

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	TOTAL FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	.1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842826	1S	0- 7	A	35.2	24.0	40.8			13.4	10.6	13.0	16.6	7.3	3.1	0.8	TR	--	--	28	--
842827	2S	7- 24	AB	52.1	16.0	31.9			7.9	8.1	10.0	12.6	5.6	2.7	1.0	TR	--	--	22	--
842828	3S	24- 42	BW1	56.4	13.5	30.1			6.8	6.7	8.9	11.0	5.5	2.9	1.8	TR	--	--	21	--
842829	4S	42- 74	BW2	56.9	13.5	29.6			6.7	6.8	8.9	11.2	5.3	3.1	1.1	TR	--	--	21	--
842830	5S	74-105	BW3	57.3	13.6	29.1			7.2	6.4	8.9	10.8	5.0	3.2	1.2	TR	--	--	20	--
842831	6S	105-144	BW3	57.6	13.3	29.1			6.4	6.9	8.7	10.9	4.8	3.1	1.6	TR	--	--	20	TR

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY - FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT - FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT	<0.4MM	<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842826	1	3.00	0.189			4.9	0.5	0.1	0.42	0.45	39	14		0.96	1.05	0.030			26.5	16.0	0.10
842827	2	1.48	0.086			5.7	0.6	0.1	0.19	0.32				1.17	1.23	0.017			23.2	16.5	0.08
842828	3	0.74	0.055			6.0	0.5	0.1	0.14	0.30	36	14		1.24	1.30	0.016			22.6	17.1	0.07
842829	4	0.37				6.0	0.5	0.1	0.11	0.29				1.26	1.30	0.010			21.9	16.5	0.07
842830	5	0.20				6.1	0.5	0.1	0.10	0.29	37	6		1.25	1.27	0.005			22.1	16.7	0.07
842831	6	0.13				6.1	0.5	0.1	0.08	0.29				1.23	1.25	0.005			22.6	16.5	0.08

*** CONTINUATION ON NEXT PAGE ***

MPONGWE S 84FN-990 -009 DATE 05/31/85 PEDON NO. 84P 515 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	BASE SAT- SUM 5C3	BASE SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH KCL IN 8C1G	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842826	1	8.0	4.6	TR	0.6	13.2	8.0		21.2	14.8			62	89				6.0	6.0	6.4
842827	2	1.8	1.4	TR	0.1	3.3	9.9	0.8	13.2	9.7	4.1	20	25	34				4.6	4.7	5.5
842828	3	1.8	1.3	TR	TR	3.1	8.2		11.3	7.7			27	40				4.7	5.0	5.9
842829	4	1.4	1.0	TR	0.1	2.5	5.7		8.2	6.0			30	42				5.0	5.1	5.6
842830	5	1.1	0.9	TR	TR	2.0	5.8		7.8	5.6			26	36				5.0	5.0	5.8
842831	6	1.0	1.0	TR	TR	2.0	5.0		7.0	4.8			29	42				5.0	5.1	5.9

SAMPLE NO.	HZN NO.	(- MINERALOGY - CLAY - X-RAY - <2U - 7A2I	7A2I	7A2I	7A2I	(- DTA - <2U - 7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842826	1								
842827	2								
842828	3	KK 4	GI 2	VR 2	GE 1	KK36	GI 2	99	WE 1
842829	4								
842830	5	KK40	GI 2	VR 2	GE 2	KK49	GI 2		
842831	6								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 57 PCT .1-75MM 21

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GI GIBBSITE VR VERMICULITE GE GOETHITE WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

48

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	TOT ANAL FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2826	1																			
84P2827	2																			
84P2828	3	FNES	99	RE99	WE 1							KK 4	GI 2	VR 2	GE 1	HE 1	KK36	GI 2	0.4	9.0
84P2829	4																			
84P2830	5											KK4	GI 2	VR 2	GE 2	HE 1	KK49	GI 2	0.4	8.5
84P2831	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE HE = HEMATITE RE = RESISTANT MINERALS VR = VERMICULITE
WE = WEATHERABLE MINERALS KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

49

Print date: 06-03-1985

SERIES: MPONGWE NSSL ID #: 84P0515
SOIL SURVEY # S83-FN-990-009
LOCATION: About 14 km WSW of Mpongwe at the GRZ/EEC wheat scheme COP Zambia.
LATITUDE: 13-36- -S LONGITUDE: 028-04- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1240 m MSL
PRECIPITATION: 1210 mm Ustic moisture regime PERMEABILITY: Rapid
AIR TEMPERATURE: ANN: 19.7, SUM: 20.6, WIN: 15.7
SOIL TEMPERATURE: ANN: 22.2, SUM: 22.3, WIN: 19.7
DRAINAGE: Well drained LAND USE:
RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from limestone material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Typic Eutrustox
WEATHER STATION: NDOLA
DIAGNOSTIC HORIZONS: 0 to 7 cm Ochric 24 to 144 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren and S. B. Salama SAMPLE DATE: 11/83
1. Classification tentatively Eutrustox based on data of nearby pits. Base saturation however is close to 50% hence soil borders the Haplustox. 2. Weather station located about 100 km to the NE.

A--0 to 7 cm; dark reddish brown (2.5YR 3/4) clay; dusky red (2.5YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky, nonplastic; many fine and medium roots throughout; many fine and medium continuous tubular and many fine void between rock fragments pores; clear smooth boundary.
84P2826

AB--7 to 24 cm; dark red (2.5YR 3/6) clay; dusky red (10R 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, very sticky, very plastic; few patchy faint-thin clay films in root channels and/or pores; many fine and medium roots throughout; many fine and medium continuous tubular and many fine void between rock fragments pores; gradual smooth boundary.
The pore coatings in AB Bw1 Bw2 and Bw3 are pressure coatings rather than illuviation coatings.
84P2827

Bw1--24 to 42 cm; red (2.5YR 4/6) clay; dark red (10R 3/6) moist; weak medium and coarse subangular blocky structure parting to moderate very fine granular; slightly hard, very sticky, very plastic; few patchy faint-thin clay films in root channels and/or pores and clay films on faces of peds; many fine roots throughout; many fine continuous tubular and many very fine and fine interstitial pores; gradual smooth boundary.
84P2828

Bw2--42 to 74 cm; red (2.5YR 4/6) clay; dark red (10R 3/6) moist; moderate very fine granular structure; soft, very sticky, plastic; few patchy faint-thin clay films in root channels and/or pores; common fine roots throughout; many fine continuous tubular and many very fine and fine interstitial pores; diffuse smooth boundary.
84P2829

remeasured
moist 2.5YR 3/6
dry 2.5YR 4/6

50

Bw3—74 to 144 cm; red (2.5YR 4/6) clay; dark red (10R 3/6) moist; moderate very fine granular structure; soft, very sticky, plastic; few patchy faint-thin clay films in root channels and/or pores; common fine roots throughout; many fine continuous tubular and many very fine and fine interstitial pores.
Difference between Bw2 and Bw3 is based on very slight color difference and a softer consistence of the Bw3. Horizon split for sampling 74 to 105 No. 2830 and 105 to 144 No. 2831.
84P2830

RAM: SEARCH FOR KANDIC HORIZON

S LEAST SQUARES TO FIT CONSTRAINED

DEGREE POLYNOMIAL

010
Mufulira

ILE IDENTIFICATION ZAMBIA 010

ZON ER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
	0 CM	12 CM	15.1 %
	12 CM	32 CM	20.0 %
	32 CM	62 CM	22.8 %
	62 CM	84 CM	25.7 %
	84 CM	120 CM	26.0 %
	120 CM	125 CM	26.2 %

→ gradual increase

KANDIC HORIZON FOUND

OTHESIS THAT THERE IS NO KANDIC HORIZON IS TRUE
H MORE THAN 90% PROBABILITY

TSTATISTIC = 3.930 WITH STUDENT'S
TRIBUTION (DF 3)

51

MUFULIRA

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC TYPIC HAPLUSTOX

S 84FN-990 -010 DATE 05/31/85 SAMPLE NO. 84P2832-2837
PEDON NO. 84P 516
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002	SILT .002 -.05	SAND .05 -2	FINE LT .0002	CO3 LT .002	FINE SILT .002 -.02	COARSE SILT .02 -.05	VF SAND .05 -.10	F SAND .10 -.25	M SAND .25 -.50	C SAND .5 -1	VC SAND 1 -2	WEIGHT 2 -5	WEIGHT 5 -20	WEIGHT 20 -75	WEIGHT .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842832	1S	0- 12	AP	15.1	18.9	66.0			6.8	12.1	22.2	32.5	9.8	1.2	0.3	1	TR	--	44	1
842833	2S	12- 32	BA	20.0	18.6	61.4			6.2	12.4	21.2	30.3	8.6	1.0	0.3	TR	--	--	40	--
842834	3S	32- 62	BW1	22.8	20.5	56.7			6.9	13.6	21.2	27.0	7.2	1.0	0.3	TR	--	--	35	--
842835	4S	62- 84	BW1	25.7	21.1	53.2			7.2	14.0	21.1	23.6	6.5	1.1	0.9	TR	--	--	32	TR
842836	5S	84-120	BW2	26.0	22.0	52.0			7.8	14.2	21.9	22.3	6.5	0.9	0.4	TR	--	--	30	TR
842837	6S	120-170	BW2	26.2	23.3	50.5			8.2	15.1	21.1	21.5	6.0	1.1	0.8	TR	--	--	29	TR

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842832	1	1.84	0.112			1.3	0.3	TR	0.43	0.47	22	5		1.29	1.31	0.005			14.8	7.1	0.10
842833	2	0.47	0.035			1.7	0.3	TR	0.12	0.37				1.48	1.51	0.007			11.8	7.3	0.07
842834	3	0.24	0.021			1.9	0.3	TR	0.08	0.36	25	10		1.40	1.43	0.007			13.6	8.1	0.08
842835	4	0.21				2.1	0.3	TR	0.08	0.36				1.38	1.41	0.007			14.4	9.2	0.07
842836	5	0.10				2.1	0.3	TR	0.08	0.37	29	12		1.37	1.40	0.007			14.5	9.6	0.07
842837	6	0.12				2.2	0.3	TR	0.14	0.38				1.42	1.46	0.009			16.8	9.9	0.10

*** CONTINUATION ON NEXT PAGE ***

No Kandic > 90 %
Test Statistic 3.930
Too gradual !

52

MUFULIRA S 84FN-990 -010 DATE 05/31/85 PEDON NO. 84P 516 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F	H2O 1:2 8C1F
		<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842832	1	0.8	0.3	TR	0.1	1.2	8.2	1.1	9.4	6.5	2.3	48	13	18				4.2	4.4	5.1
842833	2	0.2	0.1	TR	0.1	0.4	3.2	0.5	3.6	2.4	0.9	56	11	17				4.1	4.3	4.9
842834	3	--	0.1	TR	0.1	0.2	3.7	0.5	3.9	1.8	0.7	71	5	11				4.1	4.3	4.8
842835	4	TR	0.2	TR	0.2	0.4	3.2	0.3	3.6	2.1	0.7	43	11	19				4.2	4.5	5.1
842836	5	--	0.2	TR	0.2	0.4	2.5	0.1	2.9	2.0	0.5	20	14	20				4.3	4.6	5.2
842837	6	--	TR	TR	0.2	0.2	3.0	0.1	3.2	3.6	0.3	33	6	6				4.4	4.6	5.3

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - -)(- - - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842832	1	
842833	2	
842834	3	KK 4 MI 2 GI 2 GE 1 KK20 GI 2 99 WETR
842835	4	
842836	5	KK 4 MI 2 GI 2 GE 1 KK21 GI 2
842837	6	

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 24 PCT .1-75MM 34

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GI GIBBSITE GE GOETHITE WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

53

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY (OPTICAL SAND/SILT) FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	MINERALOGY (X-RAY CLAY) 7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A	(TOT ANAL)
		<-PCT->									>	<-RELATIVE AMOUNTS->					<-PCT->				
84P2832	1											KK 4	MI 2	GI 2	GE 1	VM 2	KK20	GI 2	1.5	7.5	
84P2833	2																				
84P2834	3	FNES	99	RE99	WE<1							KK 4	MI 2	GI 2	GE 1	VM 2	KK21	GI 2	1.6	7.7	
84P2835	4																				
84P2836	5																				
84P2837	6																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE RE = RESISTANT MINERALS MI = MICA VM = VERMICULITE-MICA

WE = WEATHERABLE MINERALS KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

4-9

Print date: 06-03-1985

SERIES: Mufulira NSSL ID #: 84P0516
SOIL SURVEY # S83-FN-990-010
LOCATION: Copperbelt Reg. Res. St. km S of Mufilira COP Zambia. Pitlocated 200 m E of offices.
LATITUDE: 12-36-45-S LONGITUDE: 028-09-00-E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
GEOMORPHIC POSITION: backslope headslope
MICRORELIEF: on lower third of component
SLOPE CHARACTERISITICS: 1% plane, east facing ELEVATION: 1230 m MSL
PRECIPITATION: 1210 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 19.7, SUM: 20.6, WIN: 15.7
SOIL TEMPERATURE: ANN: 22.2, SUM: 22.3, WIN: 19.7
DRAINAGE: Well drained LAND USE: Pasture land and native pasture
RUNOFF: Rapid
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from schist & phyllite material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Typic Haplustox
WEATHER STATION: NDOLA
DIAGNOSTIC HORIZONS: 0 to 12 cm Ochric 32 to 170 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren and B. Salama SAMPLE DATE: 11/83
Soil temperatures given are calculated from air temperatures from Ndola. Reference is made to air temperatures of site 9 for comparison.

Ap--0 to 12 cm; brown (7.5YR 5/4) clay; reddish brown (5YR 4/4) moist; weak massive structure; slightly hard, slightly sticky, nonplastic; many fine to coarse roots throughout; few very fine and fine continuous tubular pores; abrupt wavy boundary.
In Ap horizon many charcoal fragments occur due to frequent burning of the surface.
84P2832

BA--12 to 32 cm; reddish yellow (5YR 6/6) clay; yellowish red (5YR 4/6) moist; massive parting to moderate very fine granular; hard, very sticky, plastic; very few discontinuous distinct-thin pressure faces in root channels and/or pores; many fine and medium roots throughout and few coarse roots throughout; common to many fine and medium continuous tubular and common to many very fine and fine interstitial pores; clear smooth boundary.
84P2833

Bw1--32 to 84 cm; reddish yellow (5YR 6/8) clay; red (2.5YR 4/8) moist; massive parting to moderate very fine granular; soft, very sticky, plastic; very few discontinuous distinct-thin pressure faces in root channels and/or pores; common fine and medium roots throughout and few coarse roots throughout; many fine and medium continuous tubular and many very fine and fine interstitial pores; diffuse smooth boundary.
Horizon split for sampling 32 to 62cm No. 2834 and 62 to 84 cm No. 2835.
84P2834

Bw2--84 to 170 cm; light red (2.5YR 6/8) clay; red (2.5YR 4/8) moist; moderate very fine granular structure; soft, very sticky, plastic; few fine and medium roots throughout; many very fine and fine continuous tubular and many very fine and fine interstitial pores; very few fine and medium rounded ironstone nodules.
Horizon split for sampling 84 to 120 cm No. 2836 and 120 to 170 cm No. 2837.
84P2836

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

@11 – SHILENDA

PROFILE IDENTIFICATION ZAMBIA 011 SHILENDA

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	12 CM	11.7 %
2	12 CM	37 CM	13.1 %
3	37 CM	53 CM	27.5 %
4	53 CM	68 CM	37.0 %
5	68 CM	118 CM	42.0 %
6	118 CM	125 CM	41.1 %

KANDIC HORIZON BETWEEN 29 AND 44 CM

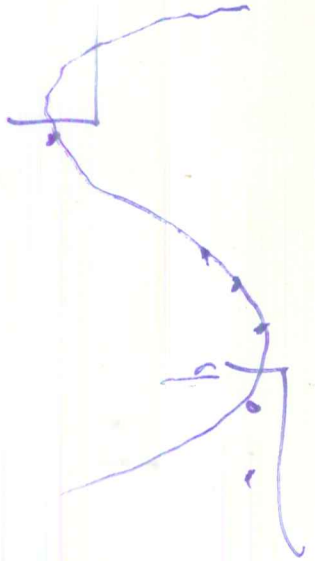
CLAY CONTENT AT TOP: 17.8 %
AT BOTTOM: 26.7 %
DIFFERENCE: 8.9 %
RATIO: 1.50

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 6.7 CM (33.0 - 39.7 CM)

CLAY CONTENT AT TOP: 20.2 %
AT BOTTOM: 24.3 %
DIFFERENCE: 4.0 %
RATIO: 1.20

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH MORE THAN 90% PROBABILITY

TESTSTATISTIC = 5.924 WITH STUDENT'S
DISTRIBUTION (DF 3)



55

SHILENDA

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTULT

S 84FN-990 -011 DATE 05/31/85 SAMPLE NO. 84P2838-2844
PEDON NO. 84P 517
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002 <- PCT OF <2MM	SILT .002 -.05	SAND .05 -2	FINE LT .0002	CO3 LT .002	FINE SILT .002 -.02	COARSE SILT .02 -.05	VF SAND .05 -.10	F SAND .10 -.25	M SAND .25 -.50	C SAND .5 -1	VC SAND 1 -2	2 -5	5 -20	20 -75	.1-75	WT PCT OF WHOLE SOIL
				(3A1)												<- PCT OF <75MM (3B1) ->				
842838	1S	0- 12	A	11.7	8.4	79.9			1.9	6.5	13.9	29.6	22.2	12.0	2.2	TR	--	--	66	--
842839	2S	12- 37	EA	13.1	8.2	78.7			2.2	6.0	13.0	29.2	20.6	13.2	2.7	--	--	--	66	--
842840	3S	37- 53	BT1	27.5	8.8	63.7			2.1	6.7	11.1	20.5	16.6	12.7	2.8	TR	--	--	53	--
842841	4S	53- 68	BT2	37.0	8.5	54.5			2.1	6.4	10.5	16.8	12.9	11.2	3.1	--	--	--	44	--
842842	5S	68-118	BT3	42.0	7.8	50.2			2.0	5.8	8.7	13.6	11.3	12.0	4.6	TR	--	--	41	TR
842843	6S	118-149	BT4	41.1	9.1	49.8			2.4	6.7	10.3	15.2	10.9	9.4	4.0	TR	--	--	39	--
842844	7S	149-182	BC	39.9	10.2	49.9			2.6	7.6	11.1	15.5	10.1	9.4	3.8	TR	--	--	39	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	WHOLE SOIL 4D1	FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- PCT OF <2MM ->									PCT <0.4MM		<- G/CC ->			CM/CM	<- PCT OF <2MM ->				CM/CM
842838	1	1.14	0.063			0.3	0.1	--	0.35	0.41		NP		1.44	1.44	--			9.3	4.8	0.06
842839	2	0.44	0.029			0.3	0.1	--	0.17	0.37				1.48	1.50	0.004			10.1	4.8	0.08
842840	3	0.28	0.021			0.5	0.1	--	0.11	0.35	29	14		1.52	1.56	0.009			11.9	9.6	0.04
842841	4	0.28				0.7	0.1	--	0.11	0.34				1.50	1.56	0.013				12.7	
842842	5	0.19				0.8	0.2	--	0.11	0.35	42	21		1.34	1.39	0.012			17.6	14.6	0.04
842843	6	0.12				1.0	0.2	--	0.08	0.35				1.32	1.38	0.015			19.1	14.4	0.06
842844	7	0.10				1.0	0.2	--	0.09	0.34				1.36	1.40	0.010			18.0	13.7	0.06

*** CONTINUATION ON NEXT PAGE ***

kandic 29-44
(33-39.7)

> 90%
Test stat = 5.924
(DF 3)

SHILENDA S 84FN-990 -011 DATE 05/31/85 PEDON NO. 84P 517 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842838	1	0.1	0.4	TR	0.2	0.7	5.2	0.9	5.9	4.1	1.6	56	12	17				3.8	4.0	4.6
842839	2	--	0.2	TR	0.2	0.4	3.0	0.6	3.4	2.2	1.0	60	12	18				4.0	4.2	4.9
842840	3	--	0.1	TR	0.2	0.3	3.6	1.0	3.9	2.9	1.3	77	8	10				3.9	4.1	4.7
842841	4	--	0.1	TR	0.2	0.3	4.6	1.3	4.9	3.9	1.6	81	6	8				3.9	4.1	4.7
842842	5	0.1	0.2	TR	0.2	0.5	4.7	1.1	5.2	4.6	1.6	69	10	11				4.0	4.2	5.0
842843	6	--	0.1	TR	0.2	0.3	3.9	1.0	4.2	3.4	1.3	77	7	9				4.1	4.3	5.2
842844	7	--	0.1	TR	0.2	0.3	5.2	0.8	5.5	3.7	1.1	73	5	8				4.1	4.3	5.3

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842838	1	
842839	2	
842840	3	KK 5 VM 2 MI 2 GI 1 KK49 GITR 99 WE 1
842841	4	
842842	5	KK 5 MI 2 GI 2 VR 1 KK63 GI 1 99 WE 1
842843	6	
842844	7	

FAMILY CONTROL SECTION: DEPTH 37- 87 PCT CLAY 36 PCT .1-75MM 46

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE VM VERM-MICA MI MICA GI GIBBSITE WE WEATH MIN
VR VERMICULITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

57

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	MINERALOGY: X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
84P2838	1																				
84P2839	2																				
84P2840	3	FNES	99	RE99	WE 1								KK 5	VM 2	MI 2	GI 1		KK49	GI<1	0.8	2.5
84P2841	4																				
84P2842	5	FNES	99	RE99	WE 1								KK 5	MI 2	GI 2	VR 1		KK63	GI 1	0.7	2.6
84P2843	6																				
84P2844	7																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GI = GIBBSITE RE = RESISTANT MINERALS MI = MICA VM = VERMICULITE-MICA WE = WEATHERABLE MINERALS

KK = KAOLINITE VR = VERMICULITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

58

Print date: 06-03-1985

SERIES: Shilenda NSSL ID #: 84P0517
SOIL SURVEY # S83-FN-990-011
LOCATION: Along road Solwezi Mwinilunga about 60 km WSW of Solwezi NWP Zambia near Junction to Shilenda school.
LATITUDE: 12-19- -S LONGITUDE: 025-52- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
GEOMORPHIC POSITION: backslope headslope
MICRORELIEF: on lower third of component
SLOPE CHARACTERISITICS: .5% plane, east facing ELEVATION: 1380 m MSL
PRECIPITATION: 1370 mm Ustic moisture regime PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 18.7, SUM: 19.8, WIN: 14.8
SOIL TEMPERATURE: ANN: 22.2, SUM: 23.1, WIN: 19.1
DRAINAGE: LAND USE: Forest land not grazed
RUNOFF: Rapid
FAMILY CONTROL SECTION: 37 to 87 cm
PARENT MATERIAL: residuum from metamorphic-acidic material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
WEATHER STATION: Solwez
DIAGNOSTIC HORIZONS: 0 to 12 cm Ochric 37 to 149 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and J. Broekhuis SAMPLE DATE: 11/83
Probably kandic.

A--0 to 12 cm; coarse sandy loam; dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; very friable, nonsticky, nonplastic; many fine and medium roots throughout; common medium continuous tubular and many fine and medium interstitial pores; abrupt smooth boundary.
Six termite chambers sizes 3 to 7 cm. Few filled animal burrows.
84P2838

EA--12 to 37 cm; sandy clay loam; yellowish brown (10YR 5/4) moist; weak massive structure; very friable, slightly sticky, plastic; many fine to coarse roots throughout; common fine and medium continuous tubular and many fine and medium interstitial pores; clear smooth boundary.
84P2839

Bt1--37 to 53 cm; clay; strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; very friable, very sticky, very plastic; common discontinuous distinct-thin organic coats on vertical and horizontal faces of peds; common fine roots throughout and few medium roots throughout; many fine and medium continuous tubular and common fine and medium interstitial pores; very few coarse rounded ironstone nodules; clear smooth boundary.
Color nodules(5YR 5/6).
84P2840

Bt2--53 to 68 cm; clay; reddish yellow (7.5YR 6/6) moist; moderate medium and coarse subangular blocky structure; friable, very sticky, very plastic; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; few fine roots throughout; common fine and medium continuous tubular and few very fine and fine interstitial pores; gradual smooth boundary.
Clay increases as compared with Bt1.
84P2841

Bt3--68 to 118 cm; clay; reddish yellow (7.5YR 6/8) moist; common fine and medium faint pinkish gray (7.5YR 7/2) mottles; weak fine and medium subangular blocky structure; very friable, very sticky, very plastic; few fine and medium roots throughout; few to common fine continuous tubular and few to common very fine and fine interstitial pores; very few medium and coarse rounded ironstone nodules; gradual smooth boundary.
Clay decreases as compared to Bt2 but decrease is less than increase from Btl to Bt2. Color of nodules is (10R 4/8).
84P2842

Bt4--118 to 149 cm; clay; pinkish gray (7.5YR 7/2) moist; common fine and medium distinct very pale brown (10YR 8/4) and reddish yellow (5YR 6/8) mottles; weak massive structure; very friable, very sticky, very plastic; few patchy faint-thin clay films on vertical faces of peds; few fine roots throughout; few to common fine continuous tubular and few to common very fine and fine interstitial pores; very few medium rounded ironstone nodules; gradual wavy boundary.
Color of nodules is (5YR 6/8).
84P2843

BC--149 to 182 cm; clay; yellow (10YR 7/6) moist; many fine and medium prominent light red (2.5YR 6/8) and common fine and medium distinct yellow (10YR 7/6) mottles; weak massive structure; very friable, slightly sticky, very plastic; very few fine roots throughout; very few fine continuous tubular and few to common very fine and fine interstitial pores; very few to few medium and coarse rounded ironstone nodules.
Color of nodules is (10YR 4/8).
84P2844

PROGRAM: SEARCH FOR ~~KANDIC~~ argillic HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

012 MUTANDA
ARGILLIC

PROFILE IDENTIFICATION ZAMBIA 012 FIRST 4 HORIZONS FOR ARGILLIC KH = 30

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	7 CM	44.8 %
2	7 CM	21 CM	47.3 %
3	21 CM	43 CM	52.3 %
4	43 CM	99 CM	53.3 %

~~KANDIC~~ argillic HORIZON BETWEEN 8 AND 38 CM

CLAY CONTENT AT TOP: 45.5 %
AT BOTTOM: 53.9 %
DIFFERENCE: 8.3 %
RATIO: 1.18

check for argillic
no horiz > 8%

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 28.3 CM (8.4 - 36.7 CM)

CLAY CONTENT AT TOP: 45.7 %
AT BOTTOM: 53.7 %
DIFFERENCE: 8.0 %
RATIO: 1.18

HYPOTHESIS THAT THERE IS A ~~KANDIC~~ argillic HORIZON IS TRUE
WITH LESS THAN 75% PROBABILITY

TESTSTATISTIC = 0.545 WITH STUDENT'S
DISTRIBUTION (DF 1)

60 no kandic, >90%

MUTANDA

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC TYPIC HAPLUSTOX

S 84FN-990 -012 DATE 05/31/85

SAMPLE NO. 84P2845-2850
PEDON NO. 84P 518
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL: CLAY LT .002	TOTAL: SILT .002 -.05	TOTAL: SAND .05 -2	CLAY: FINE LT .0002	CLAY: CO3 LT .002	SILT: FINE .002 -.02	SILT: COARSE .02 -.05	SAND: VF .05 -.10	SAND: F .10 -.25	SAND: M .25 -.50	SAND: C .5 -1	SAND: VC 1 -2	COARSE FRACTIONS (MM) WEIGHT: 2 -5	WEIGHT: 5 -20	WEIGHT: 20 -75	WEIGHT: .1- 75	(>2MM) WT PCT OF WHOLE SOIL
				-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-
				<- - - PCT OF <2MM (3A1)											- - ->	<- PCT OF <75MM(3B1)			->	
842845	1S	0- 7	A	44.8	16.9	38.3			3.7	13.2	18.3	13.7	3.2	1.8	1.3	TR	--	--	20	--
842846	2S	7- 21	BA	47.3	16.0	36.7			3.4	12.6	18.1	13.1	3.1	1.6	0.8	TR	--	--	19	--
842847	3S	21- 43	BW1	52.3	16.4	31.3			3.3	13.1	16.6	10.1	2.1	1.6	0.9	TR	--	--	15	--
842848	4S	43- 99	BW2	53.3	16.8	29.9			3.7	13.1	16.6	9.1	1.6	1.5	1.1	TR	--	--	13	--
842849	5S	99-140	BW3	47.3	22.4	30.3			7.2	15.2	17.5	8.9	1.5	1.4	1.0	--	--	--	13	--
842850	6S	140-187	BW3	45.2	24.6	30.2			8.7	15.9	18.1	9.0	1.5	1.2	0.4	TR	--	--	12	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG - LIMITS -) LL 4F1	PI 4F	(BULK DENSITY) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	(WATER CONTENT) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - - PCT OF <2MM						- - - - - - - ->			PCT <0.4MM		<- - G/CC		- - ->	CM/CM	<- - -PCT OF <2MM			- ->	CM/CM
842845	1	1.90				3.4	0.4	TR	0.15	0.35	35	12								15.6	
842846	2	1.18				3.4	0.4	TR	0.13	0.34				1.29	1.37	0.020			21.6	16.0	0.07
842847	3	0.71				3.7	0.4	TR	0.09	0.32	36	12		1.29	1.33	0.010			21.2	16.7	0.06
842848	4	0.34				4.0	0.4	TR	0.07	0.32				1.16	1.20	0.011			22.8	17.0	0.07
842849	5	0.23				3.9	0.4	TR	0.07	0.36	38	7		1.16	1.21	0.014			22.4	17.1	0.06
842850	6	0.18				4.0	0.4	TR	0.06	0.39				1.20	1.24	0.011			23.0	17.8	0.06

*** CONTINUATION ON NEXT PAGE ***

no kandic >90%

argillic, prob less than 75%, Test stat 0.545

MUTANDA S 84FN-990 -012 DATE 05/31/85 PEDON NO. 84P 518 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	-CEC - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F	H2O 8C1F
		<- - - - - - - - - - -MEQ / 100 G - - - - - - - - - - ->										<- - - - -PCT - - - ->						1:2	1:1
842845	1	--	0.2	TR	0.3	0.5	9.7	1.4	10.2	6.9	1.9	74	5	7			4.1	4.2	5.0
842846	2	--	0.1	TR	0.1	0.2	9.2	1.5	9.4	6.1	1.7	88	2	3			4.2	4.2	4.9
842847	3	--	0.1	TR	0.1	0.2	6.8	0.9	7.0	4.5	1.1	82	3	4			4.2	4.3	5.2
842848	4	--	TR	TR	0.1	0.1	5.1	0.2	5.2	3.7	0.3	67	2	3			4.4	4.5	5.0
842849	5	0.1	TR	TR	TR	0.1	4.1		4.2	3.2			2	3			4.6	5.0	5.4
842850	6	TR	TR	TR	--	TR	4.3		4.3	2.8				1			4.7	4.6	5.8

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842845	1	
842846	2	
842847	3	KK 5 GI 2 GE 2 HE 1 KK41 GI 6 99 WE 1
842848	4	
842849	5	KK 5 GI 3 GE 2 MI 1 KK52 GI 7 97 WE 3
842850	6	

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 53 PCT .1-75MM 14

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GI GIBBSITE GE GOETHITE HE HEMATITE WE WEATH MIN
MI MICA

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

62

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL/SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY/CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2845	1																			
84P2846	2																			
84P2847	3	VFS	99	RE99	WE 1							KK 5	GI 2	GE 2	HE 1		KK41	GI 6	0.5	7.8
84P2848	4																			
84P2849	5	VFS	97	RE97	WE 3							KK 5	GI 3	GE 2	MI 1	HE 1	KK52	GI 7	0.5	7.9
84P2850	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE HE = HEMATITE RE = RESISTANT MINERALS WE = WEATHERABLE MINERALS

KK = KAOLINITE MI = MICA

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

63

Print date: 06-03-1985

SERIES: Mutanda NSSL ID #: 84P0518
SOIL SURVEY # S83-FN-990-012
LOCATION: Mutanda about 32 km SSW of Solwezi NWP Zambia. Pit located 5 km SW of Mutanda Mission along road to Kasempa.
LATITUDE: 12-25- -S LONGITUDE: 026-14- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
GEOMORPHIC POSITION: summit interfluve
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1200 m MSL
PRECIPITATION: 1370 mm Ustic moisture regime PERMEABILITY: Moderately rapid
AIR TEMPERATURE: ANN: 18.7, SUM: 19.8, WIN: 14.8
SOIL TEMPERATURE: ANN: 22.2, SUM: 23.1, WIN: 19.1
DRAINAGE: Well drained LAND USE: Forest land not grazed
RUNOFF: Moderate
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from metamorphic material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Typic Haplustox
WEATHER STATION: Solwez
DIAGNOSTIC HORIZONS: 0 to 7 cm Ochric 21 to 187 cm Oxic
DESCRIBED BY: D. Hallbick O. Spaargaren and J. Broekhuis SAMPLE DATE: 11/83
1. Few filled animal burrows throughout. 2. In surrounding area of the pit many small anthills and many very large anthills 140 m apart.

A—100 to 7 cm; dark red (2.5YR 3/6) clay; dark reddish brown (2.5YR 3/4) moist; moderate medium and coarse granular structure; slightly hard, very sticky, plastic; many fine and medium roots throughout; few fine and medium continuous tubular and common very fine void between rock fragments pores; clear smooth boundary.
No clod samples horizon too thin.
84P2845

BA—7 to 21 cm; red (2.5YR 4/6) clay; dark red (2.5YR 3/6) moist; weak fine and medium subangular blocky structure; slightly hard, very sticky, plastic; common fine and medium roots throughout and few coarse roots throughout; common fine and medium interstitial and tubular and common very fine void between rock fragments pores; clear smooth boundary.
Interstitial pores smaller than tubular pores. Few cracks 55 to 90 cm apart from base of BA horizon downwards into Bw3.
84P2846

Bw1—21 to 43 cm; red (2.5YR 4/8) clay; dark red (10R 3/6) moist; moderate fine and medium subangular blocky structure; slightly hard, very sticky, plastic; few patchy faint-thin skeletans (sand or silt) in root channels and/or pores; common fine and medium roots throughout and few coarse roots throughout; common fine and medium interstitial and tubular and few very fine void between rock fragments pores; gradual smooth boundary.
Skeletans consist of extremely aggregated clay particles acting as skeletans.
Interstitial pores smaller than tubular pores.
84P2847

Bw2—43 to 99 cm; red (2.5YR 4/8) clay; dark red (10R 3/6) moist; massive parting to moderate very fine granular; soft, very sticky, very plastic; few patchy faint-thin skeletans (sand or silt) in root channels and/or pores; common fine and

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medium roots throughout and few coarse roots throughout; many medium interstitial and tubular pores; diffuse smooth boundary.
More skeletans than in Bw1. One large partly filled termite cavity 60 cm wide and 25 cm high.
84P2848

Bw3--99 to 187 cm; red (2.5YR 4/8) clay; dark red (10R 3/6) moist; massive parting to moderate very fine granular; soft, very sticky, plastic; few patchy faint-thin skeletans (sand or silt) in root channels and/or pores; few to common fine and medium roots throughout and very few coarse roots throughout; many medium interstitial and tubular pores.
Slightly less sticky than other horizons. Horizon split for sampling 99 to 140 cm No. 2849 and 140 to 187 cm No. 2850.
84P2849

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

013 - CHELTON

PROFILE IDENTIFICATION ZAMBIA 013 CHELSTON KH = 15

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	24 CM	21.7 %
2	24 CM	38 CM	28.5 %
3	38 CM	66 CM	34.9 %
4	66 CM	109 CM	41.9 %
5	109 CM	125 CM	44.5 %

NO KANDIC HORIZON FOUND

HYPOTHESIS THAT THERE IS NO KANDIC HORIZON IS TRUE
WITH LESS THAN 75% PROBABILITY

TESTSTATISTIC = 0.201 WITH STUDENT'S
DISTRIBUTION (DF 2)

PROFILE IDENTIFICATION ZAMBIA [illegible] CHECK ON ARGILLIC WITH KH = 30

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	24 CM	21.7 %
2	24 CM	38 CM	28.5 %
3	38 CM	66 CM	34.9 %
4	66 CM	109 CM	41.9 %

[illegible] argillic

[illegible]E HORIZON BETWEEN 20 AND 50 CM

CLAY CONTENT AT TOP: 23.9 %
AT BOTTOM: 34.8 %
DIFFERENCE: 10.9 %
RATIO: 1.46

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 14.2 CM (28.2 - 42.4 CM)

CLAY CONTENT AT TOP: 26.7 %
AT BOTTOM: 32.0 %
DIFFERENCE: 5.3 %
RATIO: 1.20

HYPOTHESIS THAT THERE IS A [illegible] argillic HORIZON IS TRUE
WITH MORE THAN 90% PROBABILITY

TESTSTATISTIC = 13.782 WITH STUDENT'S
DISTRIBUTION (DF 1)

CHELSTON

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTALF

S 84FN-990 -013 DATE 05/31/85

SAMPLE NO. 84P2851-2856
PEDON NO. 84P 519
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	>2MM .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842851	1S	0- 24	AP1	21.7	17.6	60.7			6.5	11.1	24.3	29.4	5.7	1.0	0.3	--	--	--	36	--
842852	2S	24- 38	AP2	28.5	16.8	54.7			6.7	10.1	21.4	27.0	5.0	1.0	0.3	--	--	--	33	--
842853	3S	38- 66	BT1	34.9	15.3	49.8			6.4	8.9	19.8	24.4	4.2	0.9	0.5	--	--	--	30	--
842854	4S	66-109	BT2	41.9	13.8	44.3			5.5	8.3	17.5	21.5	4.1	0.8	0.4	TR	--	--	27	--
842855	5S	109-157	BT3	44.5	13.9	41.6			5.4	8.5	18.2	19.0	3.4	0.8	0.2	TR	--	--	23	--
842856	6S	157-195	BT4	42.0	15.9	42.1			6.4	9.5	20.0	18.5	2.6	0.7	0.3	TR	--	--	22	TR

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	RATIO/CLAY CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - - ->				CM/CM
842851	1	0.63	0.048		2.1	0.2	TR	0.22	0.35	22	8		1.73	1.76	0.006				11.8	7.6	0.07
842852	2	0.55	0.042		2.5	0.2	TR	0.16	0.33				1.86	1.92	0.011				13.3	9.4	0.07
842853	3	0.49	0.039		3.1	0.2	TR	0.14	0.32	29	14		1.62	1.68	0.012				16.9	11.2	0.09
842854	4	0.39			3.6	0.3	TR	0.11	0.32				1.55	1.61	0.013				17.0	13.2	0.06
842855	5	0.24			3.8	0.3	TR	0.09	0.31	35	18		1.43	1.49	0.014				18.7	13.7	0.07
842856	6	0.18			3.7	0.3	TR	0.09	0.30				1.47	1.54	0.016				17.0	12.8	0.06

*** CONTINUATION ON NEXT PAGE ***

CHELSTON S 84FN-990 -013 DATE 05/31/85 PEDON NO. 84P 519 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	EXTRAL 6G9A	CEC SUM CATS 5A3A	CEC NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	BASE SUM 5C3	SAT- NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH KCL IN 8C1G	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842851	1	4.0	1.2	0.1	0.2	5.5	1.8		7.3	4.8			75	100				6.0	6.3	6.7
842852	2	3.3	1.1	TR	0.2	4.6	2.3		6.9	4.6			67	100				5.8	6.2	6.8
842853	3	2.1	1.1	TR	0.2	3.4	3.9		7.3	4.9			47	69				5.1	5.5	6.0
842854	4	1.8	1.1	TR	0.2	3.1	4.6		7.7	4.8			40	65				4.8	5.0	5.6
842855	5	1.8	1.2	TR	0.1	3.1	3.8		6.9	4.2			45	74				5.1	5.5	5.8
842856	6	1.7	1.3	TR	0.1	3.1	2.7		5.8	3.8			53	82				5.6	5.9	6.2

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->
842851	1	
842852	2	
842853	3	KK 4 MI 3 GI 1 GE 1 KK25 GITR
842854	4	
842855	5	KK 5 MI 3 GI 1 GE 1 KK40 GITR
842856	6	

FAMILY CONTROL SECTION: DEPTH 38- 88 PCT CLAY 38 PCT .1-75MM 29

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GI GIBBSITE GE GOETHITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

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CP84FN132

SAMPLE NO.	HZN NO.	FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7A2I	7A2I	7A2I	7A2I	7A2I	7A3	7A3	K2O 6Q3A	FE 6C7A
			<-PCT->									<-RELATIVE AMOUNTS->					<-PCT->			
84P2851	1																			
84P2852	2																			
84P2853	3											KK 4	MI 3	GI 1	GE 1		KK25	GI<1	1.5	8.1
84P2854	4																			
84P2855	5											KK 5	MI 3	GI 1	GE 1		KK40	GI<1	1.3	8.3
84P2856	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE MI = MICA KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

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Print date: 06-03-1985

SERIES: Chelston NSSL ID #: 84P0519
SOIL SURVEY # S83-FN-990-013
LOCATION: Unza farm about 20 km E of Lusaka LuP Zambia. Pit located next to the Met. Station Univ. farm.
LATITUDE: 15-23- -S LONGITUDE: 028-28- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
GEOMORPHIC POSITION: shoulder headslope
MICRORELIEF: on upper third of component
SLOPE CHARACTERISITICS: .5% plane, east facing ELEVATION: 1140 m MSL
PRECIPITATION: 810 mm Ustic moisture regime PERMEABILITY: Moderately slow
AIR TEMPERATURE: ANN: 20.2, SUM: 21.6, WIN: 15.7
SOIL TEMPERATURE: ANN: 23.0, SUM: 23.4, WIN: 20.3
DRAINAGE: Moderately well drained LAND USE: Cropland irrigated
RUNOFF: Moderate
FAMILY CONTROL SECTION: 38 to 88 cm
PARENT MATERIAL: residuum from limestone material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustalf
WEATHER STATION: LUSAKA
DIAGNOSTIC HORIZONS: 0 to 38 cm Ochric 38 to 195 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and Wen T. T. SAMPLE DATE: 11/83

Ap1--0 to 24 cm; reddish brown (5YR 4/4) silty clay; dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard; few patchy distinct-thin organic coats on lower surfaces of peds or stones; few fine roots throughout; few to common micro to fine interstitial and tubular pores; clear smooth boundary.
Coats occur only in the lower part of the horizon.
84P2851

Ap2--24 to 38 cm; dark reddish brown (2.5YR 3/4) clay; dark reddish brown (2.5YR 3/4) moist; weak coarse and very coarse platy structure parting to moderate fine and medium subangular blocky; hard; common discontinuous distinct-thin dark reddish brown (5YR 3/3) organic coats on vertical and horizontal faces of peds; few fine roots throughout; few to common micro to fine interstitial and tubular pores; abrupt smooth boundary.
84P2852

Bt1--38 to 66 cm; clay; dark reddish brown (2.5YR 3/4) moist; moderate coarse subangular blocky structure; friable; few patchy faint-thin clay films on vertical and horizontal faces of peds; few discontinuous faint-thin clay films in root channels and/or pores; few fine roots throughout; many fine and medium continuous tubular and common fine void between rock fragments pores; gradual smooth boundary.
84P2853

Bt2--66 to 109 cm; clay; dark red (2.5YR 3/6) moist; moderate coarse subangular blocky structure; friable; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; few discontinuous faint-thin clay films in root channels and/or pores; few fine roots throughout; many fine and medium continuous tubular and common fine void between rock fragments pores; clear smooth boundary.
84P2854

Bt3--109 to 157 cm; clay; red (2.5YR 4/6) moist; weak fine and medium subangular blocky structure; very friable; few patchy distinct-thin clay films on vertical and

3

f loamy mixed hyperthermic

horizontal faces of peds and clay films in root channels and/or pores; very few fine roots throughout; common fine and medium continuous tubular and common fine void between rock fragments pores; diffuse smooth boundary.
Few termite cavities occur of 8 to 11 cm wide.
84P2855

Bt4—157 to 195 cm; clay; red (2.5YR 4/6) moist; weak fine and medium subangular blocky structure; very friable; few patchy faint-thin clay films on vertical and horizontal faces of peds; very few fine roots throughout; common fine and medium continuous tubular and common fine void between rock fragments pores.
84P2856

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KAFUE

SAMPLED AS: FINE, MONTMORILLONITIC, ISOHYPERTHERMIC UDIC CHROMUSTERT

S 84FN-990 -014 DATE 05/31/85 SAMPLE NO. 84P2857-2862
PEDON NO. 84P 520
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002 <- PCT OF <2MM (3A1) ->	SILT .002 -.05	SAND .05 -2	FINE LT .0002	CO3 LT .002	FINE SILT .002 -.02	COARSE SILT .02 -.05	VF SAND .05 -.10	F SAND .10 -.25	M SAND .25 -.50	C SAND .5 -1	VC SAND 1 -2	2 -5	5 -20	20 -75	.1-75 <- PCT OF <75MM(3B1) ->	PCT OF WHOLE SOIL
842857	1S	0- 8	A	50.6	19.4	30.0	38.3		9.3	10.1	9.1	12.5	5.8	2.0	0.6	1	TR	--	22	1
842858	2S	8- 24	BW	52.9	21.0	26.1	34.9		11.7	9.3	8.1	10.4	5.1	1.7	0.8	--	--	--	18	--
842859	3S	24- 74	BK1	52.4	20.7	26.9	29.6		11.9	8.8	8.2	10.3	5.2	1.9	1.3	2	1	--	21	3
842860	4S	74-105	BK2	53.8	20.9	25.3	29.1		12.1	8.8	7.5	9.5	4.6	1.9	1.8	1	TR	--	19	1
842861	5S	105-133	BK2	56.0	19.0	25.0	27.7		12.8	6.2	7.7	9.4	4.3	1.7	1.9	1	2	--	20	3
842862	6S	133-154	BCK	56.0	18.6	25.4	25.1		12.8	5.8	7.8	9.5	4.5	1.9	1.7	2	2	--	21	4

SAMPLE NO.	HZN NO.	ORGN C 6A1C <- PCT OF <2MM ->	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	15 BAR 8D1	ATTERBERG LIMITS - LL 4F1 PCT <0.4MM	PI 4F	FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	WHOLE SOIL 4D1 <- G/CC ->	FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WHOLE SOIL 4C1 CM/CM
842857	1	2.45	0.186			2.3	0.3	TR	0.61	0.34	48	26		1.40	1.73	0.073			26.5	17.4	0.13
842858	2	0.81	0.067			2.7	0.4	TR	0.55	0.31				1.55	1.93	0.076			23.1	16.2	0.11
842859	3	0.57	0.045			2.6	0.3	TR	0.55	0.33	53	34		1.57	2.10	0.100			23.3	17.2	0.09
842860	4	0.56				2.6	0.3	TR	0.53	0.36				1.57	2.03	0.089			24.3	19.1	0.08
842861	5	0.47				2.5	0.3	TR	0.50	0.34	56	35		1.53	1.99	0.090			26.1	19.3	0.10
842862	6	0.36				2.5	0.3	TR	0.51	0.36				1.53	1.99	0.090			27.0	20.0	0.11

*** CONTINUATION ON NEXT PAGE ***

KAFUE S 84FN-990 -014 DATE 05/31/85 PEDON NO. 84P 520 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) ACIDITY CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	(- CEC -) SUM CATS 5A3A	NH4-OAC 5A8B	EXCH NA 5D2 PCT	SAR 5E	BASE SATURATION SUM 5C3 PCT	BASE SATURATION NH4OAC 5C1 PCT	CO3 AS CACO3 <2MM 6E1G PCT	RES. OHMS /CM 8E1	CASO4 AS GYPSUM <2MM 6F1A PCT	CASO4 AS GYPSUM <20MM 6F4 PCT	(- PH - SAT PASTE 8C1B	CACL2 .01M 1:2 8C1F	H2O 1:1 8C1F
		<- - - - - - - - - -MEQ / 100 G - - - - - - - - - ->																		
842857	1	18.1	11.0	0.2	0.7	30.0	6.1	36.1	30.9	1	1	83	97					6.6	6.2	6.7
842858	2	17.7	10.0	0.6	0.2	28.5	3.5	32.0	29.3	2	2	89	97					7.2	6.8	7.4
842859	3	19.2	12.1	2.5	0.2	34.0			28.6	8	6		100	TR				8.0	7.7	8.4
842860	4		15.7	6.0	0.2				28.7	17	13			2	880	--		8.1	8.0	8.5
842861	5		16.0	7.6	0.2				27.9	17	10			1		1		7.7	7.9	8.1
842862	6		14.5	8.0	0.2				28.5	16	11			1		1		7.8	7.9	8.3

SAMPLE NO.	HZN NO.	(- WATER EXTRACTED FROM SATURATED PASTE - MEQ / LITER -> CA 6N1B	MG 6O1B	NA 6P1B	K 6Q1B	CO3 6I1B	HCO3 6J1B	CL 6K1C	SO4 6L1C	NO3 6M1C	H2O 8A PCT	TOTAL SALTS EST. 8D5 PCT	ELEC. COND. 8A3A MMHOS /CM	(- MINERALOGY - CLAY - X-RAY - <2U - 7A2I	7A2I	7A2I	7A2I	(- DTA - <2U - 7A3	7A3	TOTAL RES 7B1A PCT	DOM WEATH 7B1A
		<- - - - - - - - - -MEQ / LITER - - - - - - - - - ->									<- -PCT ->		/CM	<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842857	1	1.9	1.7	1.1	0.1	--	2.6	0.6	1.5	--	60.8	TR	0.51								
842858	2	0.6	0.5	1.3	--	--	1.8	0.3	0.3	--	52.1	TR	0.27								
842859	3	0.5	0.2	3.7	TR	--	3.1	0.4	0.7	--	60.3	TR	0.47	KK 4	MT 3	GE 2	VR 1	KK35		99	BTTR
842860	4	1.1	1.2	13.8	TR	--	3.2	0.5	12.9	--	73.7	0.1	1.67								
842861	5	19.1	17.2	43.1	0.1	--	1.7	4.7	74.2	--	67.4	0.3	6.19	KK 4	MT 3	GE 2		KK32		99	CBTR
842862	6	18.7	17.0	47.7	0.1	--	1.4	3.9	78.1	--	74.9	0.4	6.51								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 53 PCT .1-75MM 20

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MT MONTMORILL GE GOETHITE VR VERMICULITE BT BIOTITE

CB CARB-AGG

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

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CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL: SAND/SILT: FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY: CLAY: RELATIVE AMOUNTS 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL K2O 6Q3A	TOT ANAL FE 6C7A
			<PCT>														PCT		
84P2857	1																		
84P2858	2																		
84P2859	3	FNES	99	QZ92	QC 6	RA 1	HN<1	BT<1				KK 4	MT 3	GE 2	VR 1		KK35	0.5	6.6
84P2860	4																		
84P2861	5	FNES	99	QZ95	RA 3	QC 2	EP<1	TM<1	FK<1	CB<1		KK 4	MT 3	GE 2			KK32	0.5	6.4
84P2862	6																		

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE QC = CLAY-COATED QUARTZ QZ = QUARTZ RA = RESISTANT AGGREGATES BT = BIOTITE

HN = HORNBLENDE MT = MONTMORILLONITE VR = VERMICULITE KK = KAOLINITE TM = TOURMALINE

CB = CARBONATE AGGREGATES EP = EPIDOTE FK = POTASSIUM FELDSPAR

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Print date: 06-03-1985

SERIES: Kafue NSSL ID #: 84P0520
SOIL SURVEY # S83-FN-990-014
LOCATION: Harthoorn's farm 10 km W of Kafue LUP Zambia. Pit located about 250 m SE of fish farm offices.
LATITUDE: 15-46- -S LONGITUDE: 027-55- -E
PHYSIOGRAPHY: Broad plain in lake Plains
MICRORELIEF: gilgai less than 20 cm on middle third
SLOPE CHARACTERISITICS: ELEVATION: 990 m MSL
PRECIPITATION: 780 mm Ustic moisture regime PERMEABILITY: Very slow
AIR TEMPERATURE: ANN: 20.8, SUM: 22.5, WIN: 16.0
DRAINAGE: Somewhat poorly drained LAND USE: Pasture land and native pasture
RUNOFF: Very slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: lacustrine from sedimentary material
CLASSIFICATION: Fine, montmorillonitic (calcareous), isohyperthermic Udic Chromustert
WEATHER STATION: Kafue
DIAGNOSTIC HORIZONS: 0 to 8 cm Ochric 8 to 133 cm Cambic 24 to 154 cm Calcic
DESCRIBED BY: D. Hallbick O. Spaargaren and C. Kalima SAMPLE DATE: 11/83
Not sure of length of time cracks are open may be Typic. Cracks are 4 cm wide at a depth of 50 cm. Polygon diameter about 90 to 100 cm.

A--0 to 8 cm; dark grayish brown (2.5Y 4/2) clay; very dark grayish brown (2.5Y 3/2) moist; few to common fine prominent yellowish red (5YR 5/8) mottles; strong medium and coarse granular structure; hard, very sticky, very plastic; many fine and medium roots throughout; many very fine and fine void between rock fragments pores; common fine rounded ironstone nodules; clear smooth boundary.
84P2857

Bw--8 to 24 cm; olive (5Y 4/3) clay; dark olive gray (5Y 3/2) moist; few to common fine prominent yellowish red (5YR 5/8) mottles; strong medium and coarse subangular blocky structure; hard, very sticky, very plastic; few continuous thin intersecting slickensides on faces of peds; many fine and medium roots throughout; many fine and medium discontinuous tubular pores; common fine and medium rounded ironstone nodules and few fine and medium rounded lime nodules; clear smooth boundary.
84P2858

Bk1--24 to 74 cm; olive gray (5Y 4/2) clay; dark olive gray (5Y 3/2) moist; strong medium and coarse angular blocky structure; hard; many thin intersecting slickensides on faces of peds; common to many fine roots throughout; few to common very fine and fine discontinuous tubular pores; common fine to coarse rounded lime nodules and common fine and medium rounded ironstone nodules; gradual wavy boundary.
84P2859

Bk2--74 to 133 cm; olive gray (5Y 4/2) clay; dark olive gray (5Y 3/2) moist; strong medium and coarse angular blocky structure; hard, very firm; many thin intersecting slickensides on faces of peds; common fine roots throughout; few to common very fine and fine discontinuous tubular pores; many fine to coarse rounded lime nodules and common fine and medium rounded ironstone nodules; gradual smooth boundary.
Horizon split for sampling 74 to 105 cm No. 2860 and 105 to 133 cm No. 2861.
84P2860

BCk--133 to 154 cm; clay; olive (5Y 4/3) moist; moderate medium and coarse angular blocky structure; very firm; common thin intersecting slickensides on faces of peds; few fine roots throughout; few fine discontinuous tubular pores; many fine to coarse rounded lime nodules and many fine rounded ironstone nodules.
84P2862

Possibly on calcareous schist

NAKAMBALA

SAMPLED AS: CLAYEY, MIXED, ~~ISO~~HYPERTHERMIC TYPIC PALEUSTALF

S 84FN-990 -015 DATE 05/31/85

SAMPLE NO. 84P2863-2869
PEDON NO. 84P 521
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	>2MM .1- 75	WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842863	1S	0- 8	A	11.7	12.8	75.5			5.0	7.8	23.0	35.9	13.3	2.9	0.4	--	--	--	52	--
842864	2S	8- 21	EA	16.6	11.7	71.7			4.4	7.3	21.4	34.4	12.8	2.6	0.5	--	--	--	50	--
842865	3S	21- 43	BT1	26.1	12.1	61.8			5.1	7.0	18.9	29.1	10.9	2.5	0.4	--	--	--	43	--
842866	4S	43- 75	BT2	38.1	10.7	51.2			4.7	6.0	17.8	22.3	8.8	2.1	0.2	--	--	--	33	--
842867	5S	75-112	BT2	43.4	10.4	46.2			4.0	6.4	15.7	20.1	8.0	2.1	0.3	--	--	--	30	--
842868	6S	112-157	BT3	40.8	11.4	47.8			4.5	6.9	17.8	20.9	6.9	1.9	0.3	--	--	--	30	--
842869	7S	157-186	BT4	40.5	12.1	47.4			4.6	7.5	18.0	20.5	6.6	1.6	0.7	--	--	--	29	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS - LL 4F1	PI 4F	BULK DENSITY - FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT - FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842863	1	0.88	0.072			1.1	0.1	TR	0.35	0.37	19	1		1.43	1.46	0.007			11.6	4.3	0.10
842864	2	0.74	0.057			1.4	0.2	TR	0.27	0.32				1.46	1.50	0.009			11.0	5.3	0.08
842865	3	0.57	0.022			2.1	0.2	TR	0.22	0.33	24	8		1.45	1.52	0.016			15.9	8.5	0.11
842866	4	0.52				2.8	0.3	TR	0.20	0.32				1.44	1.53	0.020			20.2	12.0	0.12
842867	5	0.44				3.3	0.4	TR	0.19	0.31	33	13		1.44	1.53	0.020			20.2	13.4	0.10
842868	6	0.27				3.1	0.4	TR	0.19	0.30				1.33	1.43	0.024			21.2	12.2	0.12
842869	7	0.22				3.1	0.4	TR	0.20	0.29				1.36	1.44	0.019			20.2	11.9	0.11

*** CONTINUATION ON NEXT PAGE ***

NAKAMBALA S 84FN-990 -015 DATE 05/31/85 PEDON NO. 84P 521 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACID-ITY 6H5A	EXTR AL 6G9A	-CEC - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842863	1	1.4	1.4	TR	0.6	3.4	2.7		6.1	4.1			56	83				5.0	5.0	5.8
842864	2	1.1	1.3	TR	0.4	2.8	3.5		6.3	4.4			44	64				4.8	4.9	5.8
842865	3	0.9	1.4	0.5	0.2	3.0	5.8	0.8	8.8	5.7	3.8	21	34	53				4.0	4.3	4.9
842866	4	1.2	2.1	0.1	0.3	3.7	7.9	1.1	11.6	7.8	4.8	23	32	47				4.1	4.3	5.4
842867	5	1.4	2.6	TR	0.3	4.3	7.7	0.9	12.0	8.4	5.2	17	36	51				4.2	4.4	5.4
842868	6	1.6	2.9	0.1	0.4	5.0	5.8	0.1	10.8	7.8	5.1	2	46	64				4.5	4.8	5.5
842869	7	1.6	3.1	0.1	0.3	5.1	5.6	0.1	10.7	8.1	5.2	2	48	63				4.7	4.9	5.6

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) TOTAL DOM (- - - - - <2U - - - -)(- -<2U - -) RES WEATH 7A2I 7A2I 7A2I 7A2I 7A3 7A3 7B1A 7B1A <- RELATIVE AMOUNTS -> <- - - - -PCT - - - ->							
842863	1								
842864	2								
842865	3	KK 3	MI 3	TA 2	GE 2	KK15		85	FK15
842866	4								
842867	5	KK 4	MI 3	GE 2	TA 2	KK36		81	WE19
842868	6								
842869	7								

4 = 12.6
5 = 12.
6 = 12.5
7 = 12.8

FAMILY CONTROL SECTION: DEPTH 21- 71 PCT CLAY 33 PCT .1-75MM 38

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA TA TALC GE GOETHITE FK POTAS-FELD
WE WEATH MIN

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

77

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL: SAND/SILT: FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	MINERALOGY: X-RAY: CLAY: RELATIVE AMOUNTS 7A2I	7A2I	7A2I	7A2I	7A2I	DTA PCT 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<PCT>										<RELATIVE AMOUNTS>					<PCT>			
84P2863	1																				
84P2864	2																				
84P2865	3	FNES	85	QZ83	FK15	TM 1	OP 1	MS<1	RA<1	HN<1	ZR<1	EP<1	KK 3	MI 3	TA 2	GE 2		KK15		1.0	8.6
84P2866	4																				
84P2867	5	FNES	81	RE81	WE19								KK 4	MI 3	GE 2	TA 2		KK36		0.9	9.2
84P2868	6																				
84P2869	7																				

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE OP = OPAQUES QZ = QUARTZ RA = RESISTANT AGGREGATES TM = TOURMALINE ZR = ZIRCON

EP = EPIDOTE FK = POTASSIUM FELDSPAR HN = HORNBLENDE MI = MICA MS = MUSCOVITE TA = TALC

KK = KAOLINITE RE = RESISTANT MINERALS WE = WEATHERABLE MINERALS

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

p81/82

except for d
e
i
j

BIRC Rodeo

Not rhodic on volume.

78

Print date: 06-03-1985

SERIES: Nakambala NSSL ID #: 84P0521
SOIL SURVEY # S83-FN-990-015
LOCATION: Magoye Reg. Res. St. 15 km W of Mazabuka SOP Zambia. Pit located about 500 m E of the offices.
LATITUDE: 15-49- -S LONGITUDE: 027-45- -E
PHYSIOGRAPHY: in
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1040 m MSL
PRECIPITATION: Ustic moisture regime
WATER TABLE DEPTH: PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 23.0, SUM: 24.3, WIN: 18.5
DRAINAGE: Well drained LAND USE: Forest land not grazed
RUNOFF: Slow
FAMILY CONTROL SECTION: 21 to 71 cm
PARENT MATERIAL: residuum from metamorphic material
CLASSIFICATION: Clayey, mixed, isohyperthermic Typic Paleustalf
WEATHER STATION: Mazabu
DIAGNOSTIC HORIZONS: 0 to 8 cm Ochric 21 to 186 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and C. Kalima SAMPLE DATE: 11/83
Cracks about 1 cm wide extend from base of A down to a depth of about 150 cm. Distance between cracks is 20 to 60 cm.

A--0 to 8 cm; reddish brown (5YR 5/3) sandy loam; dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure parting to massive; soft, very friable, nonsticky, nonplastic; many fine and medium roots throughout; common to many very fine and fine interstitial and tubular pores; clear smooth boundary.
84P2863

EA--8 to 21 cm; yellowish red (5YR 5/6) sandy clay loam; dark reddish brown (5YR 3/4) moist; massive; slightly hard, slightly sticky, nonplastic; common to many fine and medium roots throughout; common fine and medium continuous tubular and many very fine and fine interstitial pores; clear smooth boundary.
84P2864

Bt--21 to 43 cm; yellowish red (5YR 4/6) clay; dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; slightly hard, very sticky, plastic; few patchy faint-thin clay films on vertical faces of peds; common to many fine and medium roots throughout; common fine and medium continuous tubular and common to many fine and medium void between rock fragments pores; gradual smooth boundary.
84P2865

Bt2--43 to 112 cm; red (2.5YR 4/6) clay; red (2.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, very sticky, plastic; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; common fine and medium roots throughout; common fine and medium continuous tubular and common to many fine and medium void between rock fragments pores; clear smooth boundary.
Clod 43 to 112 cms bulk samples split. Horizon split for sampling 43 to 75 cm No. 2866 and 75 to 112 cm No. 2867.
84P2866

Bt3--112 to 157 cm; red (2.5YR 5/8) clay; red (2.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, very sticky, plastic; common patchy distinct-thin clay films on vertical and horizontal faces of peds; few fine and medium roots throughout; few medium continuous tubular and common fine and medium interstitial pores; gradual smooth boundary.
In Bt3 and Bt4 amount of clay somewhat less than in Bt2.
84P2868

Bt4--157 to 186 cm; red (2.5YR 5/8) clay; red (2.5YR 4/8) moist; weak fine and medium subangular blocky structure; soft, very sticky, plastic; few patchy distinct-thin clay films on vertical and horizontal faces of peds; few fine and medium roots throughout; few medium continuous tubular and common fine and medium interstitial pores.
84P2869

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

016
CHOMA

PROFILE IDENTIFICATION ZAMBIA 016 CHOMA

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	19 CM	5.4 %
2	19 CM	31 CM	6.0 %
3	31 CM	72 CM	18.4 %
4	72 CM	125 CM	24.8 %

KANDIC HORIZON BETWEEN 28 AND 43 CM

CLAY CONTENT AT TOP: 9.7 %
AT BOTTOM: 15.4 %
DIFFERENCE: 5.7 %
RATIO: 1.58

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 10.5 CM (30.1 - 40.6 CM)

CLAY CONTENT AT TOP: 10.5 %
AT BOTTOM: 14.5 %
DIFFERENCE: 4.0 %
RATIO: 1.38

HYPOTHESIS THAT THERE IS A KANDIC HORIZON IS TRUE
WITH PROBABILITY BETWEEN 75 AND 90%

TESTSTATISTIC = 2.849 WITH STUDENT'S
DISTRIBUTION (DF 1)

80

CHOMA

SAMPLED AS: FINE-LOAMY, SILICEOUS, ISOTHERMIC OXIC PALEUSTULT

Dall

S 84FN-990 -016 DATE 05/31/85

SAMPLE NO. 84P2870-2875
PEDON NO. 84P 522
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002 (-4-)	TOTAL SILT .002 -.05 (-5-)	TOTAL SAND .05 -2 (-6-)	CLAY FINE LT .0002 (-7-)	CLAY CO3 LT .002 (-8-)	SILT FINE .002 -.02 (-9-)	SILT COARSE .02 -.05 (-10-)	SAND VF .05 -.10 (-11-)	SAND F .10 -.25 (-12-)	SAND M .25 -.50 (-13-)	SAND C .5 -1 (-14-)	SAND VC 1 -2 (-15-)	COARSE FRACTIONS(MM) WEIGHT 2 -5 (-16-)	WEIGHT 5 -20 (-17-)	WEIGHT 20 -75 (-18-)	WEIGHT .1- 75 (-19-)	(>2MM) WT PCT OF WHOLE SOIL (-20-)
				<- - -	- - -	- - -	- - -	PCT OF <2MM	(3A1)	- - -	- - -	- - -	- - -	- - -	- ->	<- PCT OF	<75MM	(3B1)	->	
842870	1S	0- 19	AP1	5.4	7.6	87.0			3.4	4.2	8.5	25.5	31.6	18.8	2.6	TR	--	--	78	TR
842871	2S	19- 31	AP2	6.0	8.2	85.8			3.6	4.6	9.1	27.2	29.1	18.1	2.3	TR	--	--	77	TR
842872	3S	31- 72	BT1	18.4	6.8	74.8			3.1	3.7	6.5	20.2	28.7	16.9	2.5	1	--	--	69	1
842873	4S	72-125	BT2	24.8	6.1	69.1			2.7	3.4	5.9	16.7	25.0	17.2	4.3	1	--	--	64	1
842874	5S	125-185	BT3	29.3	9.7	61.0			4.7	5.0	7.5	14.2	18.3	16.2	4.8	2	--	--	54	2
842875	6S	185-198	2BC	23.6	16.4	60.0			9.5	6.9	10.2	13.0	15.7	14.6	6.5	13	18	--	65	31

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	DITH-CIT EXTRACTABLE AL 6G7A	DITH-CIT EXTRACTABLE MN 6D2A	RATIO/CLAY CEC 8D1	RATIO/CLAY 15 BAR 8D1	ATTERBERG LIMITS LL 4F1	ATTERBERG LIMITS PI 4F	BULK DENSITY FIELD MOIST 4A3A	BULK DENSITY 1/3 BAR 4A1D	BULK DENSITY OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	WATER CONTENT 1/10 BAR 4B1C	WATER CONTENT 1/3 BAR 4B1C	WATER CONTENT 15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - -	- - -	-PCT OF <2MM	- - -	- - -	- - -	->			PCT <0.4MM		<- - G/CC	- -	- ->	CM/CM	<- - -PCT OF	<2MM	- -	->	CM/CM
842870	1	0.46	0.036			0.3	TR	TR	0.22	0.37		NP		1.63	1.66	0.006			7.0	2.0	0.08
842871	2	0.24	0.019			0.3	0.1	TR	0.15	0.37				1.61	1.65	0.008			8.3	2.2	0.10
842872	3	0.15	0.014			0.7	0.1	--	0.11	0.33	19	7		1.66	1.71	0.010			7.4	6.0	0.02
842873	4	0.14				0.9	0.2	--	0.10	0.30				1.54	1.59	0.011			10.3	7.5	0.04
842874	5	0.09				1.2	0.2	--	0.09	0.31	31	15		1.64	1.69	0.010			12.6	9.1	0.06
842875	6	0.08				2.2	0.2	--	0.17	0.41				1.55	1.59	0.007			19.8	9.6	0.13

*** CONTINUATION ON NEXT PAGE ***

Marginally an alfisol, but decreasing base saturation

Kandic 28/43 (80.1 - 40.6)
Prob 75-90 %
Stat. 2,849

CHOMA S 84FN-990 -016 DATE 05/31/85 PEDON NO. 84P 522 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	-1-- CA 5B5A 6N2E	-2-- MG 5B5A 6O2D	-3-- NA 5B5A 6P2B	-4-- K 5B5A 6Q2B	-5-- SUM BASES	-6-- ACID-ITY 6H5A	-7-- EXTR AL 6G9A	-8-- SUM CATS 5A3A	-9-- CEC NH4-OAC 5A8B	-10- BASES + AL 5A3B	-11- AL SAT 5G1	-12- BASE SAT SUM 5C3	-13- BASE SAT NH4 OAC 5C1	-14- CO3 AS CACO3 <2MM 6E1G	-15- RES. OHMS /CM 8E1	-16-	-17- COND. MMHOS /CM 8I	-18- PH KCL IN 8C1G	-19- PH CACL2 .01M 8C1F 1:2	-20- PH H2O 8C1F 1:1
		<- - - -	- - - -	- - - -	- - -	-MEQ /	100 G - -	- - - -	- - - -	- - - -	- - ->	<- - -	- - -PCT	- - - - ->							
842870	1	0.7	0.3	TR	0.2	1.2	1.2	TR	2.4	1.2			50	100					4.3	4.4	4.8
842871	2	0.2	0.1	TR	0.2	0.5	1.5	0.2	2.0	0.9	0.7	29	25	56					4.2	4.3	4.7
842872	3	1.3	0.2	0.2	0.2	1.9	2.4		4.3	2.1			44	90					4.7	5.0	5.7
842873	4	1.2	0.5	TR	0.2	1.9	1.7		3.6	2.4			53	79					5.0	5.3	5.8
842874	5	0.7	0.7	TR	0.1	1.5	2.4		3.9	2.7			38	56					4.8	5.0	5.8
842875	6	0.7	0.9	TR	0.2	1.8	3.4		5.2	3.9			35	46					5.0	4.7	5.6

SAMPLE NO.	HZN NO.	MINERALOGY: CLAY X-RAY <2U 7A2I	X-RAY <2U 7A2I	X-RAY <2U 7A2I	X-RAY <2U 7A2I	DTA <2U 7A3	DTA <2U 7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- RELATIVE	AMOUNTS	->		<- - - -	-PCT	- - -	->
842870	1								
842871	2								
842872	3	KK 5	MI 3	GE 1		KK37		86	FK13
842873	4								
842874	5	KK 5	MI 3	GE 2		KK39			
842875	6								

FAMILY CONTROL SECTION: DEPTH 31- 81 PCT CLAY 20 PCT .1-75MM 68

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GE GOETHITE FK POTAS-FELD

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

82

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2870	1																			
84P2871	2																			
84P2872	3	FNES	86	QZ86	FK13	MS<1	ZR<1	RA<1	OP<1			KK 5	MI 3	GE 1			KK37		1.2	4.8
84P2873	4																			
84P2874	5											KK 5	MI 3	GE 2			KK39		1.0	5.3
84P2875	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE OP = OPAQUES QZ = QUARTZ RA = RESISTANT AGGREGATES ZR = ZIRCON FK = POTASSIUM FELDSPAR

MI = MICA MS = MUSCOVITE KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

83

Print date: 06-03-1985

SERIES: Choma NSSL ID #: 84P0522
SOIL SURVEY # S83-FN-990-016
LOCATION: Mochipapa Reg. Res. St. about 10 km SE of Choma SOP Zambia. Pit located
PHYSIOGRAPHY: Upland slope in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1075 m MSL
PRECIPITATION: 830 mm Ustic moisture regime PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 18.3, SUM: 22.1, WIN: 12.9
DRAINAGE: Moderately well drained LAND USE: Pasture land and native pasture
RUNOFF: Moderate
FAMILY CONTROL SECTION: 31 to 81 cm
PARENT MATERIAL: residuum from schist & phyllite material
CLASSIFICATION: Fine-loamy, siliceous, isothermic Oxic Paleustult
WEATHER STATION: Choma
DIAGNOSTIC HORIZONS: 0 to 31 cm Ochric 31 to 185 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and C. Kalima SAMPLE DATE: 11/83
Near pit termite mounds with diameter of 5 m at base occur about 40 to 50 m apart.

10YR Ap1--0 to 19 cm; loamy sand; brown to dark brown (7.5YR 4/4) moist; massive parting to single grain; very friable, nonsticky, nonplastic; common fine and medium roots throughout; very fine and fine total porosity and few fine and medium continuous tubular pores; clear smooth boundary.
84P2870

10YR Ap2--19 to 31 cm; loamy sand; brown to dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) moist; massive; very friable, nonsticky, nonplastic; common fine and medium roots throughout; very fine and fine total porosity and few fine and medium continuous tubular pores; clear smooth boundary.
84P2871

7.5YR 6/6

7 1/2 YR Bt1--31 to 72 cm; yellowish red (5YR 5/8) sandy clay loam; yellowish red (5YR 4/6) moist; weak coarse and very coarse angular blocky structure; slightly hard, slightly sticky, plastic; few patchy faint-thin clay films on faces of peds; common patchy faint-thin clay films between sand grains; few to common fine roots throughout; common very fine and fine interstitial and few fine and medium continuous tubular pores; gradual smooth boundary.
84P2872

7 1/2 Bt2--72 to 125 cm; reddish yellow (5YR 6/8) sandy clay; yellowish red (5YR 5/8) moist; weak coarse and very coarse angular blocky structure; slightly hard, very sticky, plastic; few patchy faint-thin clay films on faces of peds; common patchy faint-thin clay films between sand grains; few fine roots throughout; common very fine and fine interstitial and very few fine and medium continuous tubular pores; clear smooth boundary.
84P2873

7/2 Bt3--125 to 185 cm; reddish yellow (5YR 6/8) clay; yellowish red (5YR 5/8) moist; common medium faint red (2.5YR 5/8) and common medium prominent yellow (10YR 7/6) mottles; moderate medium and coarse subangular blocky structure; hard, very sticky, very plastic; few discontinuous distinct-thin clay films on faces of peds; common patchy faint-thin clay films between sand grains; very few fine roots throughout; common very fine and fine interstitial pores; abrupt wavy boundary.
84P2874

84

2BC--185 to 198 cm; yellowish red (5YR 5/6) gravelly clay; yellowish red (5YR 5/6) moist; common medium prominent dark red (2.5YR 3/6) and common medium faint strong brown (7.5YR 5/6) mottles; massive; hard, slightly sticky, very plastic; few discontinuous prominent-thin dark red (10R 3/6) clay films on sand and gravel; very few fine roots throughout; few very fine and fine interstitial pores; common medium and coarse irregular soft masses of iron; 25 percent pebbles, 5 percent stones from siltstone.
84P2875

"Oxic psammentic Paleustalf."

no argillic > 90%. agreed; possibly rhodic

KABUYU

SAMPLED AS: MIXED, ISOHYPERTHERMIC TYPIC USTIPSAMMENT

S 84FN-990 -017 DATE 05/31/85

SAMPLE NO. 84P2876-2881
PEDON NO. 84P 523
PROJECT NO. 84P 97

ZAMBIA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	-1-- TOTAL CLAY LT .002	-2-- TOTAL SILT .002 -.05	-3-- TOTAL SAND .05 -2	-4-- CLAY FINE LT .0002	-5-- CLAY CO3 LT .002	-6-- SILT FINE .002 -.02	-7-- SILT COARSE .02 -.05	-8-- SAND VF .05 -.10	-9-- SAND F .10 -.25	-10- SAND M .25 -.50	-11- SAND C .5 -1	-12- SAND VC 1 -2	-13- COARSE FRACTIONS(MM) WEIGHT 2 -5	-14- 5 -20	-15- 20 -75	-16- .1- 75	-17- (>2MM) WT PCT OF WHOLE SOIL
				<- - - PCT OF <2MM (3A1)											->	<- PCT OF <75MM(3B1)			->	
842876	1S	0- 17	A	5.9	3.5	90.6	3.3		2.1	1.4	13.8	36.4	22.8	17.2	0.4	--	--	--	77	--
842877	2S	17- 32	E	5.2	2.3	92.5	3.0		1.3	1.0	16.2	38.2	21.9	15.8	0.4	--	--	--	76	--
842878	3S	32- 54	BW1	6.0	1.8	92.2	3.5		1.3	0.5	14.8	36.1	23.1	18.0	0.2	--	--	--	77	--
842879	4S	54- 94	BW2	9.1	1.9	89.0	5.6		1.0	0.9	13.2	35.7	23.9	16.0	0.2	--	--	--	76	--
842880	5S	94-144	BW3	10.5	1.4	88.1	6.8		0.9	0.5	12.6	35.4	23.4	16.3	0.4	--	--	--	75	--
842881	6S	144-167	BW3	11.6	1.2	87.2	7.8		0.7	0.6	10.7	29.3	25.5	21.2	0.5	--	--	--	76	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	(RATIO/CLAY) CEC 8D1	15 BAR 8D1	(ATTERBERG - LIMITS -) LL 4F1	PI 4F	(- BULK DENSITY -) FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	(- - -WATER CONTENT - -) FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - - -PCT OF <2MM						->			PCT <0.4MM		<- - G/CC		->	CM/CM	<- - -PCT OF <2MM			->	CM/CM
842876	1	0.84	0.038			0.4	TR	TR	0.70	0.41				1.55	1.60	0.011			8.6	2.4	0.10
842877	2	0.27	0.014			0.4	TR	TR	0.29	0.31				1.73	1.75	0.004			5.8	1.6	0.07
842878	3	0.09	0.008			0.4	TR	TR	0.15	0.28				1.68	1.72	0.008			6.1	1.7	0.07
842879	4	0.09				0.5	TR	TR	0.11	0.27				1.67	1.69	0.004			3.9	2.5	0.02
842880	5	0.12				0.5	--	TR	0.11	0.27				1.70	1.72	0.004			4.4	2.8	0.03
842881	6	0.09				0.5	--	TR	0.10	0.29				1.68	1.70	0.004			4.7	3.4	0.02

*** CONTINUATION ON NEXT PAGE ***

KABUYU S 84FN-990 -017 DATE 05/31/85 PEDON NO. 84P 523 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	-1-- CA 5B5A 6N2E	-2-- MG 5B5A 6O2D	-3-- NA 5B5A 6P2B	-4-- K 5B5A 6Q2B	-5-- SUM BASES	-6-- ACID-ITY 6H5A	-7-- EXTR AL 6G9A	-8-- SUM CATS 5A3A	-9-- CEC NH4-OAC 5A8B	-10- BASES + AL 5A3B	-11- AL SAT 5G1	-12- BASE SAT SUM 5C3	-13- BASE SAT NH4 OAC 5C1	-14- CO3 AS CACO3 <2MM 6E1G	-15- RES. OHMS /CM 8E1	-16-	-17- COND. MMHOS /CM 8I	-18- PH KCL IN 8C1G	-19- PH CACL2 .01M 8C1F 1:2	-20- PH H2O 8C1F 1:1
		<- - - - - -	- - - - - - -	- - - -MEQ	/ 100 G - -	- - - - -	- - - -	- - - ->		<- - - - -	-PCT - -	- - ->							
842876	1	2.9	0.4	TR	0.1	3.4	2.4	TR	5.8	4.1			59	83					4.9	4.8	5.3
842877	2	0.8	0.3	TR	0.1	1.2	1.1		2.3	1.5			52	80					5.0	5.1	5.9
842878	3	0.4	0.2	TR	TR	0.6	1.0	TR	1.6	0.9			38	67					4.4	4.8	5.5
842879	4	0.4	0.3	TR	0.1	0.8	1.1	TR	1.9	1.0			42	80					4.4	4.7	5.5
842880	5	0.6	0.4	TR	0.2	1.2	1.1		2.3	1.2			52	100					4.7	5.1	5.6
842881	6	0.6	0.4	TR	0.1	1.1	1.3		2.4	1.2			46	92					4.8	5.2	5.9

SAMPLE NO.	HZN NO.	MINERALOGY CLAY X-RAY <2U 7A2I	7A2I	7A2I	7A2I	DTA <2U 7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- RELATIVE	AMOUNTS ->			<- - - -	-PCT - -	- ->	
842876	1								
842877	2								
842878	3	KK 4	MI 2	GE 1		KK12		93	FK 6
842879	4								
842880	5	KK 5	MI 2	GE 1		KK28		90	FK 9
842881	6								

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 8 PCT .1-75MM 76

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MI MICA GE GOETHITE FK POTAS-FELD

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

87

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2876	1																			
84P2877	2																			
84P2878	3	FNES	93	QZ93	FK 6	BT<1	RU<1	OP<1				KK 4	MI 2	GE 1			KK12		0.9	3.9
84P2879	4																			
84P2880	5	FNES	90	QZ90	FK 9	AM<1	OP<1					KK 5	MI 2	GE 1			KK28		0.9	4.3
84P2881	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE OP = OPAQUES QZ = QUARTZ RU = RUTILE BT = BIOTITE FK = POTASSIUM FELDSPAR MI = MICA

KK = KAOLINITE AM = AMPHIBOLE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

Print date: 06-03-1985

SERIES: Kabuyu NSSL ID #: 84P0523
SOIL SURVEY # S83-FN-990-017
LOCATION: 43 km NE of Livingstone SOP Zambia along road to Lusaka.
PHYSIOGRAPHY: Low sand ridge in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1140 m MSL
PRECIPITATION: 880 mm Ustic moisture regime PERMEABILITY: Rapid
AIR TEMPERATURE: ANN: 20.1, SUM: 22.7, WIN: 15.7
SOIL TEMPERATURE: ANN: 24.3, SUM: 24.7, WIN: 20.9
DRAINAGE: Somewhat excessively drained LAND USE: Forest land not grazed
RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: eolian sand from sandstone material
CLASSIFICATION: , siliceous, isohyperthermic, coated Typic Ustipsamment
WEATHER STATION: Living
DIAGNOSTIC HORIZONS: 0 to 17 cm Ochric
DESCRIBED BY: D. Hallbick O Spaargaren and C. Kalima SAMPLE DATE: 11/83
Classification problematic because insufficient data are available yet to justify classification in either Inceptisols (because of possible cambic horizon) or Alfi/Ultisols (because of possible argillic horizon).

O--7 to 0 cm; loamy fine sand; strong brown (7.5YR 4/6) and black (N 2/0) moist; single grain parting to massive; loose, nonsticky, nonplastic; common fine and medium roots throughout; many very fine and fine interstitial pores; abrupt smooth boundary.
84P2876

A--0 to 17 cm; dark reddish gray (5YR 4/2) loamy sand; dark reddish brown (5YR 2/2) moist; massive; soft, nonsticky, nonplastic; common fine and medium roots throughout and few coarse roots throughout; many very fine and fine interstitial and few fine to coarse continuous tubular pores; clear wavy boundary.
84P2877

E--17 to 32 cm; reddish brown (5YR 5/4) loamy sand; dark reddish brown (5YR 3/4) moist; massive; soft, nonsticky, nonplastic; common fine and medium roots throughout; many very fine and fine interstitial and few fine to coarse continuous tubular pores; clear wavy boundary.
There is a clay increase from the E to the Bw3 however not sufficient to warrant other PCS than LS.
84P2878

Bw1--32 to 54 cm; yellowish red (5YR 5/6) loamy sand; dark red (2.5YR 3/6) moist; massive; soft, nonsticky, nonplastic; few fine and medium roots throughout; many very fine and fine interstitial and few fine to coarse continuous tubular pores; clear smooth boundary.
Many termite burrows are coated with gray thick linings probably a mixture of clay and organic matter.
84P2879

Bw2--54 to 94 cm; red (2.5YR 5/6) loamy sand; dark red (2.5YR 3/6) moist; massive; soft, nonsticky, nonplastic; few fine and medium roots throughout; many very fine and fine interstitial and few fine to coarse continuous tubular pores; clear smooth boundary.

89

84P2880

Bw3—94 to 167 cm; red (2.5YR 5/6) sandy loam; dark red (2.5YR 3/6) moist; massive; slightly hard, slightly sticky, nonplastic; few fine and medium roots throughout; many very fine and fine interstitial and few fine to coarse continuous tubular pores.
84P2881

KANDE

SAMPLED AS: SANDY, SILICEOUS, ISOHYPERTHERMIC AERIC TROPOHUMOD

S 84FN-990 -018 DATE 05/31/85 SAMPLE NO. 84P2882-2887
PEDON NO. 84P 524
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002	TOTAL SILT .002 -.05	TOTAL SAND .05 -2	CLAY FINE LT .0002	CLAY CO3 LT .002	SILT FINE .002 -.02	SILT COARSE .02 -.05	SAND VF .05 -.10	SAND F .10 -.25	SAND M .25 -.50	SAND C .5 -1	SAND VC 1 -2	COARSE FRACTIONS(MM) WEIGHT 2 -5	5 -20	20 -75	.1- 75	>2MM WT PCT OF WHOLE SOIL
				<- - - - - - - - - - - - PCT OF <2MM (3A1) - - - - - - - - - - - - ->												<- PCT OF <75MM(3B1)->				
842882	1S	0- 9	A1	1.5	1.2	97.3			0.4	0.8	2.9	17.9	70.0	6.5	--	--	--	--	94	--
842883	2S	9- 41	A2	1.3	0.8	97.9			0.3	0.5	4.4	22.6	65.4	5.5	--	--	--	--	93	--
842884	3S	41- 76	A3	--	1.8	98.2			0.4	1.4	3.7	18.0	70.6	5.9	--	--	--	--	94	--
842885	4S	76-101	E	--	1.7	98.3			0.4	1.3	4.0	24.0	64.8	5.5	--	--	--	--	94	--
842886	5S	101-150	BH1	0.1	3.1	96.8			0.3	2.8	5.6	26.8	58.8	5.6	--	--	--	--	91	--
842887	6S	150-200	BH2	0.5	2.6	96.9			0.2	2.4	7.0	36.3	49.3	4.3	--	--	--	--	90	--

SAMPLE NO.	HZN NO.	ORGN C	TOTAL N	EXTR P	TOTAL S	DITH-CIT EXTRACTABLE FE	DITH-CIT EXTRACTABLE AL	DITH-CIT EXTRACTABLE MN	RATIO/CLAY CEC	RATIO/CLAY 15 BAR	ATTERBERG LIMITS - LL	ATTERBERG LIMITS - PI	BULK DENSITY FIELD MOIST	BULK DENSITY 1/3 BAR	BULK DENSITY OVEN DRY	COLE WHOLE SOIL	WATER CONTENT FIELD MOIST	WATER CONTENT 1/10 BAR	WATER CONTENT 1/3 BAR	WATER CONTENT 15 BAR	WRD WHOLE SOIL
		<- - - - - - - -PCT OF <2MM - - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - - ->				CM/CM
842882	1	1.98				TR	--	--	4.40	2.13				1.54	1.54	--			7.4	3.2	0.06
842883	2	0.93				TR	--	--	2.62	1.46				1.60	1.62	0.004			5.5	1.9	0.06
842884	3	0.51				TR	--	--												1.2	
842885	4	0.28				TR	--	--												0.8	
842886	5	0.72				TR	0.3	--	21.00	15.00				1.62	1.62	--			3.1	1.5	0.03
842887	6	0.26				TR	0.1	--	0.80	1.80				1.74	1.74	--			4.1	0.9	0.06

*** CONTINUATION ON NEXT PAGE ***

KANDE S 84FN-990 -018 DATE 05/31/85 PEDON NO. 84P 524 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A 6N2E	MG 5B5A 6O2D	NA 5B5A 6P2B	K 5B5A 6Q2B	SUM BASES	ACIDITY 6H5A	EXTRACTAL 6G9A	(- - - -CEC - - - -) SUM CATS 5A3A	NH4-OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	(- - - -PH - - - -) NAF 8C1D	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842882	1	0.4	TR	TR	--	0.4	10.2	1.0	10.6	6.6	1.4	71	4	6				6.9	3.0	3.9
842883	2	0.2	--	TR	--	0.2	5.9	1.3	6.1	3.4	1.5	87	3	6				7.3	3.2	3.6
842884	3	0.2	--	TR	--	0.2	3.5	1.1	3.7	2.2	1.3	85	5	9				8.1	3.6	4.4
842885	4	0.1	--	TR	--	0.1	2.6	0.7	2.7	1.5	0.8	88	4	7				8.7	3.9	4.5
842886	5	0.1	--	TR	--	0.1	6.6	0.7	6.7	2.1	0.8	88	1	5				10.5	4.5	5.1
842887	6	0.2	--	TR	--	0.2	1.9	0.2	2.1	0.4	0.4	50	10	50				10.1	4.9	5.4

SAMPLE NO.	HZN NO.	(- - - -SPODIC HORIZON CRITERIA - - - - -) (- -NA PYROPHOSPHATE EXTRACTABLE- -) C 6A4A	FE 6C8A	AL 6G10	INDEX OF ACCUM (- -DIVIDED BY- -) FE+AL DI-CI PCT FE+AL	FE+AL PCT CLAY	AL+C PCT CLAY	(- - - - - - - - -MINERALOGY - - - - - - - - -) (- - - - - - - CLAY - - - - - - - -)(- - -) -) (- - - - X-RAY - - - -)(- -DTA - -) (- - - - - <2U - - - -)(- -<2U - -) 7A2I	7A2I	7A2I	7A2I	7A3	7A3	TOTAL DOM RES 7B1A	WEATH 7B1A
		<- PCT OF <2MM->						<- RELATIVE AMOUNTS ->						<- - - - -PCT - - - ->	
842882	1		0.1	0.1												99	WETR
842883	2		--	0.1								KK 3			KK12	99	WETR
842884	3		--	0.1													
842885	4		0.1	0.1								KK 2			KK13		
842886	5		0.1	0.3	1.3	4.0											
842887	6		0.1	0.2	3.0	0.6											

FAMILY CONTROL SECTION: DEPTH 25-100 PCT CLAY 0 PCT .1-75MM 94. SPODIC HORIZON: INDEX OF ACCUMUL 326

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL WE WEATH MIN KK KAOLINITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

92

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	7A3	TOT ANAL K2O 6Q3A	FE 6C7A
			<-PCT->									<-RELATIVE AMOUNTS->					<-PCT->			
84P2882	1																			
84P2883	2	FNES	99	RE99	WE<1															
84P2884	3	FNES	99	RE99	WE<1							KK 3					KK12		0.3	0.9
84P2885	4																			
84P2886	5											KK 2					KK13		0.3	0.9
84P2887	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: RE = RESISTANT MINERALS WE = WEATHERABLE MINERALS KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

93

Print date: 06-03-1985

SERIES: Kande NSSL ID #: 84P0524
SOIL SURVEY # S83-FN-990-018
LOCATION: 14 km E of Mongu WEP Zambia along road Mongu Lusaka.
PHYSIOGRAPHY: Sand dune or hill in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1020 m MSL
PRECIPITATION: 1000 mm Ustic moisture regime PERMEABILITY: Rapid
AIR TEMPERATURE: ANN: 21.3, SUM: 22.4, WIN: 16.7
SOIL TEMPERATURE: ANN: 25.0, SUM: 25.2, WIN: 22.3
DRAINAGE: Somewhat excessively drained LAND USE:
STONINESS: EROSION OR DEPOSITION: Slight RUNOFF: Moderate
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: eolian sand from sandstone material
CLASSIFICATION: Sandy, siliceous, isohyperthermic Arenic Tropohumod
WEATHER STATION: Mongu
DIAGNOSTIC HORIZONS: 0 to 76 cm Umbric 76 to 101 cm Albic 101 to 200 cm Spodic
DESCRIBED BY: D. Hallbick O. Spaargaren and R. Henneman SAMPLE DATE: 11/83
Most proper classification is ustic arenic Tropohumod.

A1--0 to 9 cm; sand; black (N 2/0) moist; single grain; loose, loose, nonsticky, nonplastic; common to many fine to coarse roots throughout and many micro roots throughout; many micro to fine interstitial and few fine and medium continuous tubular pores; clear smooth boundary.
On top of soil a thin layer of several mm thick occurs consisting of white bleached sand.
84P2882

A2--9 to 41 cm; sand; very dark gray (N 3/0) moist; single grain; loose, loose, nonsticky, nonplastic; many fine to coarse roots throughout and many micro roots throughout; many micro to fine interstitial and few fine and medium continuous tubular pores; gradual smooth boundary.
84P2883

A3--41 to 76 cm; sand; very dark gray (N 3/0) moist; single grain; loose, loose, nonsticky, nonplastic; many fine to coarse roots throughout and many micro roots throughout; many micro to fine interstitial and fewfine and medium continuous tubular pores; clear wavy boundary.
A3 horizon contains more bleached sand grains than A2.
84P2884

E--76 to 101 cm; light gray to gray (10YR 6/1) sand; dark gray (10YR 4/1) moist; single grain; loose, nonsticky, nonplastic; common fine to coarse roots throughout and many micro roots throughout; many micro to fine interstitial and few fine and medium continuous tubular pores; clear wavy boundary.
No clod samples.
84P2885

Bhl--101 to 150 cm; dark brown (7.5YR 3/4) sand; dark brown (7.5YR 3/2) moist; single grain parting to massive; loose, nonsticky, nonplastic; many continuous distinct-thin organic coats on sand and gravel; many fine and medium roots

throughout and many micro roots throughout; many micro to fine interstitial and few fine and medium continuous tubular pores; diffuse smooth boundary.
In top of Bh1 horizon thin discontinuous fibers of accumulated amorphous organic matter occur generally 2 to 4 mm thick dry color (7.5YR 3/2).
84P2886

Bh2--150 to 200 cm; brown to dark brown (7.5YR 4/4) sand; brown to dark brown (7.5YR 4/2) moist; single grain parting to massive; loose, nonsticky, nonplastic; many continuous distinct-thin organic coats on sand and gravel; few fine and medium roots throughout and many micro roots throughout; many micro to fine interstitial and very few fine and medium continuous tubular pores.
84P2887

PROGRAM: SEARCH FOR ~~KANDIC~~ argillic HORIZON

019 - Mangango

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

PROFILE IDENTIFICATION ZAMBIA 019 MA. CHECK FOR ARGILLIC KH = 30

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	11 CM	21.0 %
2	11 CM	45 CM	39.3 %
3	45 CM	80 CM	44.1 %
4	80 CM	111 CM	42.0 %
5	111 CM	125 CM	44.9 %

---

argillic

~~KANDIC~~ HORIZON BETWEEN 15 AND 45 CM

CLAY CONTENT AT TOP: 31.1 %
AT BOTTOM: 41.5 %
DIFFERENCE: 10.5 %
RATIO: 1.34

THINNEST HORIZON FULFILLING CONDITIONS
THICKNESS 18.1 CM (20.8 - 38.9 CM)

CLAY CONTENT AT TOP: 33.0 %
AT BOTTOM: 39.6 %
DIFFERENCE: 6.6 %
RATIO: 1.20

HYPOTHESIS THAT THERE IS A ~~KANDIC~~ argillic HORIZON IS TRUE
WITH PROBABILITY BETWEEN 75 AND 90%

TESTSTATISTIC = 0.919 WITH STUDENT'S
DISTRIBUTION (DF 2)

PROGRAM: SEARCH FOR KANDIC HORIZON

USING LEAST SQUARES TO FIT CONSTRAINED

4TH DEGREE POLYNOMIAL

019 MANGANO

PROFILE IDENTIFICATION ZAMBIA 019 MANGANO

HORIZON NUMBER	DEPTH AT TO	DEPTH AT BOTTOM	MEAN CLAY CONTENT
1	0 CM	11 CM	21.0 %
2	11 CM	45 CM	39.3 %
3	45 CM	80 CM	44.1 %
4	80 CM	111 CM	42.0 %
5	111 CM	125 CM	44.9 %

NO KANDIC HORIZON FOUND

HYPOTHESIS THAT THERE IS NO KANDIC HORIZON IS TRUE
WITH LESS THAN 75% PROBABILITY

TESTSTATISTIC = 0.482 WITH STUDENT'S
DISTRIBUTION (DF 2)

MANGANGO

SAMPLED AS: CLAYEY, KAOLINITIC, ISOHYPERTHERMIC OXIC PALEUSTULT

S 84FN-990 -019 DATE 05/31/85 SAMPLE NO. 84P2888-2894
PEDON NO. 84P 525
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

-1-- -2-- -3-- -4-- -5-- -6-- -7-- -8-- -9-- -10- -11- -12- -13- -14- -15- -16- -17- -18- -19- -20-

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	TOTAL CLAY LT .002 <- PCT OF <2MM (3A1) ->	TOTAL SILT .002 -.05 <- PCT OF <2MM (3A1) ->	TOTAL SAND .05 -2 <- PCT OF <2MM (3A1) ->	CLAY FINE LT .0002 <- PCT OF <2MM (3A1) ->	CLAY CO3 LT .002 <- PCT OF <2MM (3A1) ->	SILT FINE .002 -.02 <- PCT OF <2MM (3A1) ->	SILT COARSE .02 -.05 <- PCT OF <2MM (3A1) ->	SAND VF .05 -.10 <- PCT OF <2MM (3A1) ->	SAND F .10 -.25 <- PCT OF <2MM (3A1) ->	SAND M .25 -.50 <- PCT OF <2MM (3A1) ->	SAND C .5 -1 <- PCT OF <2MM (3A1) ->	SAND VC 1 -2 <- PCT OF <2MM (3A1) ->	COARSE FRACTIONS(MM) WEIGHT 2 -5 <- PCT OF <75MM(3B1)->	5 -20	20 -75	.1- 75	>2MM WT PCT OF WHOLE SOIL
842888	1S	0- 11	A	21.0	14.1	64.9	11.3		5.9	8.2	9.6	22.2	26.4	6.6	0.1	TR	TR	--	55	--
842889	2S	11- 45	BT1	39.3	12.2	48.5	22.3		4.9	7.3	8.3	17.5	17.7	4.9	0.1	TR	--	--	40	--
842890	3S	45- 80	BT2	44.1	12.5	43.4	23.2		5.0	7.5	7.8	15.4	15.4	4.5	0.3	TR	--	--	36	--
842891	4S	80-111	BT2	42.0	14.6	43.4	20.2		6.4	8.2	8.5	15.1	14.5	4.4	0.9	1	TR	--	36	1
842892	5S	111-145	BT3	44.9	13.3	41.8	25.7		5.0	8.3	9.0	14.3	13.8	4.0	0.7	1	TR	--	33	1
842893	6S	145-162	BT4	44.5	15.7	39.8	24.2		7.3	8.4	9.0	12.9	13.2	3.9	0.8	1	TR	--	31	1
842894	7S	162-173	2BTC	43.0	17.7	39.3	23.1		8.6	9.1	9.1	11.0	9.4	4.5	5.3	--	42	--	60	42

SAMPLE NO.	HZN NO.	ORGN C 6A1C <- PCT OF <2MM ->	TOTAL N 6B3A <- PCT OF <2MM ->	EXTR P	TOTAL S 6R3A <- PCT OF <2MM ->	DITH-CIT EXTRACTABLE FE 6C2B <- PCT OF <2MM ->	AL 6G7A <- PCT OF <2MM ->	MN 6D2A <- PCT OF <2MM ->	CEC 8D1 <- PCT OF <2MM ->	RATIO/CLAY 15 BAR 8D1 <- PCT OF <2MM ->	ATTERBERG LIMITS LL 4F1 PCT <0.4MM	PI 4F PCT <0.4MM	BULK DENSITY FIELD MOIST 4A3A <- G/CC ->	1/3 BAR 4A1D <- G/CC ->	OVEN DRY 4A1H <- G/CC ->	COLE WHOLE SOIL 4D1 CM/CM	WATER CONTENT FIELD MOIST 4B4 <- PCT OF <2MM ->	1/10 BAR 4B1C <- PCT OF <2MM ->	1/3 BAR 4B1C <- PCT OF <2MM ->	15 BAR 4B2A <- PCT OF <2MM ->	WRD WHOLE SOIL 4C1 CM/CM
842888	1	1.23			5.0	0.4	0.1	0.25	0.47			1.45	1.51	0.014				11.2	9.8	0.02
842889	2	0.41			6.8	0.5	0.1	0.11	0.35			1.43	1.47	0.009				16.5	13.7	0.04
842890	3	0.26			7.2	0.5	0.1	0.10	0.35			1.30	1.35	0.013				19.5	15.3	0.05
842891	4	0.21			7.2	0.5	0.1	0.10	0.37			1.28	1.32	0.010				18.3	15.5	0.04
842892	5	0.21			7.6	0.5	0.1	0.09	0.35			1.28	1.32	0.010				19.3	15.8	0.04
842893	6	0.24			7.9	0.5	0.1	0.09	0.38			1.27	1.39	0.030				22.0	16.7	0.07
842894	7	0.21			9.5	0.6	0.2	0.12	0.42			1.23	1.29	0.012				25.0	18.1	0.06

*** CONTINUATION ON NEXT PAGE ***

MANGANGO S 84FN-990 -019 DATE 05/31/85 PEDON NO. 84P 525 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A	MG 5B5A	NA 5B5A	K 5B5A	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	-CEC - - -) SUM CATS 5A3A	NH4- OAC 5A8B	BASES + AL 5A3B	AL SAT 5G1	-BASE SAT- SUM 5C3	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	-PH - - -) KCL IN 8C1G	CACL2 .01M 8C1F 1:2	H2O 8C1F 1:1
		<- - - - - - - - - - - -MEQ / 100 G - - - - - - - - - - - ->										<- - - - -PCT - - - ->								
842888	1	--	--	--	--	--	5.0		5.0	5.2				TR				5.4	5.4	5.9
842889	2	0.4	0.9	TR	0.2	1.5	6.2	0.2	7.7	4.2	1.7	12	19	36				4.6	4.5	5.2
842890	3	0.3	0.6	TR	0.1	1.0	6.1	0.3	7.1	4.3	1.3	23	14	23				4.6	4.5	5.2
842891	4	0.5	0.8	TR	TR	1.3	5.6	--	6.9	4.2			19	31				4.9	4.7	5.5
842892	5	0.8	1.0	TR	TR	1.8	4.9		6.7	4.0			27	45				5.4	5.0	5.6
842893	6	1.0	1.3	TR	0.1	2.4	4.8		7.2	4.2			33	57				5.7	5.4	5.8
842894	7	0.8	1.1	TR	0.1	2.0	5.9	TR	7.9	5.2			25	38				5.6	5.2	5.4

SAMPLE NO.	HZN NO.	(- - - - - - - - -MINERALOGY - - - - - - - - -) CLAY X-RAY 7A2I	CLAY X-RAY 7A2I	CLAY X-RAY 7A2I	CLAY X-RAY 7A2I	<2U DTA 7A3	<2U DTA 7A3	TOTAL DOM RES 7B1A	TOTAL WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- - - - -PCT - - - ->			
842888	1								
842889	2								
842890	3	KK 4	GE 2			KK50	GITR	99	TR
842891	4								
842892	5	KK 3	GE 2			KK45	GITR		
842893	6								
842894	7								

FAMILY CONTROL SECTION: DEPTH 11- 61 PCT CLAY 41 PCT .1-75MM 39

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE GE GOETHITE GI GIBBSITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

97

CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2888	1																			
84P2889	2																			
84P2890	3	FNES	99	QZ92	OP 8	RA<1	TM<1					KK 4	GE 2				KK50	GI<1	0.1	13.0
84P2891	4																			
84P2892	5											KK 3	GE 2				KK45	GI<1	0.1	12.3
84P2893	6																			
84P2894	7																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE GI = GIBBSITE OP = OPAQUES QZ = QUARTZ RA = RESISTANT AGGREGATES TM = TOURMALINE

KK = KAOLINITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

98

Print date: 06-03-1985

SERIES: Mangango NSSL ID #: 84P0525
SOIL SURVEY # S83-FN-990-019
LOCATION: Mangango state farm about 4 km NW of Mangango WEP Zambia. Pit located along road Mangango Mafuya Kuta.
PHYSIOGRAPHY: Upland slope in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1150 m MSL
PRECIPITATION: 940 mm Ustic moisture regime PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 20.4, SUM: 21.6, WIN: 15.7
DRAINAGE: Well drained LAND USE:
RUNOFF: Slow
FAMILY CONTROL SECTION: 25 to 100 cm
PARENT MATERIAL: residuum from igneous-basalt material
CLASSIFICATION: Clayey, kaolinitic, isohyperthermic Oxic Paleustult
WEATHER STATION: Kaoma
DIAGNOSTIC HORIZONS: 0 to 11 cm Ochric 11 to 162 cm Argillic
DESCRIBED BY: D. Hallbick O. Spaargaren and R. Henneman SAMPLE DATE: 11/83

A—0 to 11 cm; clay; dark reddish brown (2.5YR 3/4) moist; weak fine granular structure; very friable, very sticky, plastic; many fine and medium roots throughout; many very fine and fine void between rock fragments pores; clear smooth boundary.
84P2888

Bt1—11 to 45 cm; clay; dark red (10R 3/6) moist; moderate medium and coarse subangular blocky structure; friable, very sticky, plastic; few patchy faint-thin clay films on vertical faces of peds; many fine and medium roots throughout; many very fine and fine continuous tubular and common very fine and fine void between rock fragments pores; diffuse smooth boundary.
84P2889

Bt2—45 to 111 cm; clay; dark red (10R 3/6) moist; weak medium and coarse subangular blocky structure parting to moderate very fine granular; very friable, very sticky, plastic; few patchy faint-thin clay films on vertical faces of peds; many fine and medium roots throughout; many very fine and fine continuous tubular and common very fine and fine void between rock fragments pores; gradual smooth boundary.
Horizon split for sampling 45 to 80cm No. 2890 and 80 to 111 cm No. 2891.
84P2890

Bt3—111 to 145 cm; clay; dark red (10R 3/6) moist; moderate medium and coarse subangular blocky structure parting to moderate very fine granular; very friable, very sticky, plastic; few patchy faint-thin clay films on vertical faces of peds; many fine and medium roots throughout; common very fine and fine continuous tubular and common very fine and fine void between rock fragments pores; clear smooth boundary.
84P2892

Bt4—145 to 162 cm; clay; dark red (2.5YR 3/6) moist; moderate medium and coarse subangular blocky structure; friable, very sticky, plastic; common discontinuous distinct-thin clay films on vertical and horizontal faces of peds; common fine and medium roots throughout; common very fine and fine continuous tubular and common very fine and fine void between rock fragments pores; clear smooth boundary.

84P2893

2Btc--162 to 173 cm; gravelly clay; dark red (10R 3/6) moist; weak fine and medium subangular blocky structure; friable, very sticky, plastic; common continuous distinct-thin clay films on sand and gravel; common fine and medium roots throughout; common fine and medium void between rock fragments pores; common to many medium and coarse irregular iron concretions; 50 percent pebbles from ironstone, 10 percent stones from saprolite.
Clod samples not taken.
84P2894

LITETA

SAMPLED AS:

S 84FN-990 -020

ZAMBIA

GENERAL METHODS 1B1A, 2A1, 2B

DATE 05/31/85

SAMPLE NO. 84P2895-2900
PEDON NO. 84P 526
PROJECT NO. 84P 97

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NATIONAL SOIL SURVEY LABORATORY
LINCOLN, NEBRASKA 68508-3866

SAMPLE NO.	HZN NO.	DEPTH (CM)	HORIZON	CLAY LT .002 <- PCT OF <2MM	SILT .002 -.05	SAND .05 -2	FINE CLAY LT .0002	CO3 LT .002	FINE SILT .002 -.02	COARSE SILT .02 -.05	VF SAND .05 -.10	F SAND .10 -.25	M SAND .25 -.50	C SAND .5 -1	VC SAND 1 -2	COARSE FRAGS 2 -5	COARSE FRAGS 5 -20	COARSE FRAGS 20 -75	COARSE FRAGS .1- 75	WT PCT OF WHOLE SOIL
				(3A1) - ->												<- PCT OF <75MM (3B1) ->				
842895	1S	0- 21	AP	37.4	21.8	40.8	21.9		9.3	12.5	16.5	17.5	4.6	1.6	0.6	--	--	--	24	--
842896	2S	21- 39	AB	49.7	19.3	31.0	31.9		8.4	10.9	13.6	12.2	3.3	1.3	0.6	--	--	--	17	--
842897	3S	39- 70	BT1	56.9	17.5	25.6	37.3		7.7	9.8	11.5	9.6	2.6	0.9	1.0	--	--	--	14	--
842898	4S	70-103	BT2	60.1	16.6	23.3	37.2		8.0	8.6	10.4	9.1	2.2	1.1	0.5	TR	--	--	13	--
842899	5S	103-144	BT3	56.7	18.2	25.1	32.3		9.1	9.1	10.8	10.0	2.2	1.1	1.0	TR	--	--	14	--
842900	6S	144-179	BTCO	56.2	18.6	25.2	30.0		8.8	9.8	11.2	9.5	2.3	1.2	1.0	--	--	--	14	--

SAMPLE NO.	HZN NO.	ORGN C 6A1C	TOTAL N 6B3A	EXTR P	TOTAL S 6R3A	DITH-CIT EXTRACTABLE FE 6C2B	AL 6G7A	MN 6D2A	CEC/CLAY 8D1	15 BAR/CLAY 8D1	ATTERBERG LL 4F1	PI 4F	BULK DENSITY FIELD MOIST 4A3A	1/3 BAR 4A1D	OVEN DRY 4A1H	COLE WHOLE SOIL 4D1	WATER CONTENT FIELD MOIST 4B4	1/10 BAR 4B1C	1/3 BAR 4B1C	15 BAR 4B2A	WRD WHOLE SOIL 4C1
		<- - - - - - PCT OF <2MM - - - - - - ->									PCT <0.4MM		<- - G/CC - - ->			CM/CM	<- - -PCT OF <2MM - ->				CM/CM
842895	1	2.03	0.136			3.9	0.5	0.1	0.40	0.36				1.25	1.36	0.029			21.1	13.3	0.10
842896	2	1.41	0.113			4.5	0.7	0.1	0.32	0.33				1.37	1.53	0.038			24.7	16.5	0.11
842897	3	1.11	0.092			4.9	0.7	0.1	0.28	0.33				1.34	1.47	0.031			26.5	18.9	0.10
842898	4	0.79				4.9	0.7	TR	0.25	0.32				1.23	1.35	0.032			26.9	19.2	0.09
842899	5	0.62				4.6	0.7	TR	0.25	0.33				1.24	1.34	0.026			26.1	18.7	0.09
842900	6	0.37				5.0	0.8	TR	0.21	0.33				1.26	1.36	0.026			26.4	18.3	0.10

*** CONTINUATION ON NEXT PAGE ***

LITETA S 84FN-990 -020 DATE 05/31/85 PEDON NO. 84P 526 NATIONAL SOIL SURVEY LABORATORY

SAMPLE NO.	HZN NO.	(- NH4OAC EXTRACTABLE BASES -) CA 5B5A <- MEQ / 100 G ->	MG 5B5A	NA 5B5A	K 5B5A	SUM BASES	ACID- ITY 6H5A	EXTR AL 6G9A	CEC SUM CATS 5A3A	CEC NH4- OAC 5A8B	CEC BASES + AL 5A3B	AL SAT 5G1	BASE SAT- SUM 5C3 <- PCT ->	NH4 OAC 5C1	CO3 AS CACO3 <2MM 6E1G	RES. OHMS /CM 8E1	COND. MMHOS /CM 8I	PH NAF 8C1D	PH CACL2 .01M 8C1F 1:2	PH H2O 8C1F 1:1
842895	1	5.8	3.9	TR	0.2	9.9	10.3		20.2	15.1			49	66					4.8	5.8
842896	2	6.1	3.8	0.1	0.1	10.1	10.7		20.8	15.7			49	64				9.2	5.0	5.9
842897	3	6.1	3.6	TR	0.1	9.8	9.8		19.6	15.8			50	62				9.3	5.0	6.0
842898	4	6.0	3.7	TR	0.1	9.8	9.0		18.8	14.8			52	66				9.5	5.2	5.7
842899	5	5.5	3.8	TR	TR	9.3	7.6		16.9	13.9			55	67				9.5	5.4	5.9
842900	6	4.6	3.7	TR	TR	8.3	6.8		15.1	11.9			55	70				9.6	5.8	6.2

SAMPLE NO.	HZN NO.	MINERALOGY CLAY X-RAY <2U 7A2I	7A2I	7A2I	7A2I	DTA <2U 7A3	7A3	TOTAL RES 7B1A	DOM WEATH 7B1A
		<- RELATIVE AMOUNTS ->				<- PCT ->			
842895	1								
842896	2								
842897	3	KK 3	MT 2	GE 2		KK33		94	EP 3
842898	4								
842899	5	KK 3	GE 2	MT 2	VR 1	KK35			
842900	6								

FAMILY CONTROL SECTION: DEPTH 39- 89 PCT CLAY 58 PCT .1-75MM 14

ANALYSES: S= ALL ON SIEVED <2MM BASIS

MINERALOGY: KIND OF MINERAL KK KAOLINITE MT MONTMORILL GE GOETHITE EP EPIDOTE VR VERMICULITE

RELATIVE AMOUNT 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

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CP84FN132

SAMPLE NO.	HZN NO.	MINERALOGY: OPTICAL SAND/SILT FA 7B1A	RE 7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	7B1A	X-RAY CLAY 7A2I	7A2I	7A2I	7A2I	7A2I	DTA 7A3	TOT ANAL 7A3	K2O 6Q3A	FE 6C7A
			<PCT>									<RELATIVE AMOUNTS>					<PCT>			
84P2895	1																			
84P2896	2																			
84P2897	3	VFS	94	QZ84	OP 7	EP 3	FK 2	RU 2	TM 1	BT 1	RA<1	KK 3	MT 2	GE 2			KK33		0.4	10.6
84P2898	4																			
84P2899	5											KK 3	GE 2	MT 2	VR 1	MI 1	KK35		0.4	10.2
84P2900	6																			

ANALYSES: S=ALL ON SIEVED < 2mm BASIS

MINERALOGY: FA = FRACTION ANALYZED RE = RESISTANT

KIND OF MINERAL: GE = GOETHITE OP = OPAQUES QZ = QUARTZ RA = RESISTANT AGGREGATES RU = RUTILE TM = TOURMALINE

BT = BIOTITE EP = EPIDOTE FK = POTASSIUM FELDSPAR MT = MONTMORILLONITE KK = KAOLINITE MI = MICA

VR = VERMICULITE

RELATIVE AMOUNT: 6 INDETERMINATE 5 DOMINANT 4 ABUNDANT 3 MODERATE 2 SMALL 1 TRACE

MINERALOGY BASED ON SAND/SILT:

MINERALOGY BASED ON CLAY:

FAMILY PLACEMENT:

COMMENTS:

103

photos - 22 leprosarium
- 23 small plots

Print date: 06-03-1985

SERIES: Liteta NSSL ID #: 84P0526
SOIL SURVEY # S83-FN-990-020
LOCATION: Chief Liteta Corp. Farm 5 km N of Liteta Leprosarium along Grear North road between Lusaka and Kabwe CEP Zamb
LATITUDE: 14-43- -S LONGITUDE: 028-04- -E
PHYSIOGRAPHY: Upland slope in level or undulating uplands
MICRORELIEF:
SLOPE CHARACTERISITICS: ELEVATION: 1150 m MSL
PRECIPITATION: 950 mm Ustic moisture regime PERMEABILITY: Moderate
AIR TEMPERATURE: ANN: 20.1, SUM: 21.3, WIN: 16.0
SOIL TEMPERATURE: ANN: 23.9, SUM: 24.1, WIN: 20.8
DRAINAGE: Moderately well drained LAND USE: Cropland
RUNOFF: Slow
FAMILY CONTROL SECTION: 39 to 89 cm
PARENT MATERIAL: residuum from limestone material
CLASSIFICATION: Very-fine, mixed, isohyperthermic Udic Paleustoll
WEATHER STATION: Kabwe
DIAGNOSTIC HORIZONS: 0 to 21 cm Mollic 39 to 144 cm Argillic
DESCRIBED BY: D. Hallbick and O. Spaargaren SAMPLE DATE: 11/83

Ap--0 to 21 cm; brown to dark brown (10YR 4/3) clay; very dark grayish brown (10YR 3/2) moist; moderate to strong medium and coarse subangular blocky structure parting to moderate to strong medium granular; slightly hard, slightly sticky, plastic; many fine roots throughout; common to many fine and medium continuous tubular and many very fine and fine void between rock fragments pores; abrupt smooth boundary.
84P2895

AB--21 to 39 cm; brown to dark brown (7.5YR 4/4) clay; dark brown (7.5YR 3/4) moist; strong medium and coarse subangular blocky structure; slightly hard, slightly sticky, plastic; few patchy distinct-thin organic coats on vertical faces of peds; many fine roots throughout; many fine and medium continuous tubular and many fine and medium void between rock fragments pores; clear smooth boundary.
84P2896

Bt1--39 to 70 cm; strong brown (7.5YR 5/6) clay; strong brown (7.5YR 4/6) moist; very few fine faint 48 (7.5YR 4/8) mottles; weak very coarse subangular blocky structure parting to strong medium and coarse angular blocky; hard, very sticky, plastic; many discontinuous distinct-thin clay films on vertical and horizontal faces of peds; common fine roots throughout; many fine and medium continuous tubular and many fine to coarse void between rock fragments pores; very few fine and medium rounded ironstone nodules; gradual smooth boundary.
84P2897

Bt2--70 to 103 cm; strong brown (7.5YR 5/6) clay; strong brown (7.5YR 4/6) moist; few fine faint yellowish red (5YR 4/6) mottles; moderate medium prismatic structure; slightly hard, very sticky, plastic; common discontinuous distinct-thin clay films on vertical faces of peds; few patchy prominent-thin black (N 2/0) manganese or iron-manganese coats on vertical and horizontal faces of peds; common fine roots throughout; common fine and medium continuous tubular and many fine to coarse void between rock fragments pores; few to common fine and medium rounded ironstone nodules; gradual smooth boundary.
84P2898

Bt3—103 to 144 cm; yellowish brown (10YR 5/6) clay; dark yellowish brown (10YR 4/6) moist; few to common fine distinct yellowish red (5YR 4/8) mottles; weak to moderate coarse and very coarse subangular blocky structure; slightly hard, very sticky, plastic; common discontinuous faint-thin clay films on vertical faces of peds; few patchy prominent-thin black (N 2/0) manganese or iron-manganese coats on vertical and horizontal faces of peds; common fine roots throughout; common fine to coarse continuous tubular and many fine to coarse void between rock fragments pores; common fine and medium rounded ironstone nodules; clear smooth boundary.
84P2899

Btco—144 to 179 cm; yellowish brown (10YR 5/6) clay; dark yellowish brown (10YR 4/6) moist; common to many fine and medium prominent red (2.5YR 4/8) mottles; moderate medium and coarse subangular blocky structure; slightly hard, very sticky, plastic; common patchy faint-thin clay films on vertical faces of peds; few patchy prominent-thin black (N 2/0) manganese or iron-manganese coats on vertical and horizontal faces of peds; few fine roots throughout; common fine and medium void between rock fragments pores; many fine to coarse rounded ironstone nodules; 50 percent cobbles from ironstone.
84P2900

Wai Lan
marän ah.