CHAPTER V

LABORATORY INVESTIGATIONS

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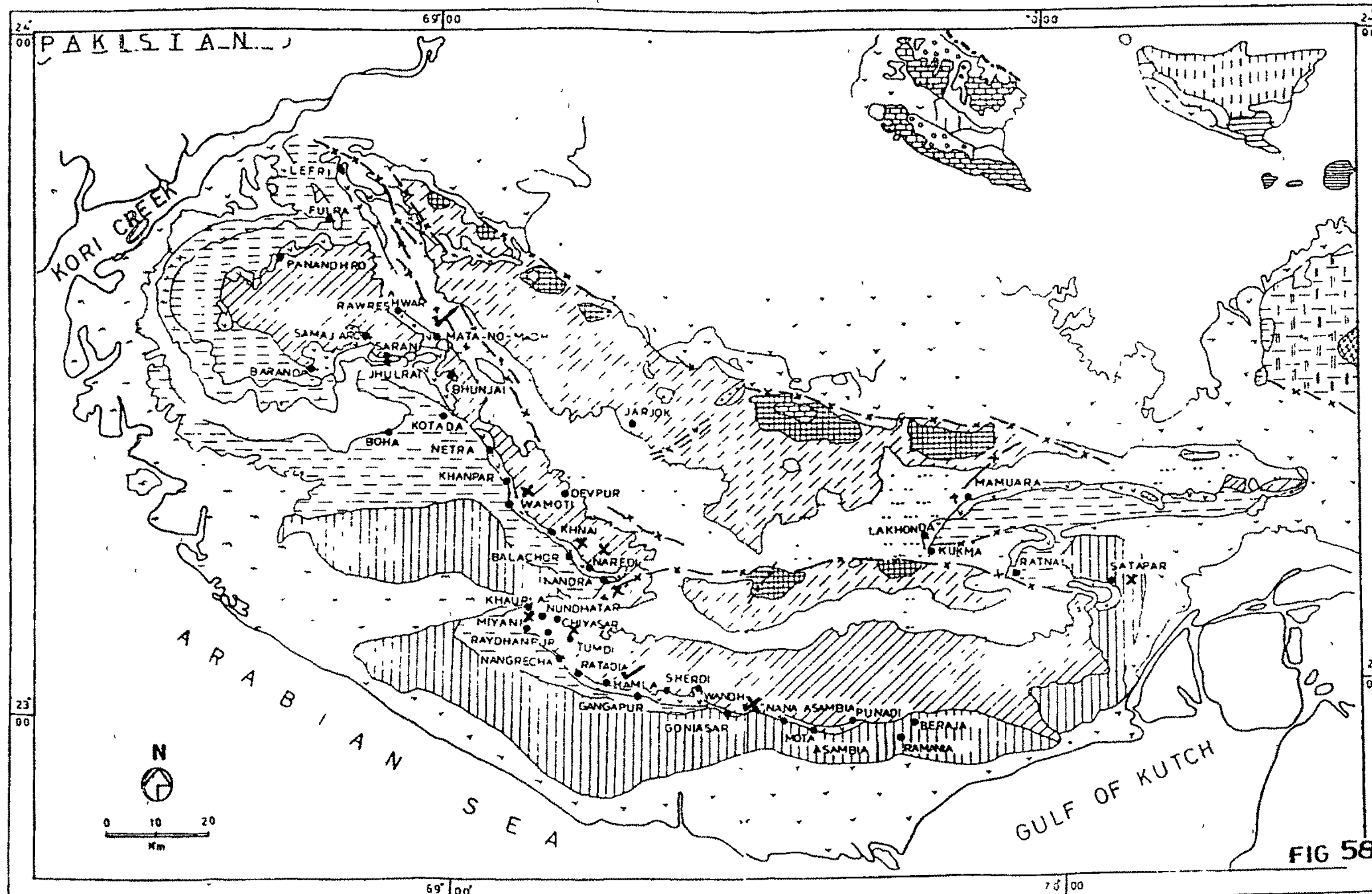
Major Oxides and Trace Element Analyses

Chemical analyses of samples from representative members of nearly all lateritic profiles described earlier on was done. Normal wet variation diagrams of the oxide versus the depth have also been given.

In order to study the variation of major oxides and trace elements, 10 profiles representing 8 LST type and 2 HST type sections were chosen (Fig. 58), spanning from the eastern end of the lateritic belt to the western end.
The profiles selected were (starting from the eastern flank (Fig. 58) :

(a) Satapar (Anjar Taluka) - LST type section
(b) Goniasar mota and nana (Mandvi Taluka) - LST type section
(c) Hamla (Mandvi Taluka) - HST type section
(d) Chiyasar (Abdasa Taluka) - LST type section



Location of 2 HST and 8 LST profiles of which complete major oxides and rare elements have been analysed of all the representative horizons. HST LST

(e) Nundhatar (Abdasa Taluka) - LST type section
(f) Naredi (Abdasa Taluka) - LST type section
(g) Balachor (Abdasa Taluka) - LST type section
(h) Wamoti - LST type section
(i) Mata-no-Madh (Lakhpat Taluka) - HST type section

Further, in order to ascertain the relative losses and gains of chemical constituents in the various horizons of the 10 weathering profiles mentioned, a mass balance model was made of each of the profiles. The methodology followed was as per Esson's (1983) paper. Elements, conventionally those contributing significantly to the analytical total, reported as oxides were retained as oxides in the mass balance model. The mathematical basis of the model is as follows (after Esson,1983):

The purpose of the model is to estimate,

(a) the thickness of bedrock consumed in forming the soil profile, and
(b) elemental balance for each sampling interval in the profile.

Aggregate bedrock thicknesses and elemental balances for individual horizons and the full profile are obtained by summing the results from (b) over the measured thicknesses. All calculations are based on unit area of profile.

Consider a sampling interval of thickness T formed, according to the model, by differential leaching of bedrock. The mass of index constituent in this interval is given by IDT/100 where I is Wt % of index constituent and D, the bulk density of the dry sample. Let T' be the thickness of bedrock containing an equal mass of index constituent. Then, $IDT/100 = I'D'T'/100$, where I' and D' are the Wt % index constituent and density for the bedrock. Thus the model bedrock thickness consumed to produce thickness T of the soil profile is given by,

$$T' = \frac{IDT}{I'D'} \quad \ldots \qquad (1)$$

In order to estimate T', however, the bulk density of the dry soil is required and is difficult to measure because variable amounts of shrinkage and crumbling occur on drying. Values of the mean particle density for dried powdered samples from horizon -3 B are in the range 3.05 - 3.50 gcm. Crude measurements of dry bulk density indicate a maximum porosity of about 50 %. For the sake of uniformity, the D values used were taken as 50 % of the mean particle densities, ie., D values in the range 1.52 - 1.75. Bedrock density measurements give an approximate average value of 2.75 (D').

For any other constituent, the mass in dry soil of thickness T is given by EDT/100, where E is the constituent Wt %. Similarly, a thickness T' of bedrock contains,

$$\frac{E'D'T'}{100}$$, where E' is the constituent Wt % in the bedrock.

These two expressions can be used to evaluate the Wt % of the constituent lost during the conversion of thickness T' of bedrock into a thickness T of soil. The result is

$$100 \quad 1 - \frac{(EDT)}{E'D'T'} \quad .$$

Using equation (1) to eliminate T', this reduces to

Wt % constituent lost

$$100 \quad 1 - \frac{(EI')}{(E'1)} \quad .. (2)$$

The index constituent could be a resistant mineral or a chemical constituent, and in the present case Cr has been taken as the resistant index.

XRD Analyses

Minus 230 mesh portions of the powdered bulk samples of the samples were subjected to XRD studies. The instrument used was Philips X-ray diffractometer with a Cu-target and CuK alpha radiation. The study was carried out at the R & D laboratory of the I.P.C.L., Baroda. The samples were scanned from 10^{o} to $C5^{o}$ at a speed rate of 2 per minute and having a chart speed of 2 cm per minute, the range being 2x10 3 c/s. The 'd' spacings and intensities were calculated and compared with ASTM standard charts for different minerals.

Samples were collected from typical HST sections at Hamla and Mata-no-Madh and LST section at Wamoti (Fig. 59). Care was taken to take samples from each of the identifiable horizons.

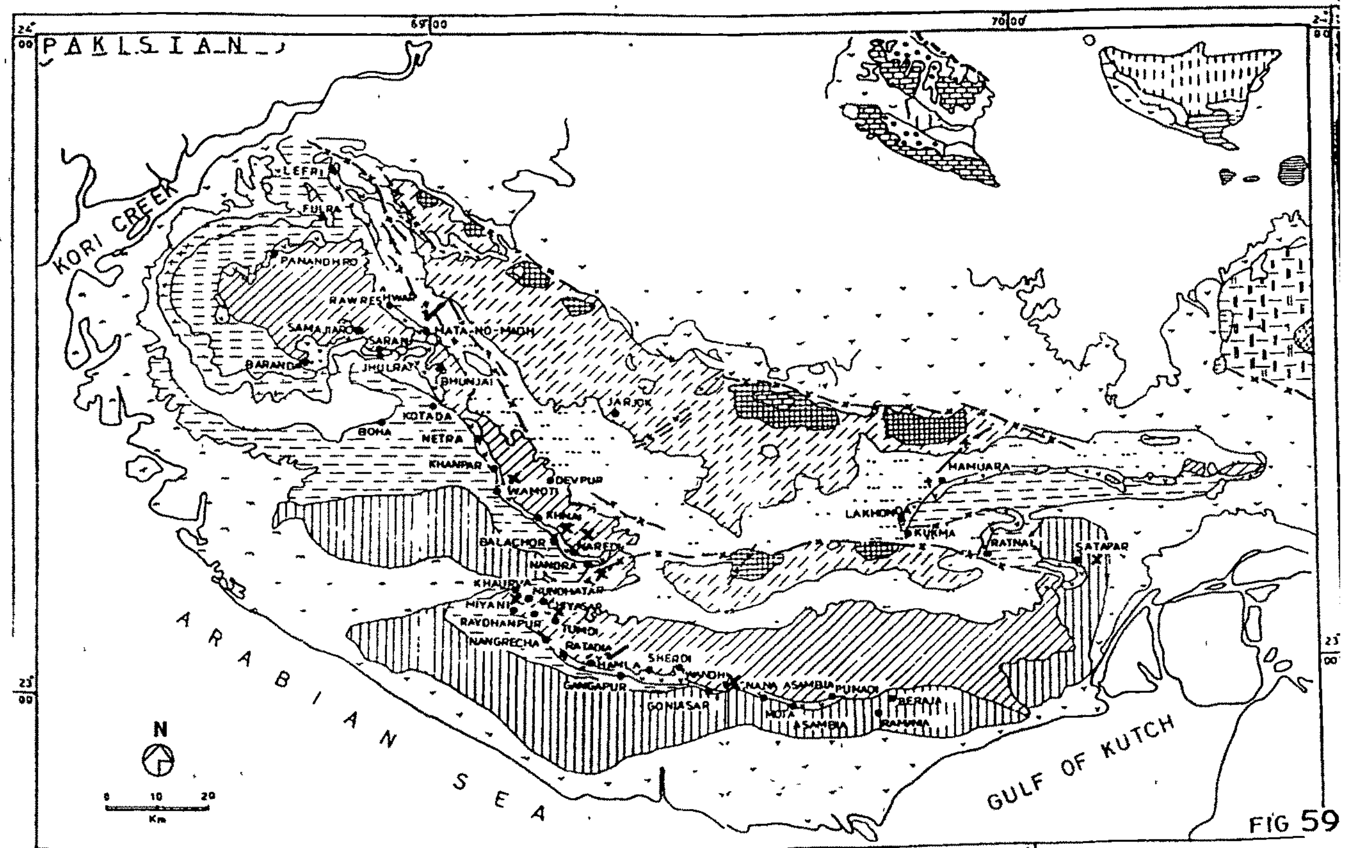


FIG 59

Location of 2 HST and 1 LST sections, of which complete XR) analyses has been done of all the typical representative horizons.

HST LST

Table 3

Anjar Taluka.

Satapar. (LST)

(in percent)

Depth	0.0-1.1m	1.1m-1.6m	1.6m-2.3m	2.3m-3.2m	3.2m-
Horizon	B_{ox}	B_{ox}	B_{ox}	B	C
Major Oxides.	Ferricrete	Ferricrete	Alucrete	Saprolite	Basalt
SiO_2	19.83	18.89	8.50	37.88	48.90
Al_2O_3	10.56	14.62	51.70	14.89	10.28
Fe_2O_3	48.21	44.28	15.22	12.50	7.60
TiO_2	3.66	3.58	4.15	1.89	1.60
MnO_2	.90	.38	.01	1.42	.10
CaO	.02	.01	.46	3.12	.80
MgO	1.78	1.16	.15	2.19	1.70
K_2O	.01	.03	.28	1.00	1.10
Na_2O	.05	.03	.57	1.48	.78
P_2O_5	.22	.06	.22	-	.07
CO_2	.68	.25	1.03	-	.49
H_2O	14.10	16.00	18.53	22.68	21.60
Total	100.02	99.29	100.82	99.77	95.02

Trace Elem. (in ppm.)

Ba	50	50	50	50	50
Cu	150	150	150	150	140
Rb	N.D.	N.D.	N.D.	N.D.	N.D.
Sr	N.D.	N.D.	N.D.	N.D.	N.D.
Zn	50	55	60	60	60
Pb	100	120	160	200	210
Mn	60	60	65	70	70
Cr	160	120	100	100	90
Ni	160	170	140	170	-
Co	130	135	150	140	120
V	5	5	5	5	5
Zr	T	T	T	T	T

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **SATAPAR** VILLAGE, ANJAR TALUKA, KUTCH DISTRICT

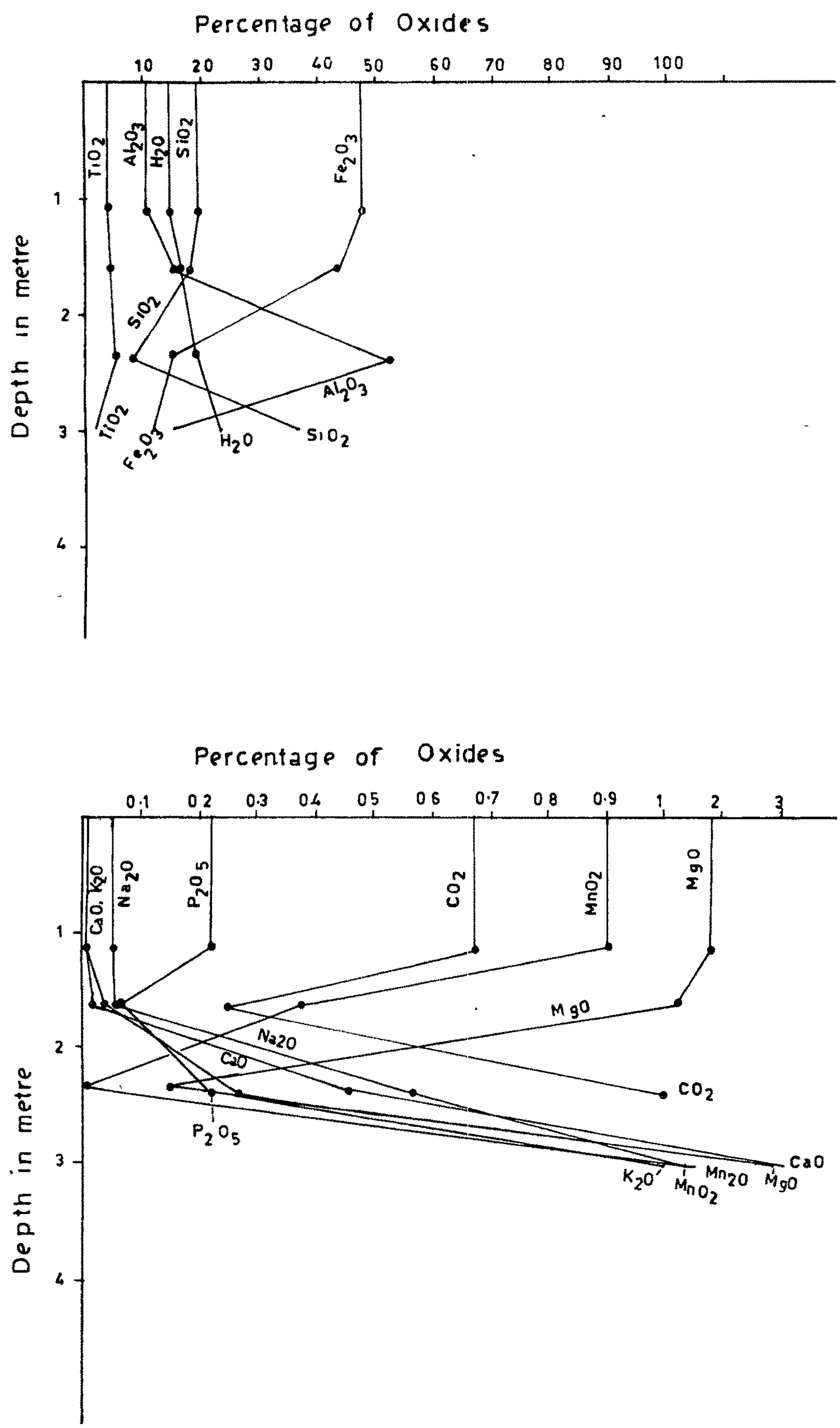


FIG. 60

VARIATION OF TRACE ELEMEMENTS IN LATERITE PROFILE
AT **SATPAR** VILLAGE, ANJAR TALUKA KUTCH DISTRICT

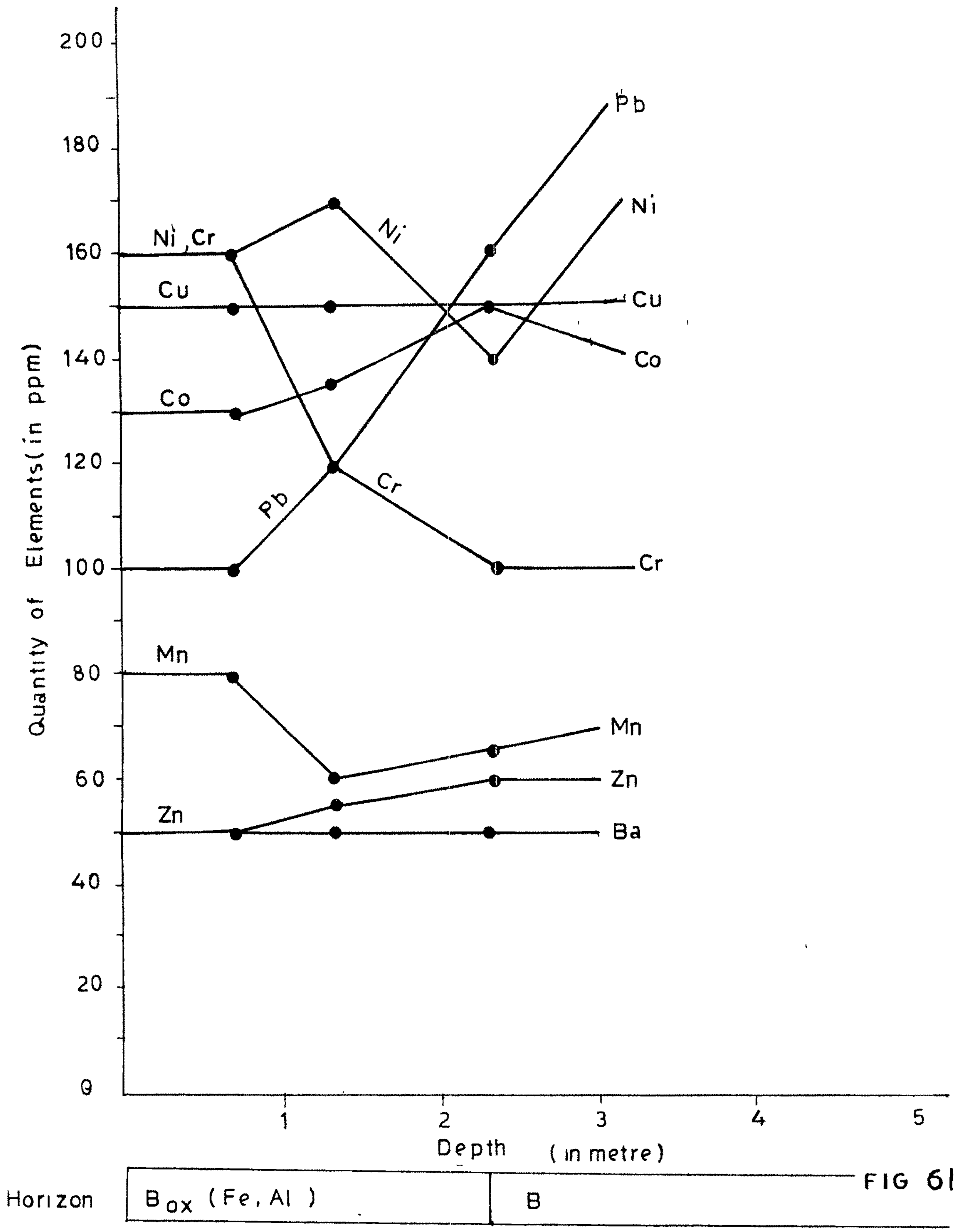


FIG 61

Table 4

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL.

Taluka ANJAR Village SATPAR LST TYPE SECTION

Bed rock thickness consumed to produce present thickness
of th weathered profile : 140 m.

Depth	0-1 1m	1 1-.6m	1 6-2 3m	2 3-3 2m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	B sap	Remarks
SiO_2	-77 19	-71 02	-84 35	-30 28	Lost throughout the profile Maximum mobility seen in the Box zone.
Al_2O_3	42 21	6 66	352 62	30.35	Overall gain with a maximum in the Box (Alu) zone
Fe_2O_3	256 81	336.97	80.23	48 02	Overall gain with a maximum in the two top horizons.
TiO_2	28 67	67 81	133.43	6 31	Overall gain with a maximum in the Box(Alu) zone
MnO_2	406 25	185 00	-91 00	1176 00	Mid-profile zone of depletion in the Box(Alu) zone with ovrflying and under-lying horizons, showing maximum gains
CaO	-98 59	-99.06	-48.25	251 00	Bottom horizon of gain with overlying zones of losses
MgO	41 10	-48 82	-92.05	-15 94	Top horizon of gain with underlying zones of depletion
K_2O	-99 48	-97 95	-77 09	-18 18	Overall losses with mobility increasing inplies in the profile
Na_2O	-96 39	-97.11	-34 23	-70 76	Overall losses with mobility increasing directio in the profile
P_2O_5	76 76	-35.71	182 65-		Mid-profile zone of depletion with under and overflying zones of gains
Ba	-	-	-	-	-
Cu	39.73	19.84	3.57	3 57	Overall gains with a maximum in the top horizon
Rb	N.D.	N.D.	N.D.	N.D	-
Sr	N D	N.D.	N.D.	N D	-
Zn	-53.12	-31.25	10 00	10 00	Overall loss with increase in mobility higher in the profile.
Pb	-73 21	-57.14	-31.42	-14 28	Overall loss with increase in mobility higher in the profile.
Mn	35 71	-50.00	-16 42	10 00	Top zone of horizon with underflying zones of depletion.
Cr	-	-	-	-	-
Ni	-	-	-	-	-
Co	39 06	15 62	12.50	5 00	Overall gain with a maximum in the top horizon
[illegible]			-	-	-

Table 5

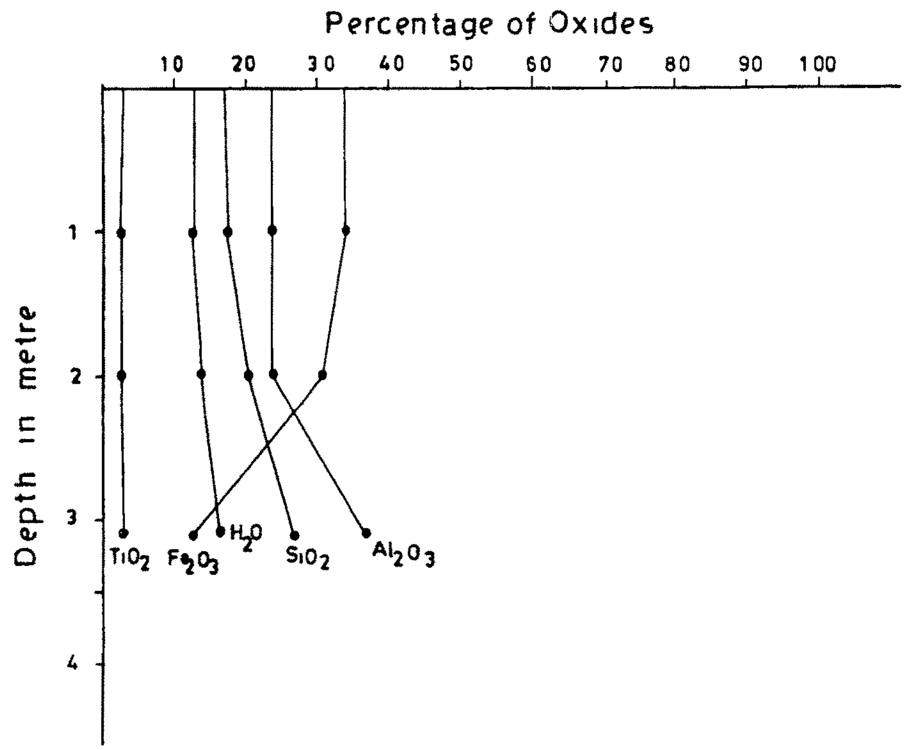
Anjar Taluka

Ratnal :-

Depth	0-1 m	1m - 2m	2m - 3.2m
Horizon	Box	Box	Box
	Ferricrete	Ferricrete	Alucrete
SiO_2	18.10	20.15	7.85
Al_2O_3	13.62	13.92	56.87
Fe_2O_3	43.89	40.19	13.02
TiO_2	3.21	2.51	2.86
MnO_2	.42	.59	.18
CaO	1.89	1.98	.72
MgO	1.72	.96	.60
K_2O	1.70	1.20	.30
Na_2O	1.16	1.24	.39
P_2O_5	.18	.19	.22
CO_2	1.40	1.02	1.00
H_2O	12.60	14.01	16.00
Total	99.89	97.96	100.01

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **RATNAL** VILLAGE, ANJAR TALUKA, KUTCH DISTRICT.



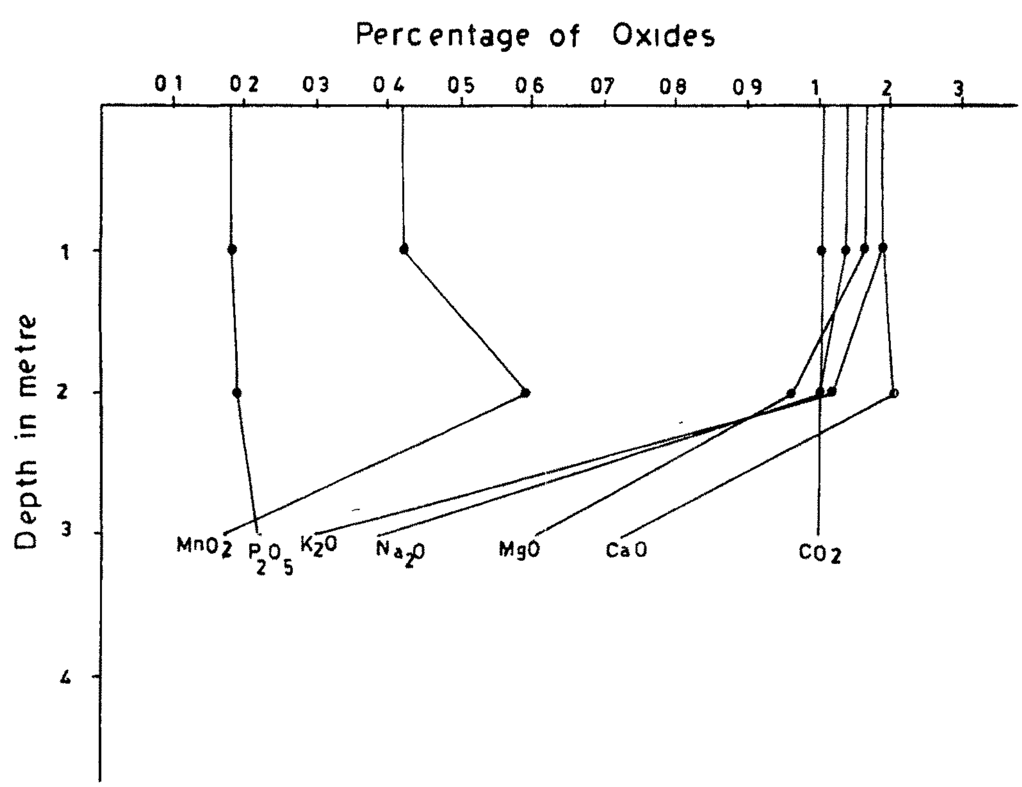


FIG. 62

Table 6 Table 7

Bhuj Taluka

	Kukma :-		Lakhond :-	
Depth	0-1.2 m	1.2 m	0-1.3 m	1.3 m
Horizon	Box	Box	Box	Box
	Ferricrete	Alucrete	Alucrete	Saprolite
SiO_2	21.88	8.50	16.84	37.88
Al_2O_3	18.68	49.70	46.76	24.89
Fe_2O_3	34.40	12.20	11.82	12.70
TiO_2	1.94	4.15	2.60	1.89
MnO_2	1.72	.03	.02	1.42
CaO	2.92	.46	.36	3.12
MgO	1.89	.15	.68	2.91
K_2O	.96	.28	.46	1.00
Na_2O	1.24	.37	.32	1.48
P_2O_5	T	.22	.64	T
CO_2	1.04	1.03	1.14	1.10
H_2O	13.29	23.03	19.31	11.58
Total	99.98	100.12	100.95	99.97

In percent

Table 8

Bhuj Taluka

Mamuara :-

Depth	0-1.6 m	1.6-2 m	2.1 m
Horizon	Box	Box	Box
	Ferricrete	Alucrete	Saprolite
SiO_2	20.11	16.84	29.50
Al_2O_3	12.57	46.76	12.07
Fe_2O_3	47.22	14.82	14.00
TiO_2	2.59	2.60	.98
MnO_2	.37	.02	.33
CaO	.05	.36	1.00
MgO	4.53	.68	26.13
K_2O	.02	.46	.01
Na_2O	.04	.32	.04
P_2O_5	.12	.64	.06
CO_2	1.10	1.04	2.88
H_2O	10.98	17.82	13.82
Total	99.70	102.36	100.82

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **MAMUARA** VILLAGE, BHUJ TALUKA, KUTCH DISTRICT.

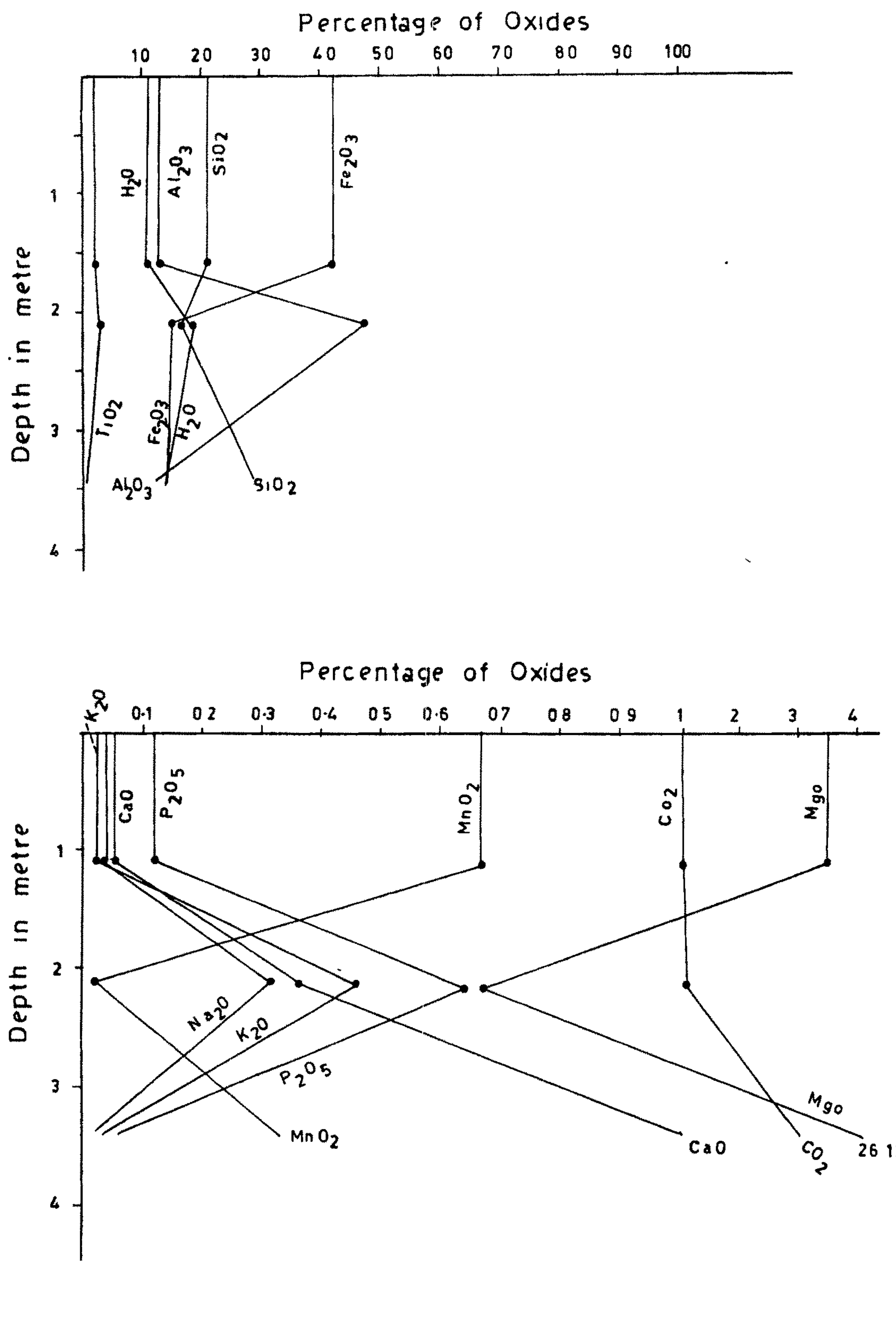


FIG. 63.

Table 9 | Table 10

Mundra Taluka

Baraja :- | Ramania :-

Depth	0-1.3 m	1.3 - 2.4 m	0-2.1 m
Horizon	Box	Box	Box
	Ferricrete	Ferricrete	Ferricrete
SiO_2	27.11	28.89	23.83
Al_2O_3	19.57	18.68	16.56
Fe_2O_3	39.22	44.18	42.21
TiO_2	2.88	3.58	3.66
MnO_2	.55	.38	.90
CaO	.06	.02	.01
MgO	5.53	1.16	1.78
K_2O	.02	.03	.01
Na_2O	.06	.03	.05
P_2O_5	.14	.06	.22
CO_2	1.09	.25	.78
H_2O	11.00	10.10	10.00
Total	107.03	107.36	100.01

In percent

Table 11

Mandvi Taluka

Punadi :-

Depth	0 - 2 m	2 m
Horizon	Box	Box
	Ferricrete	Ferricrete
SiO_2	35.88	16.80
Al_2O_3	18.68	49.88
Fe_2O_3	21.40	13.80
TiO_2	1.94	3.62
MnO_2	1.78	.20
CaO	2.92	.84
MgO	1.89	.91
K_2O	.98	.88
Na_2O	1.24	.42
P_2O_5	T	.29
CO_2	1.19	1.03
H_2O	12.30	11.92
Total	100.20	100.59

In percent

Table 12

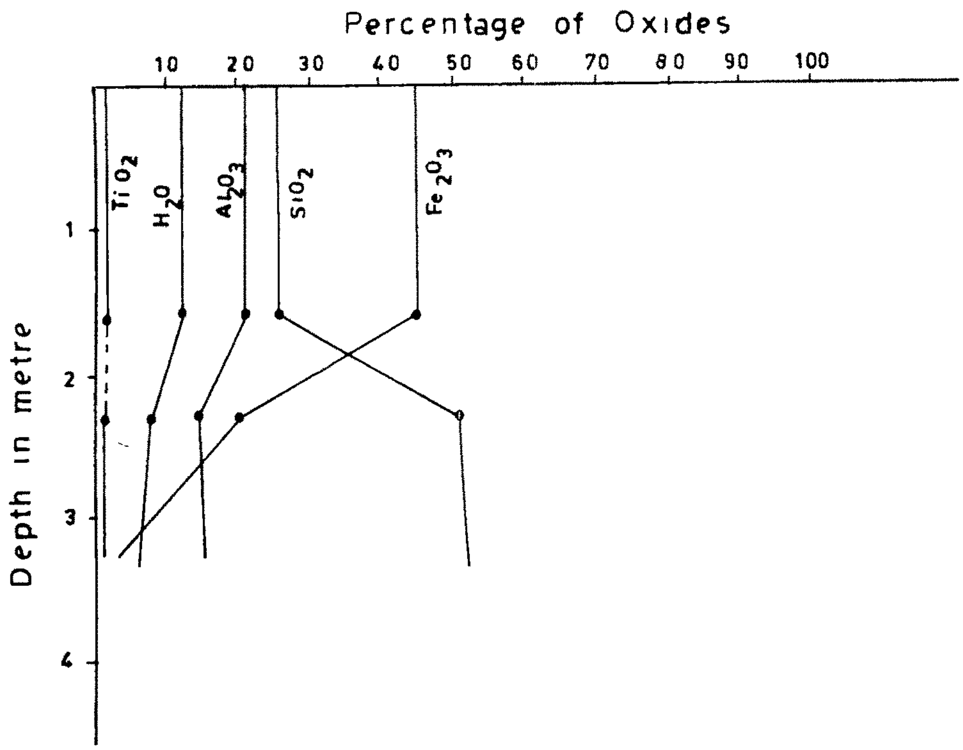
Mandvi Taluka

Mota Asambia and Nana Asambia:-

Depth	0-1.6 m	1.6-2.3 m	2.3 m
Horizon	Box	B	C
	Ferricrete	Saprolite	Basalt
SiO_2	23.57	50.95	51.50
Al_2O_3	19.73	13.57	14.93
Fe_2O_3	43.26	20.03	3.41
TiO_2	1.90	T	1.73
MnO_2	.96	1.12	.09
CaO	1.30	1.99	9.51
MgO	.36	.67	.22
K_2O	.32	.67	1.02
Na_2O	.41	1.07	3.24
P_2O_5	.44	.22	.22
CO_2	1.10	1.00	1.60
H_2O	10.79	7.89	7.80
Total	104.14	99.18	95.27

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **MOTA ASAMBIA** VILLAGE, MANDVI TALUKA, KUTCH DISTRICT.



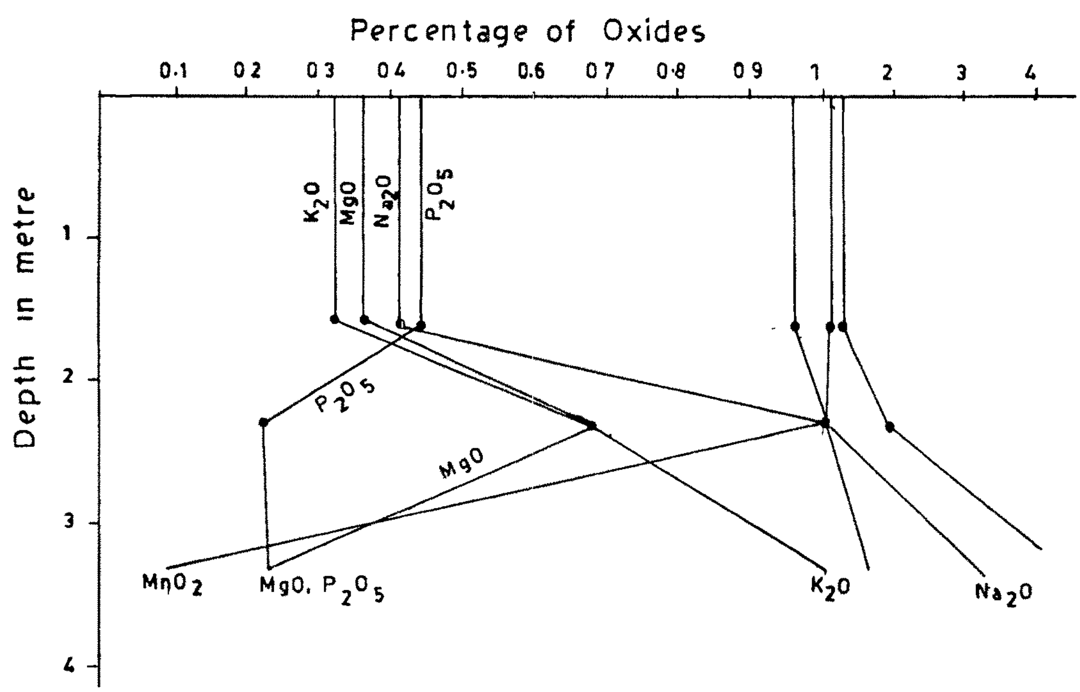


FIG. 64

Table 13

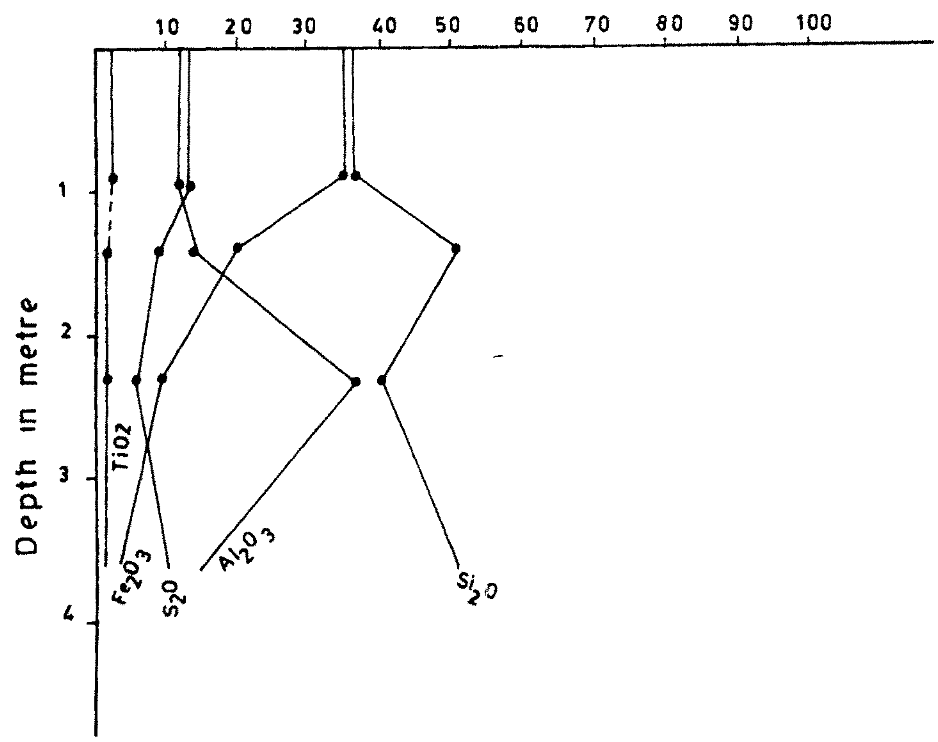
Mandvi Taluka

Goniasar Mota and Goniasar Nana :-

Depth	0-.9 m	00.9 - 1.4 m	1.4 - 2.3m	2.3 m
Horizon	Box	B	B	C
	Ferricrete	Saprolite	Saprolite	Basalt
SiO_2	35.57	50.95	40.24	51.50
Al_2O_3	11.73	13.57	37.26	14.93
Fe_2O_3	35.26	20.03	8.55	3.41
TiO_2	1.70	T	1.89	1.73
MnO_2	.96	1.12	T	.09
CaO	1.30	1.99	2.89	9.51
MgO	.36	.67	.88	3.89
K_2O	.32	.67	2.60	1.02
Na_2O	.41	1.07	1.65	3.24
P_2O_5	.44	.22	T	.22
CO_2	.69	1.00	.46	.18
H_2O	12.89	7.89	6.09	9.77
Total	101.63	99.18	102.51	99.49

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **GONIASAR** VILLAGE, MANDVI TALUKA, KUTCH DISTRICT,



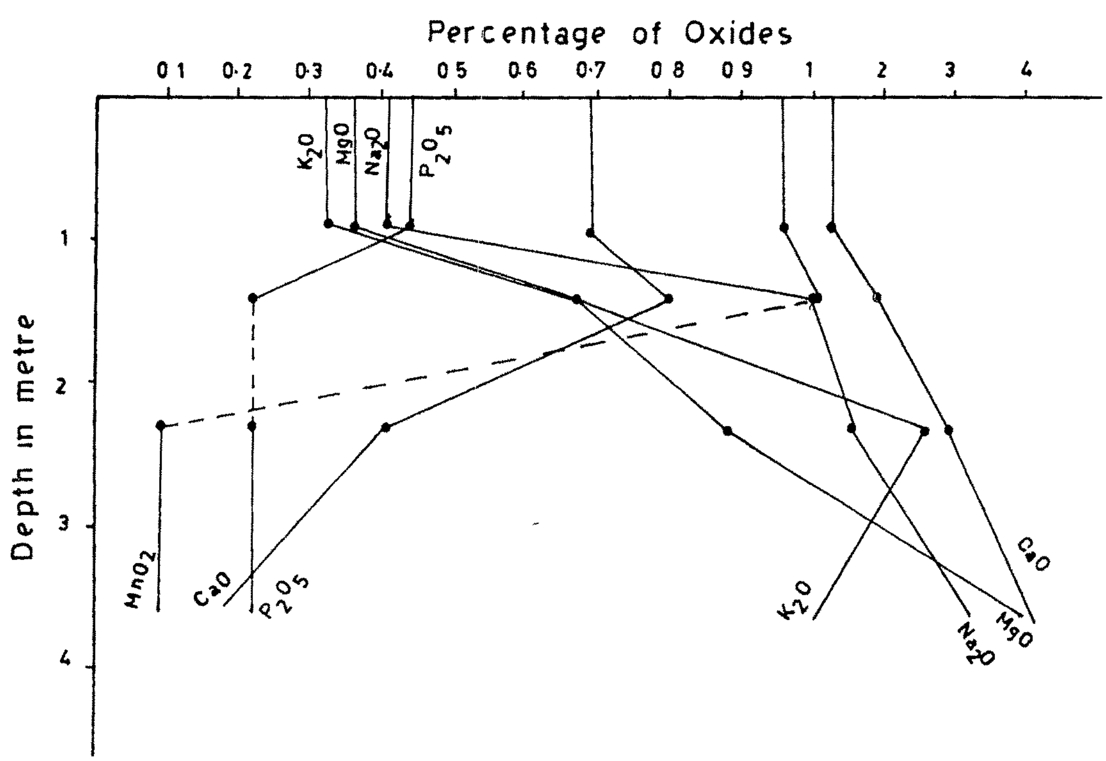


FIG. 65

Table 14

Mandvi Taluka.

Goniasar Mota and Goniasar Nana. (LST) (in percent)

Depth	0-0.9m	0.9m-2.8m	2.8m-3.2m	3.2m-
Horizon	Box	Box	B	C
	Ferricrete	Alucrete	Saprolite	Basalt
Major Oxides				
SiO_2	23.57	30.16	50.95	51.50
Al_2O_3	16.73	44.90	13.57	14.93
Fe_2O_3	32.56	9.00	20.03	3.41
TiO_2	1.90	2.90T		1.73
MnO_2	.96	.02	1.12	.09
CaO	1.30	.42	1.99	9.51
MgO	.36	.76	.67	4.54
K_2O	.32	.38	1.07	1.02
Na_2O	.41	.38	1.07	3.24
P_2O_5	.44	T	.22	.20
CO_2	.89	1.14	T	T
H_2O	12.01	10.21	8.84	9.77
Total	94.15	100.43	99.13	99.94
Trace Elements		(in ppm.)		
Ba	20	20	20	20
Cu	80	40	40	10
Rb	20	40	40	60
Sr	43	46	53	59
Zn	65	65	65	70
Pb	20	20	20	50
Mn	50	45	45	40
Cr	150	120	100	90
Ni	60	70	80	100
Co	10	10	15	15
V	150	150	150	100
Zr	50	40	40	30

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **GONIASAR** VILLAGE, MANDVI TALUKA, KUTCH DISTRICT.

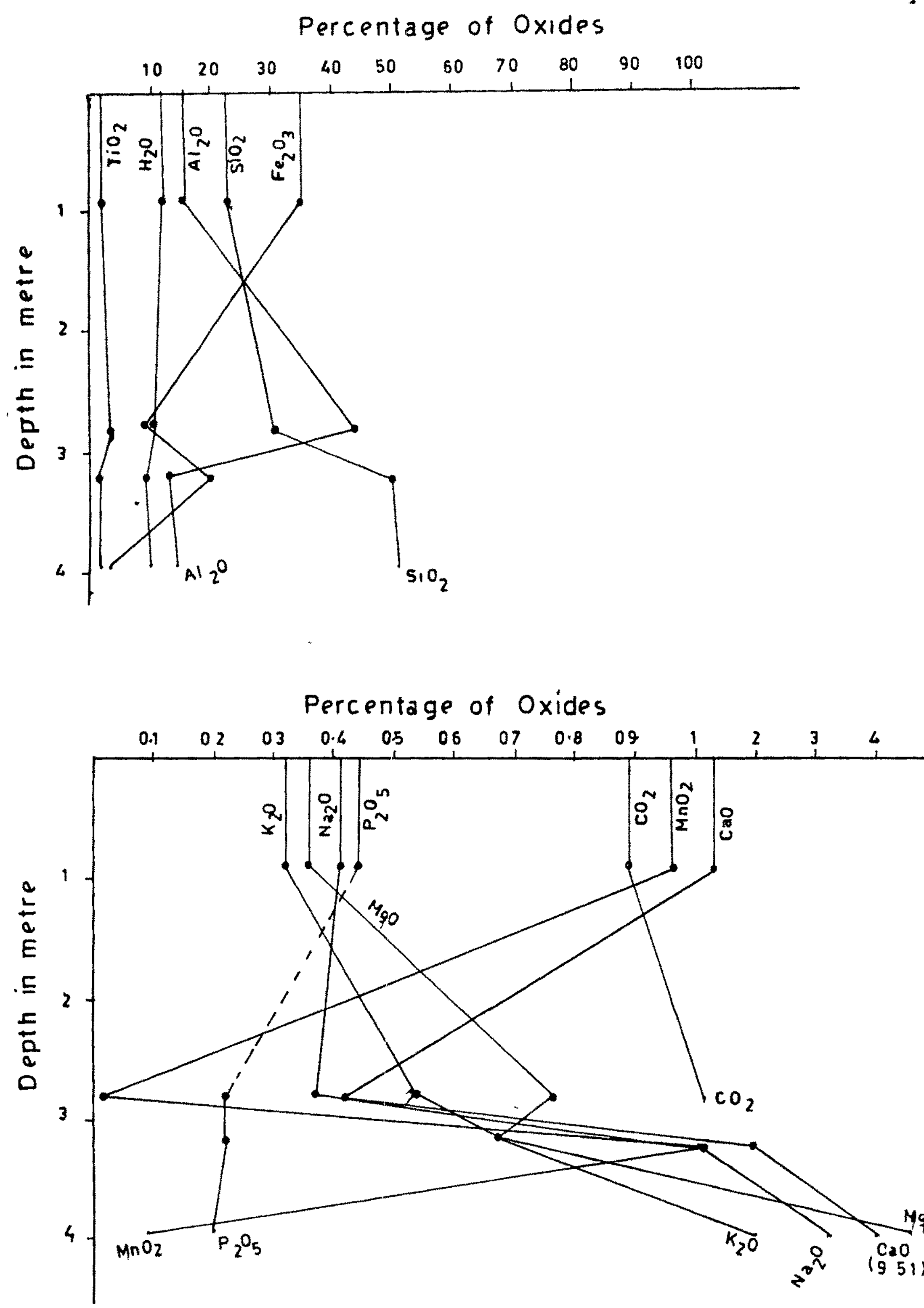


FIG. 66

VARIATION OF TRAC ELEMENTS IN LATERITE PROFILE AT **GONIASAR** VILLAGE, MANDVI TALUKA KUTCH DIST.

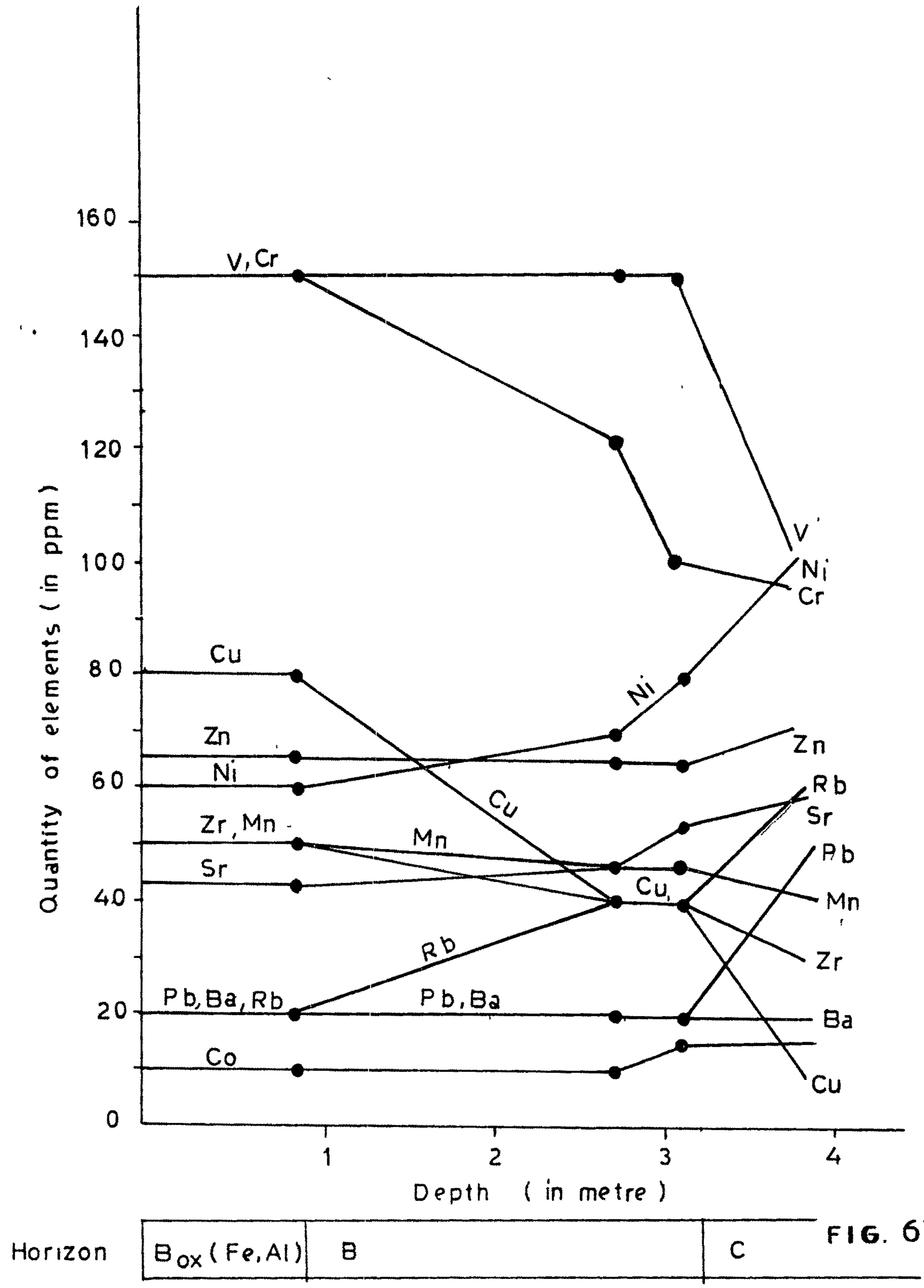


FIG. 67

Table 15

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL.

Taluka: MANDVI Village: GONIASAR MOTA & NANA
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile : 160 m

Depth	0-0 9m	0.9-2.8m	2.8-3.2m	
Horizon	Box(Fer)	Box(Alu)	B (Sap)	Remarks
SiO_2	-72 53	-56.07	-44 36	Overall losses with mobility increasing higher in the profile.
Al_2O_3	32.76	125.55	-16.19	Bottom horizon of loss with above lying horizon of gain in the Box(Alu) zone.
Fe_2O_3	520 41	979.00	428.65	Overall gain with a maximum in the Box(Alu) zone.
TiO_2	34.10	25.72	-	Bottom horizon of complete depletion with two top horizons of gains.
MnO_2	540.00	-83.33	1020.00	Mid-profile zone of depletion with top and bottom horizons of gains.
CaO	-91.79	-3.31	-81.16	Overall loss with top and bottom horizons showing maximum mobility.
MgO	-95.24	-87.44	-66.71	Overall loss with mobility increasing higher in the profile.
K_2O	-81 17	-72.05	5.56	Bottom horizon of gain with overlying depleted zones.
Na_2O	-92.40	-91 20	-70 27	Overall losses with mobility increasing higher in the profile
P_2O_5	32 00-		1.00	Mid-profile zone of depletio with overlying zone of gain
Ba	-	-	-	-
Cu	360 00	33.33	260.00	Overall gain with top and botton zones of maxima.
Rb	-80.00	-50.00	-40.00	Overall loss with mobility increasing higher in the profile.
Sr	-56.27	-41.52	-19.15	Overall loss with mobility increasing higher in the profile.
Zn	-44.26	-30 35	-16.42	Overall loss with mobility increasing higher in the profile.
Pb	-76.00	-70.00	-64.00	Overall loss with mobility increasing higher in the profile.
Mn	25 00	15 62	1.25	Overall gain with a maximum in the top horizon.
Cr	-	-	-	-
Ni	-64.00	-47.50	-28.00	Overall loss with mobility increasing higher in the profile.
Co	-60.00	-50 00	10.00	Overall loss with mobility increasing higher in the profile
V	10.00	12 50	35.00	Overall gain with a maximum in the bottom horizon.

Table 16

Mandvi Taluka

Goniasar Mota and Goniasar Nana :-

Depth	0 -.92m	00.92-3 m	3 - 4.2 m	4.2 m
Horizon	Box	Box	B	B
	Ferricrete	Alucrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	20.57	22.16	52.95	40.24
Al_2O_3	17.73	50.96	13.57	27.26
Fe_2O_3	34.26	11.00	17.98	8.55
TiO_2	1.90	1.90	.89	1.89
MnO_2	.96	.04	1.12	T
CaO	1.30	.62	1.92	2.89
MgO	.36	.66	.87	.88
K_2O	.32	.64	.71	2.60
Na_2O	.41	.48	1.27	1.65
P_2O_5	.44	.21	.18	T
CO_2	.89	.98	T	.20
H_2O	17.01	10.40	8.89	15.89
Total	96.15	100.05	100.35	102.05

In percent

Table 17

Mandvi Taluka

Wandh:-

Depth	0 - .8 m	00.8-1.4 m	1.4 m
Horizon	Box	B	B
	Ferricrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	27.40	50.95	44.24
Al_2O_3	22.60	13.57	32.26
Fe_2O_3	34.38	20.03	8.55
TiO_2	3.14	T	1.89
MnO_2	.02	1.12	T
CaO	.86	1.99	2.89
MgO	.30	.67	.88
K_2O	1.48	.67	2.60
Na_2O	T	.41	1.65
P_2O_5	2.10	.44	T
CO_2	.89	1.02	.98
H_2O	12.89	7.89	10.09
Total	106.06	98.76	106.03

In percent

Table 18

Mandvi Taluka

Wandh :-

Depth	0 - 1 m	1 m - 1.9 m	1.9 m -
Horizon	Box	B	B
	Ferricrete	Saprolite Bentonite	Saprolite Bentonite
	26.98	45.24	45.14
	18.62	28.26	29.26
	35.28	8.55	8.80
	T	1.96	1.82
	.02	T	.23
	.88	1.92	1.62
	.92	.96	.89
	.40	1.52	.96
	1.24	1.13	1.18
	1.89	1.02	1.04
	1.12	.99	.99
	14.89	12.09	10.06
Total	102.22	103.64	101.99

In percent

Table 19

Mandvi Taluka

Sherdi :-

Depth	0 - 0.6 m	0.6 -
Horizon	B	B
	Saprolite Bentonite	Saprolite Bentonite
SiO_2	37.88	40.88
Al_2O_3	24.89	22.68
Fe_2O_3	12.70	10.68
TiO_2	1.39	1.72
MnO_2	1.42	1.12
CaO	3.12	3.64
MgO	2.91	3.68
K_2O	1.00	1.24
Na_2O	1.48	1.64
P_2O_5	T	T
CO_2	1.68	1.02
H_2O	11.06	11.08
Total	99.53	99.38

In percent

Table 20

Mandvi Taluka

Sherdi :-

Depth	0 - 0.7 m	0.7m - 1.2 m	1.2 m-
Horizon	Box	B	B
	Ferricrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	19.25	35.25	40.25
Al_2O_3	14.92	22.68	18.23
Fe_2O_3	40.79	15.89	9.62
TiO_2	2.15	1.98	1.72
MnO_2	.59	.68	.69
CaO	1.98	2.74	4.90
MgO	1.96	2.48	3.60
K_2O	1.20	1.36	1.60
Na_2O	1.24	1.46	1.90
P_2O_5	6.40	2.62	1.98
CO_2	1.28	1.10	T
H_2O	8.98	12.08	16.06
Total	100.74	100.32	100.55

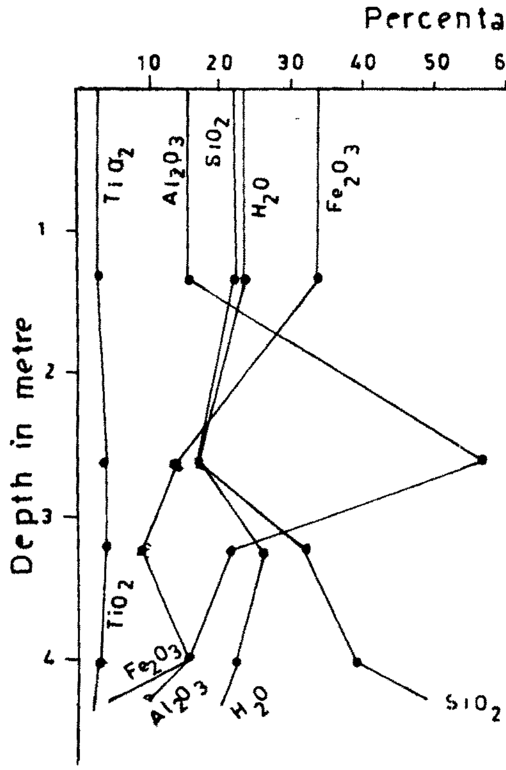
In percent

Table 21

Mandvi Taluka. Hamla (HST)

Depth	0.0-1.3m	1.3m-2.6m	2.6m-3.2m	3.2m-4.2m	4.2m-
Horizon	Box	Box	B	B	C
	Ferricrete	Alucrete	Saprolite Lithomerge	Saprolite Bentonite	Basalt
Major Oxide					
SiO_2	20.20	10.70	30.24	39.00	49.10
Al_2O_3	15.80	57.10	20.94	15.20	9.00
Fe_2O_3	34.15	10.40	10.08	15.10	4.80
TiO_2	5.61	3.76	3.80	3.40	1.90
MnO_2	.02	.09	.06	.05	.10
CaO	.18	.91	1.02	.69	.80
MgO	.10	1.02	1.80	1.76	1.90
K_2O	.05	.05	.60	.89	1.00
Na_2O	.02	.10	T	.71	.68
P_2O_5	.17	.52	T	.07	.04
CO_2	.48	5.26	T	.65	.49
H_2O	22.90	10.42	22.58	22.25	20.60
Total	99.68	100.33	91.12	99.77	90.41
Trace Elements				(in ppm.)	
Ba	15	20	20	10	10
Cu	40	30	30	20	20
Rb	20	35	35	40	50
Sr	48	50	52	55	55
Zn	80	90	120	95	95
Pb	10	15	15	40	45
Mn	55	50	40	30	20
Cr	170	150	130	170	170
Ni	80	90	95	125	-
Co	10	18	20	20	20
V	100	100	100	100	80
Zr	60	55	50	40	30

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE
AT **HAMLA** VILLAGE, MANDVI TALUKA, KUTCH DISTRICT



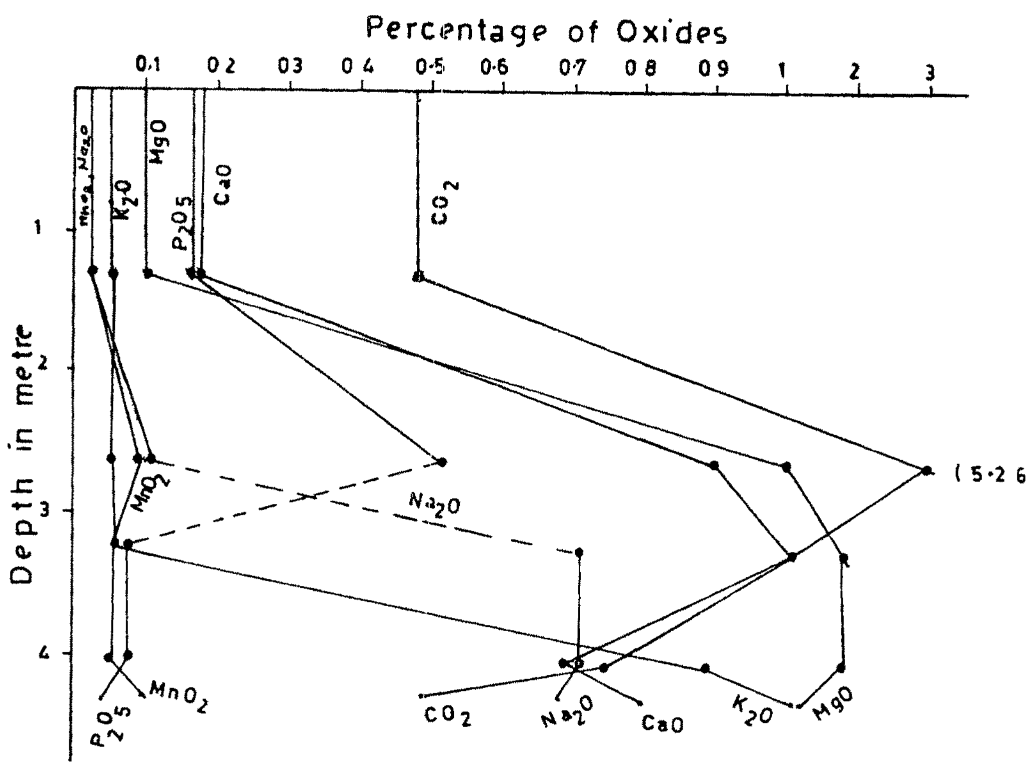


FIG. 68.

VARIATION OF TRACE ELEMENTS IN LATERITE PROFILE
AT **HAMLA** VILLAGE, MANDVI TALUKA, KUTCH DIST

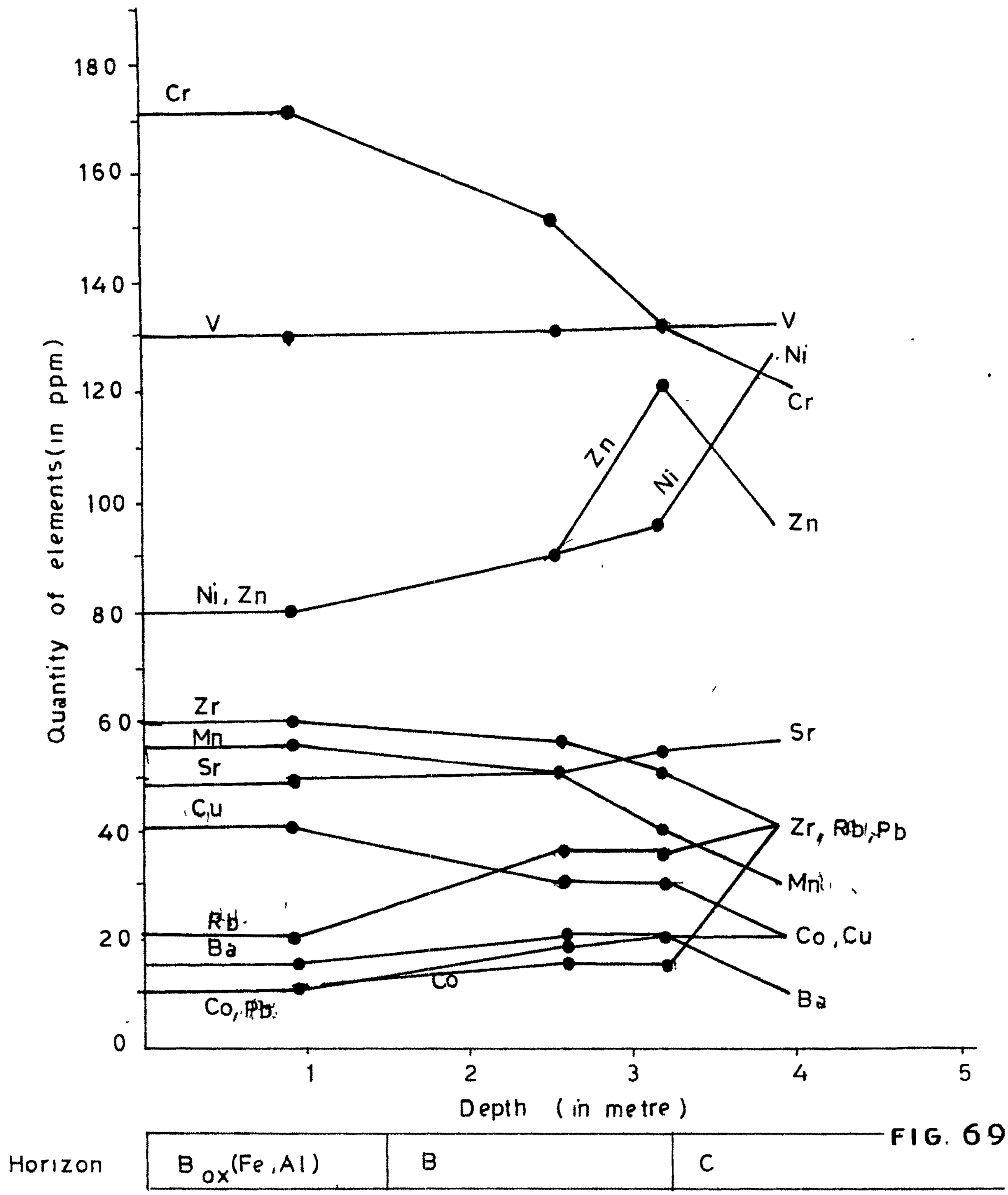


FIG. 69

Table 22

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL.

Taluka MANDVI Village: HAMLA
HST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile : 160 m.

Depth	0-1.3m	1 3-2.6m	2.6-3.2m	3 2-4 2m	
Horizon	Box(Fer)	Box(Alu)	B(Sap)	B(Sap)	Remarks
SiO_2	-58 85	-75.30	-19.46	-20 57	Overall loss with maximum mobility in the Box zone.
Al_2O_3	75 55	619 03	204 25	68 88	Overall gain with a maximum in the Box(Alu) horizon
Fe_2O_3	611 45	145.55	174.61	214.58	Overall gain with maximum in the top and bottom horizons
TiO_2	195.26	124.28	161 53	78.94	Overall gain with a maximum in the top horizon.
MnO_2	-80.00	-2.00	-21.53	-50 00	Overall loss with maximum mobility in the top and bottom horizons.
CaO	-77 50	26.91	66 73	-13 75	Mid-profile gains in the Box(Sap) and Box(Alu) zones with under-and overlying zones of depletion.
MgO	-94.73	-39 15	-23.88	-7 36	Overall losses with mobility increasing higher in the profile
K_2O	-95.00	-94 33	-21 53	-11 00	Overall losses with mobility increasing higher in the profile
Na_2O	-97.05	-83 33	T	4 41	Bottom horizon of gain with overlying depleted zones.
P_2O_5	325.00	137 33	T	75 00	Overall gain with a maximum in the top horizon.
Ba	50.00	128.66	161.53	-	Overall gain with a mid-profile maximum in the Bsap zone.
Cu	100.00	70.00	96.15	-	Overall gain with a maximum in the top zone
Rb	-60.00	-20 66	-8 46	-20.00	Overall loss with increasing mobility higher in the profile
Sr	-12.72	-3.03	-23.63	-	Overall loss in the profile
Zn	-13.78	-7.36	65.18	-	Two top horizons of depletion with an underlying zone of gain
Pb	-77.77	-62.22	-56.41	-11.11	Overall loss with an increase in mobility higher in the profile.
Mn	175 00	183 33	161.53	50 00	Overall gain with maximum in the top two horizons.
Cr	-	-	-	-	-
Ni	-	-	-	-	-
Co	-50.00	-2 00	-30 76	-	Overall losses with maximum mobility in the top and bottom horizons
V	25.00	41 66	63 46	25 00	Overall gain with a maximum in the mid-profile region
•	100.00	107.77	117.94	33 33	Overall gains with a maximum in the

Table 23

Mandvi Taluka — X-ray data — Box - Ferricrete

Hamla :- HST Type Section

2 (a)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
17.90	4.9417	92.50	100.00	Goethite
19.80	4.4846	31.00	33.51	Kaolinite
20.00	4.4907	17.00	18.38	Kaolinite
24.60	3.6193	7.00	7.57	Kaolinite
25.80	3.4632	6.00	6.49	Maghemite
26.10	3.4126	1.50	8.65	Maghemite
26.60	3.3517	2.00	1.58	Quartz
27.00	3.3114	8.00	2.04	Quartz
27.10	3.2902	7.00	7.57	Lepidocrocite
27.80	3.2094	3.50	3.78	Maghemite
35.20	2.5443	8.50	9.19	Ilmenite
35.30	2.5426	14.00	15.14	Ilmenite
35.60	2.5078	5.00	5.40	Hematite
36.40	2.1095	17.00	18.38	Lepidocrocite
37.90	2.3779	3.00	3.24	Anatase
38.70	2.3262	6.00	6.49	Maghemite
40.20	2.2429	8.50	9.19	Kaolinite
42.60	2.1219	11.00	11.89	Quartz
43.70	2.0712	8.00	8.65	Diaspore

Table 24

Mandvi Taluka X-ray data Box - Alucrete

Hamla :- HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
18.20	4.873	88.00	100.00	Gibbsite
20.20	4.3951	28.50	32.39	Gibbsite
20.50	4.3285	14.00	15.91	Gibbsite
25.20	3.5346	4.00	4.55	Anatase
26.50	3.3634	4.00	4.55	Kaolinite
26.90	3.3143	7.00	7.96	Quartz
27.90	3.1974	5.50	6.25	Gibbsite
28.60	3.1213	2.00	2.27	Gibbsite
36.50	2.4614	10.00	11.36	Goethite
37.00	2.4296	3.00	3.41	Goethite
37.60	2.3919	13.00	14.77	Gibbsite
39.30	2.2923	2.50	2.84	Gibbsite
40.10	2.2485	4.00	4.55	Kaolinite
41.60	2.1709	5.00	5.68	Kaolinite
44.10	2.0535	8.50	9.66	Gibbsite
45.40	1.9977	6.50	7.50	Gibbsite

Table 25

Mandvi Taluka X-ray data B - Kaolinite

Hamla :- HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
19.95	4.4509	22.00	50.00	Kaolinite
20.40	4.3529	39.00	88.64	Kaolinite
21.40	4.1513	37.00	84.09	Kaolinite
23.20	3.8334	18.00	40.91	Kaolinite
23.80	3.7697	10.00	22.73	Maghemite
25.00	3.5624	44.00	100.00	Maghemite
25.50	3.4956	30.00	68.18	Maghemite
26.50	3.3634	10.00	22.73	Maghemite
28.80	3.0997	2.00	4.55	Quartz
31.80	2.8135	6.00	12.63	Calcite
35.10	2.556	18.00	40.91	Kaolinite
35.50	2.5285	14.00	31.82	Kaolinite
36.00	2.4948	20.00	45.45	Kaolinite
37.90	2.3779	9.00	20.45	Kaolinite
38.60	2.3354	32.00	72.72	Kaolinite
39.30	2.2923	18.00	40.91	Kaolinite
45.60	1.9894	9.00	20.45	Kaolinite
46.90	1.9374	2.00	4.55	Kaolinite
48.00	1.8955	4.00	9.09	Anatase
49.50	1.8441	3.00	6.82	Maghemite
51.10	1.7874	2.00	4.55	Kaolinite
55.10	1.6688	13.00	29.55	Kaolinite

Table 26

Mandvi Taluka — X-ray data — B - Bentonite

Hamla :- HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
17.50	5.0474	60.40	100.00	Montmorillonite
18.60	4.7647	42.20	69.87	Quartz
19.90	4.4563	6.00	9.93	Kaolinite
20.40	4.3482	10.00	16.56	Kaolinite
21.40	4.1472	9.00	14.90	Kaolinite
22.30	3.9907	7.00	11.59	Beidellite
23.20	3.8294	11.00	18.21	Beidellite
28.80	3.0964	6.00	9.93	Maghemite
29.00	3.0753	8.00	13.24	Quartz
29.60	3.0143	9.00	14.90	
30.00	2.9751	11.00	18.21	
31.80	2.8108	9.00	14.90	Kaolinite
32.60	2.7435	8.00	13.24	Nontronite
33.90	2.6412	6.00	9.93	Kaolinite
35.10	2.5536	8.00	13.24	Kaolinite
36.00	2.4918	7.00	11.59	Kaolinite
37.90	2.3711	6.00	9.93	
38.50	2.3355	4.00	6.62	
39.80	2.2624	7.00	11.59	Beidellite
40.50	2.2247	7.00	11.59	Beidellite
42.60	2.1197	7.00	11.59	Beidellite

Table 27

Mandvi Taluka X-ray data C - Basalt

Hamla :- HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
18.60	4.7647	86.00	100.00	Quartz
19.90	4.4563	43.00	48.80	Quartz
21.30	4.1665	18.00	20.90	Labaradorite
22.30	3.9907	16.00	18.60	
23.80	3.7344	11.00	12.80	Ilmenite
24.10	3.6884	6.00	6.98	Augite
24.60	3.6145	8.00	9.30	Augite
27.00	3.2984	2.00	2.32	Augite
27.70	3.2166	22.00	25.00	Sphene
28.00	3.1826	6.00	.98	Maghemite
28.80	3.0964	24.00	27.90	Labradorite
29.00	3.0753	4.00	4.65	Olivine
30.00	2.9751	7.00	8.14	Augite
31.00	2.8813	8.00	9.30	Maghemite
32.60	2.7435	10.00	11.32	Sphene
33.90	2.6412	21.00	24.42	
34.50	2.596	19.00	22.10	Rutile
35.10	2.5536	12.00	13.95	Lepidocrocite
36.20	2.4765	7.00	8.10	Augite
38.10	2.5561	15.00	17.40	Rutile
39.20	2.2954	14.00	16.28	Maghemite
40.20	2.2379	14.00	16.28	

X-RAY DIFFRACTION TRACES OF VARIOUS HORIZONS OF LATERITIC PROFILE AT HAMLA (MANDVI TALUKA) HST Type Section.

Depth in meter	Horizon	Dominating minerals
0–I.3m	Box-Ferricrete	Maghemite Lepidocrocite Kaolinite Ilmenite Quartz Goethite Diaspore Anatase
I.3–2.6m	Box-Alucrete	Gibbsite Kaolinite Goethite Quartz Anatase
2.6–3.2m	B-Kaolinite	Kaolinite Maghemite Quartz Calcite Anatase Maghemite
B-Bentonite	3.2–4.2m	Beidellite Montmorillonite Nontronite Kaolinite Quartz
C-Basalt	4.2– m	Labradorite Augite Olivine Quartz Ilmenite Rutile Sphene Maghemite Lepidocrocite

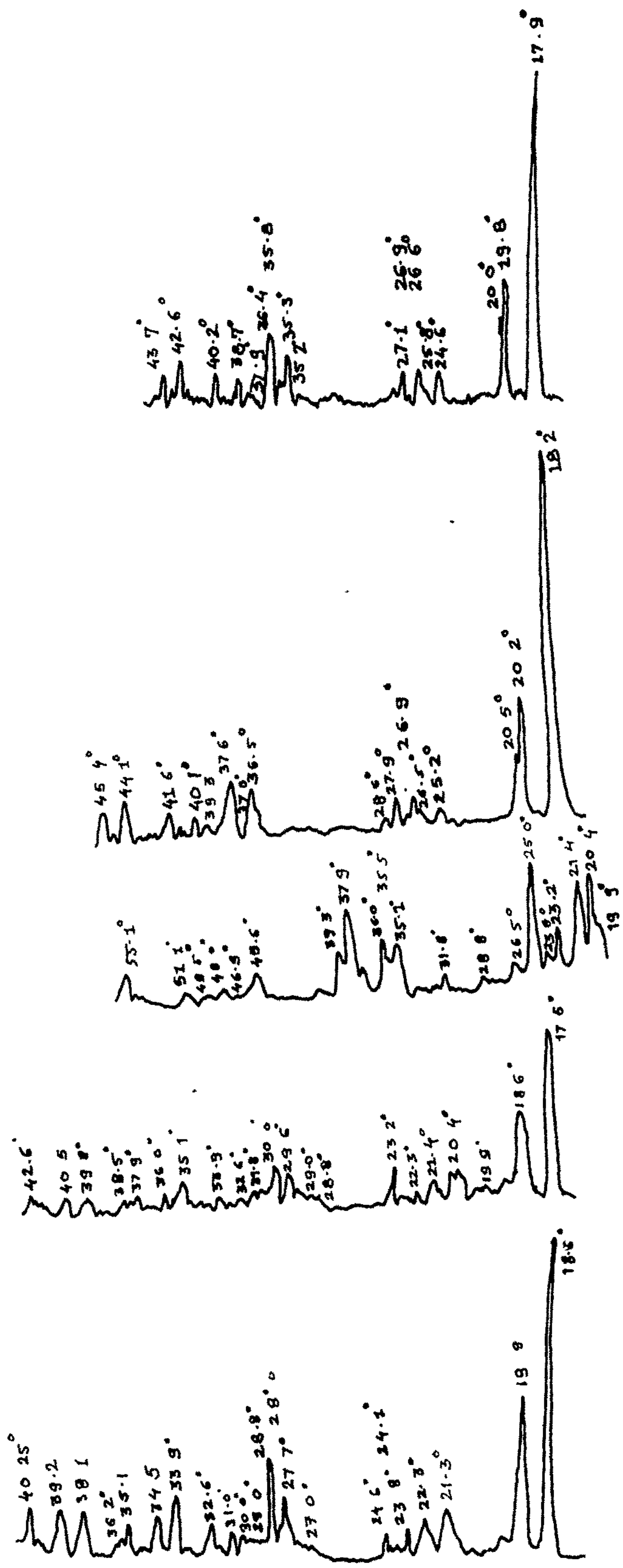


FIG 70

Table 28

Mandvi Taluka

Hamla :-

Depth	0 - 1.4m	1.4m-1.9 m	1.9m -
Horizon	Box	B	B
	Ferricrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	26.80	37.80	46.88
Al_2O_3	14.60	34.60	10.68
Fe_2O_3	35.40	5.10	9.62
TiO_2	1.48	1.28	1.42
MnO_2	.19	.02	.69
CaO	1.02	1.24	1.48
MgO	.96	.19	.62
K_2O	.20	.20	1.28
Na_2O	.96	.80	1.48
P_2O_5	.42	.16	.42
CO_2	.86	1.00	1.20
H_2O	12.06	16.02	20.68
Total	94.95	98.41	96.45

In percent

Table 29

Mandvi Taluka

Hamla :-

Depth	0-0.4m	00.4m-1.3m	1.3m-2.6m	2.6m-
Horizon	Box	Box	B	B
	Ferricrete	Ferricrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	23.68	24.98	38.92	46.72
Al_2O_3	12.42	12.62	32.46	10.42
Fe_2O_3	39.12	38.48	7.02	6.62
TiO_2	1.42	1.62	1.12	1.22
MnO_2	.04	.19	.12	.89
CaO	.68	.98	.92	.68
MgO	.96	1.04	.28	.21
K_2O	1.12	.98	.92	1.06
Na_2O	1.68	1.96	.86	1.42
P_2O_5	T	.62	T	T
CO_2	1.12	1.12	1.00	1.42
H_2O	14.82	13.08	16.48	26.68
Total	97.67	100.10	100.10	97.34

In percent

Table 30

Mandvi Taluka

Tumdi :-

Depth	0-0.3 m	0.3-1.7 m	1.7 m	
Horizon	Box	Box	B	
	Ferricrete	Alucrete	Saprolite Lithomarge	Saprolite Bentonite
SiO_2	24.68	14.96	37.80	48.56
Al_2O_3	18.98	50.70	24.60	19.32
Fe_2O_3	32.98	14.98	10.10	7.74
TiO_2	4.96	3.15	3.48	2.86
MnO_2	.10	.02	.02	.89
CaO	1.36	1.21	1.24	1.48
MgO	.28	.22	.19	.32
K_2O	.18	.24	.20	.25
Na_2O	.98		.80	.90
P_2O_5	.48	.16	.16	.14
CO_2	1.86	1.76	1.00	.90
H_2O	14.98	13.20	19.06	15.60
Total	100.60	98.65	98.65	98.96

In percent

Table 31

Abdasa Taluka (LST)

Nandra. (in percent)

Depth	0.0m-1.7m	1.7m-3.2m	3.2m-3.7m	3.7m
Horizon	Box	Box	B	C
	Ferricrete	Alucrete	Saprolite	Deccan Trap
SiO_2	24.83	11.50	37.60	49.80
Al_2O_3	19.56	54.60	30.80	27.80
Fe_2O_3	38.21	4.22	4.10	9.80
TiO_2	3.66	4.15	4.80	8.60
MnO_2	.90	.01	.01	T
CaO	.01	.46	.32	1.02
MgO	1.78	.15	.10	1.00
K_2O	.01	.28	.08	.90
Na_2O	.50	.57	-	.80
P_2O_5	.22	.22	.18	.34
CO_2	.68	.44	.46	2.00
H_2O	10.12	23.03	21.90	3.90
Total	99.63	100.35	100.35	105.96

Trace Elements (in ppm.)

Ba	20	20	20	20
Cu	80	60	60	80
Rb	T	T	T	T
Sr	10	20	20	30
Zn	30	40	40	60
Pb	5	5	5	5
Mn	80	70	60	40
Cr	60	50	40	40
Ni	10	20	40	60
Co	30	40	60	80
V	5	5	5	5
Zr	10	5	5	5

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **NANDRA** VILLAGE, ABDASA TALUKA, KUTCH DISTRICT

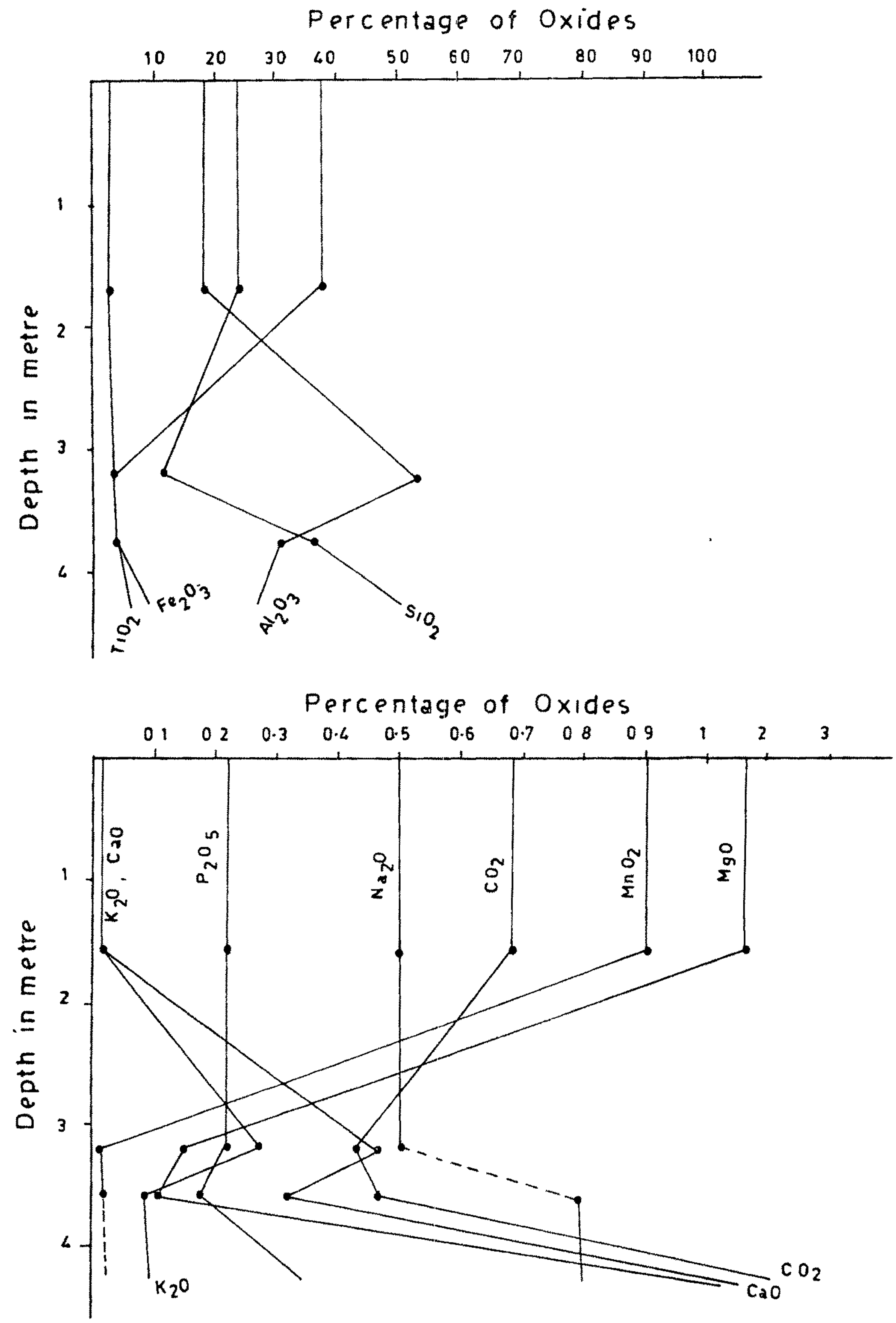


FIG. 71

VARIATION OF TRACE ELEMENTS IN LATERITE PROFILE AT NANDRA VILLAGE, ABDASA TALUKA KUTCH DIST.

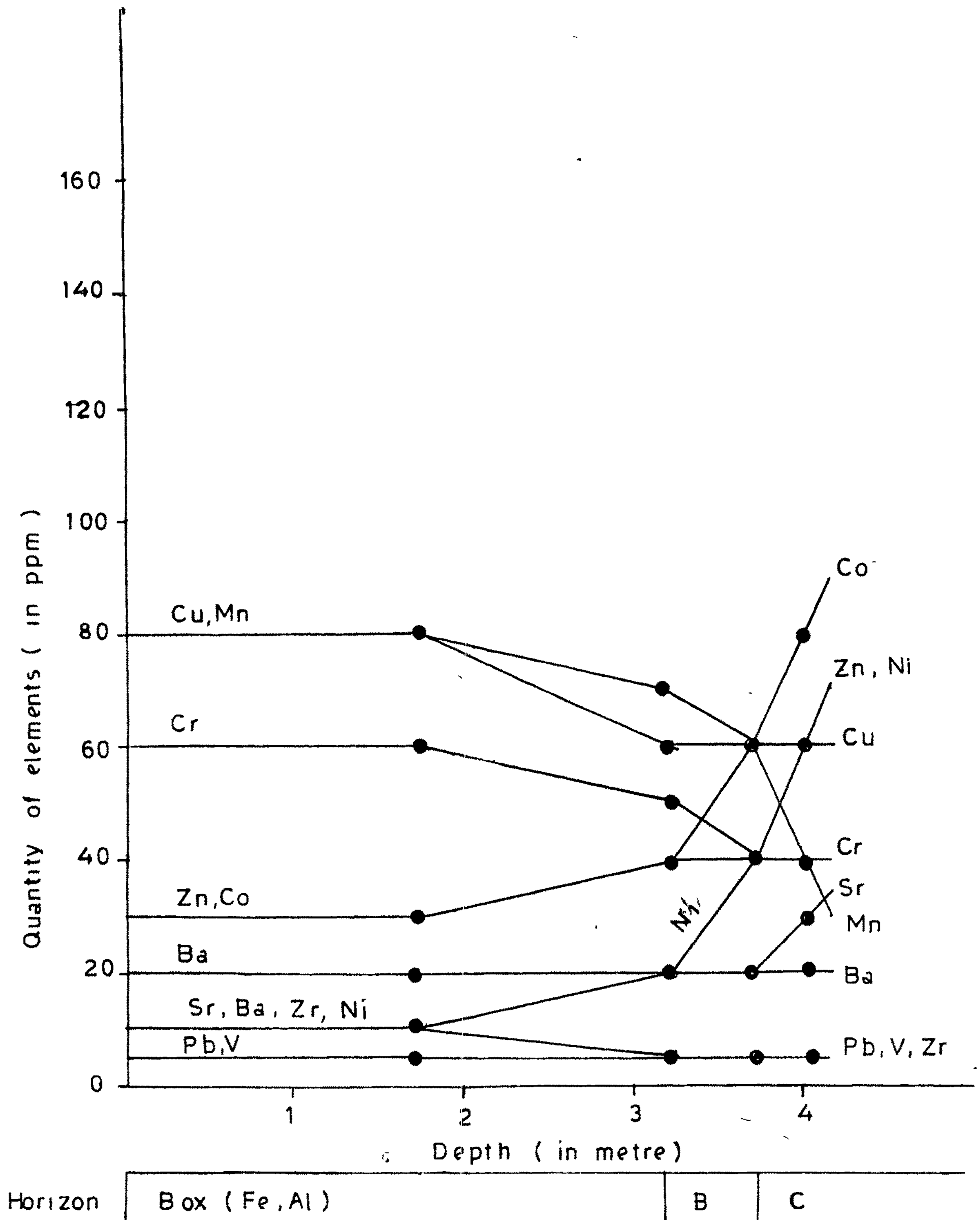


FIG 72

Table 32

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL

Taluka. ABDASA Village: NANDRA
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile · 180 m

Depth	0-1 7m	1.7-3.2m	3 2-3.7m	
Horizon	Box(Fer)	Box(Alu)	B(Sap)	Remarks
SiO_2	-66 76	-81 52	-24 49	Overall loss with increasing mobility higher in the profile.
Al_2O_3	-53 09	57.12	10.79	Top depleted zone with underlying zones of gain
Fe_2O_3	159 93	-85.55	-58.16	Top horizon of gain with underlying depleted zones.
TiO_2	-71 62	-81.39	-44 18	Lost throughout the profile with mobility increasing higher in the profile
MnO_2	-	-	-	-
CaO	-99 34	-63 92	-68 62	Lost throughout the profile with mobility increasing higher in the profile
MgO	18 66	-88 00	-90.00	Top horizon of gain with underlying zones of depletion.
K_2O	-99 25	-75.11	-91.11	Overall loss throughout the profile
Na_2O	-58.33	-43 00	-	Overall loss throughout the profile
P_2O_5	-56 86	-48 23	47.05	Overall loss with mobility increasing higher in the profile
Ba	-	-	-	-
Cu	11.11	-	-	Top horizon of gain with lower horizons showing losses
Rb	-	-	-	-
Sr	-77 77	-46.66	-33.33	Overall loss with mobility increasing higher in the profile
Zn	-66.66	-5.33	-33.33	Overall loss with maximum mobility in the top and bottom horizons.
Pb	-	-	-	-
Mn	33.33	40.00	50.00	Overall gain with a maximum in the bottom horizon mobility increasing higher in the profile.
Cr	-	-	-	-
Ni	-88 88	-73 33	-33 33	Overall loss with mobility increasing higher in the profile
Co	-75 00	-60 00	-25.00	Overall loss with mobility increasing higher in the profile
V	-	-		-
Zr	33 33	-		Top horizon of gain with underlying zones showing losses

Table 33

Abdasa Taluka. (LST)

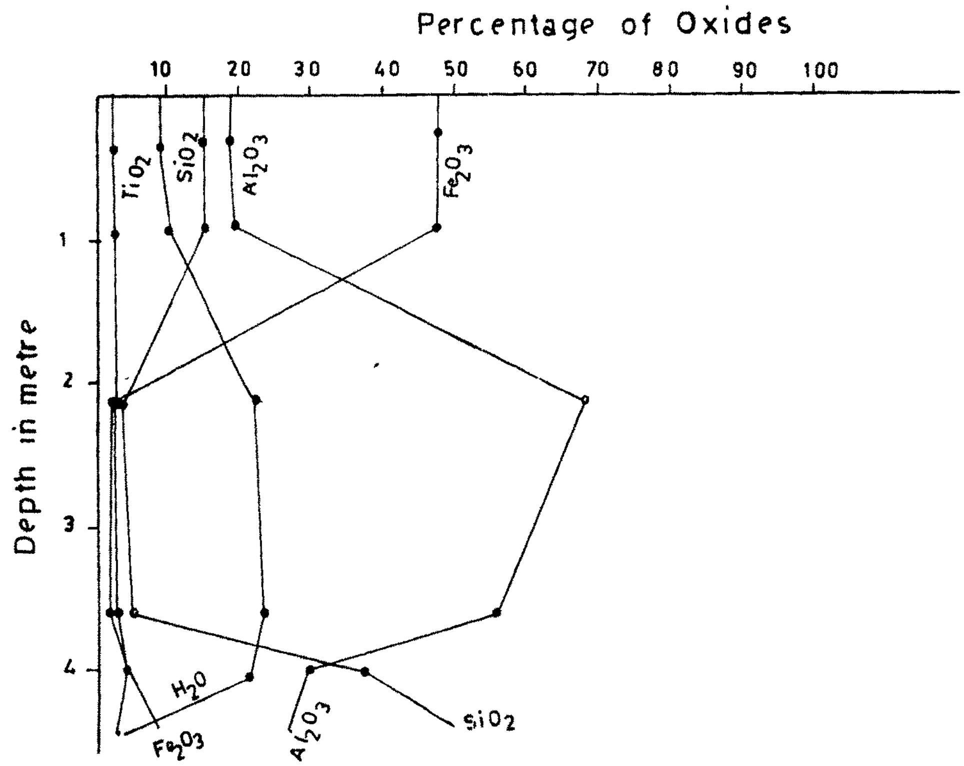
Naredi. (in percent)

Depth	0m-0.3m	0.3m-0.9m	0.9m-2.1m	2.1m-3.6m	3.6m-4m	4m
Horizon	A	Box	Box	Box	B	C
	Soil	Ferricrete	Alucrete	Alucrete	Saprolite	Basalt
SiO_2	14.80	14.83	4.40	5.50	37.60	49.80
Al_2O_3	19.20	19.56	68.60	56.70	30.80	27.80
Fe_2O_3	48.21	48.21	2.38	2.22	4.10	9.80
TiO_2	3.66	3.66	3.13	4.15	4.80	3.60
MnO_2	.98	.90	.02	.01	.01	T
CaO	.01	.01	.86	.46	.32	1.02
MgO	1.79	1.78	.20	.15	.10	1.00
K_2O	.40	.01	.30	.28	.08	.90
Na_2O	.10	.05	.48	.57	T	.80
P_2O_5	.20	.22	T	.22	.18	.24
CO_2	1.00	.78	.84	1.03	.44	2.00
H_2O	9.98	10.06	22.89	23.03	21.90	3.80
Total	100.07	104.11	104.11	94.32	100.33	100.78

Trace Elements (in ppm.)

Ba -		T	T	T	T	T
Cu -		90	70	70	70	60
Rb -		5	5	5	5	5
Sr -		20	30	30	40	50
Zn -		10	20	20	20	20
Pb -		ND.	ND.	ND.	ND.	ND.
Mn -		60	50	45	45	20
Cr -		90	80	80	80	80
Ni -		40	60	60	80	90
Co -		20	20	30	60	70
V -		20	5	T	T	T
Zr -		20	10	5	5	5

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE
AT **NAREDI** VILLAGE, ABDASA TALUKA, KUTCH DISTRICT



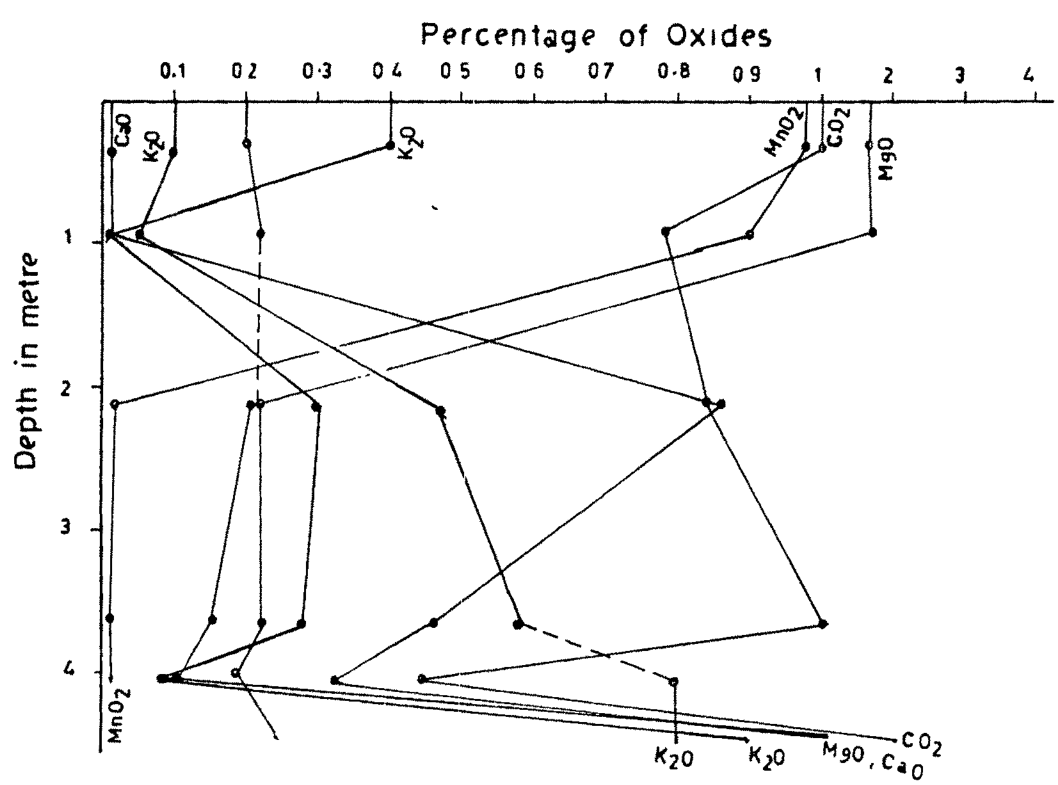


FIG. 73

VARIATION OF TRACE ELEMENTS IN LATERITE PROFILE AT **NAREDI** VILLAGE, ABDASA TALUKA KUTCH DIST

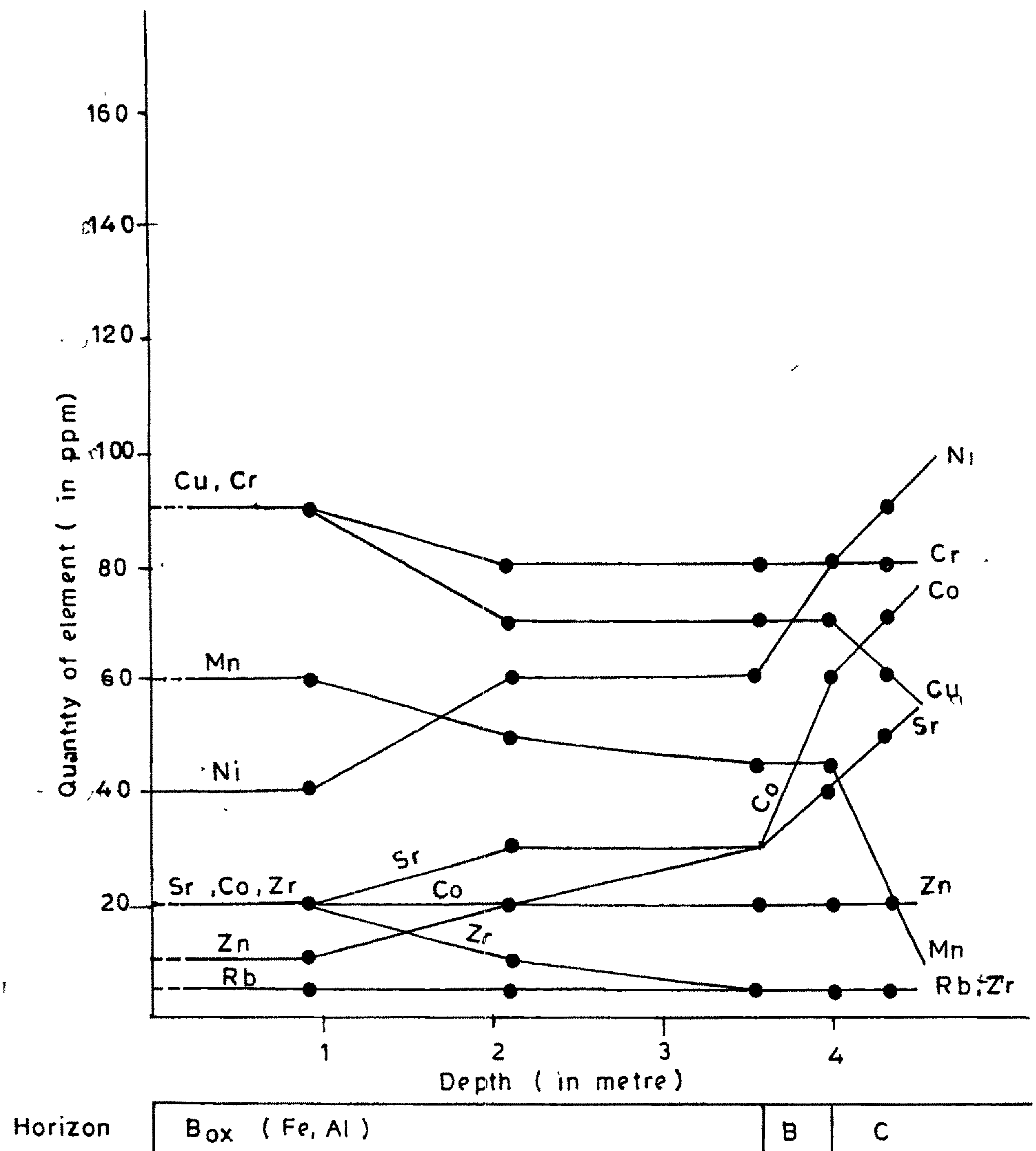


FIG 74

Table 34

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL

Taluka. ABDASA Village: NAREDI
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of weathered profile 190 m.

Depth	0-0 3m	0.3-0 9m	0.9-2.1m	2 1-3.6m	3.6-4m	
Horizon	A(Soil)	Box(Fer)	Box(Alu)	Box(Alu)	B(Sap)	Remarks
SiO_2	-	-73.52	-91 16	-88 95	-24.49	Overall losses with maximum mobility in the Box horizon.
Al_2O_3	-	-37 45	146 76	103.95	10.79	Top horizon of loss with an underlying zone of gain maxima.
Fe_2O_3	-	337.27	-75.71	-77 34	-58.16	Top horizon of gain with underlying zones of depletion.
TiO_2	-	9.62	13 05	15 22	33.33	Overall gains with a maximum in the bottom horizon.
MnO_2	-	-	-	-	-	-
CaO	-	-99 12	-15 68	-54 90	-68 62	Overall losses with maximum mobility in top and bottom horizons.
MgO	-	58 22	-80 00	-85 00	-90.00	Top horizon of gain with underlying zones of depletion
K_2O	-	-99 01	-66.66	-68 88	-91.11	Overall losses with top and bottom zones showing maximum mobility.
Na_2O		-94 44	-40 00	-28 75	-	Overall loss with an increase in the mobility higher in the profile.
P_2O_5	-	-	-	-8 33	-25 00	Overall loss with maximum mobility in the upper horizons where it is lost
Ba	-	-	-	-	-	-
Cu	-	50 00	16.66	16.66	16.66	Overall gains with a maximum in the top horizon.
Rb	-	C	C	C	C	-
Sr	-	-64.44	-40.00	-40 00	-20 00	Overall loss with an increase in the mobility higher in the profile
Zn	-	-50.00	C	C	C	Overall loss with maximum mobility in lower horizons.
Pb	-	N.D.	N.D.	N.D.	N.D	-
Mn	-	200.00	150.00	125 00	125 00	Overall gain with a maximum in the top most horizon.
Cr	-	-	C	C	C	-
Ni	-	-55.55	-33.33	-33.33	-11.11	Overall loss with an increase in the mobility higher in the profile
Co	-	-74.60	-71 42	-57 14	-14.28	Overall loss with an increase in mobility higher in the profile
V	-	C	T	T	T	-
Zr	-	400 00	100 00	C	C	Increase higher in the profile

Table 35

Abdasa Taluka

Raydhanpur :-

Depth	0-0.4 m	0.4-1.2 m	1.2 m
Horizon	Box	Box	Box
	Ferricrete	Ferricrete	Alucrete
SiO_2	22.14	28.98	20.42
Al_2O_3	18.16	19.40	40.60
Fe_2O_3	25.86	24.86	3.86
TiO_2	2.89	3.69	3.89
MnO_2	.42	.24	.04
CaO	.86	.96	.82
MgO	1.68	1.96	1.80
K_2O	.98	.70	.70
Na_2O	.02	T	T
P_2O_5	1.02	.96	.84
CO_2	1.14	.68	.89
H_2O	12.62	16.80	16.80
Total	99.21	90.66	90.66

In percent

Table 36

Abdasa Taluka

Miyani :-

Depth	0-1.2m	1.2-2.4 m
Horizon	Box	Box
	Alucrete	Alucrete
SiO_2	6.08	12.70
Al_2O_3	63.84	61.80
Fe_2O_3	3.04	3.00
TiO_2	4.12	3.89
MnO_2	T	.01
CaO	.90	.96
MgO	1.00	.84
K_2O	.40	.50
Na_2O	T	.47
P_2O_5	.42	.36
CO_2	.62	1.02
H_2O	19.60	14.65
Total	100.20	100.20

In percent

Table 37

Abdasa Taluka (HST)

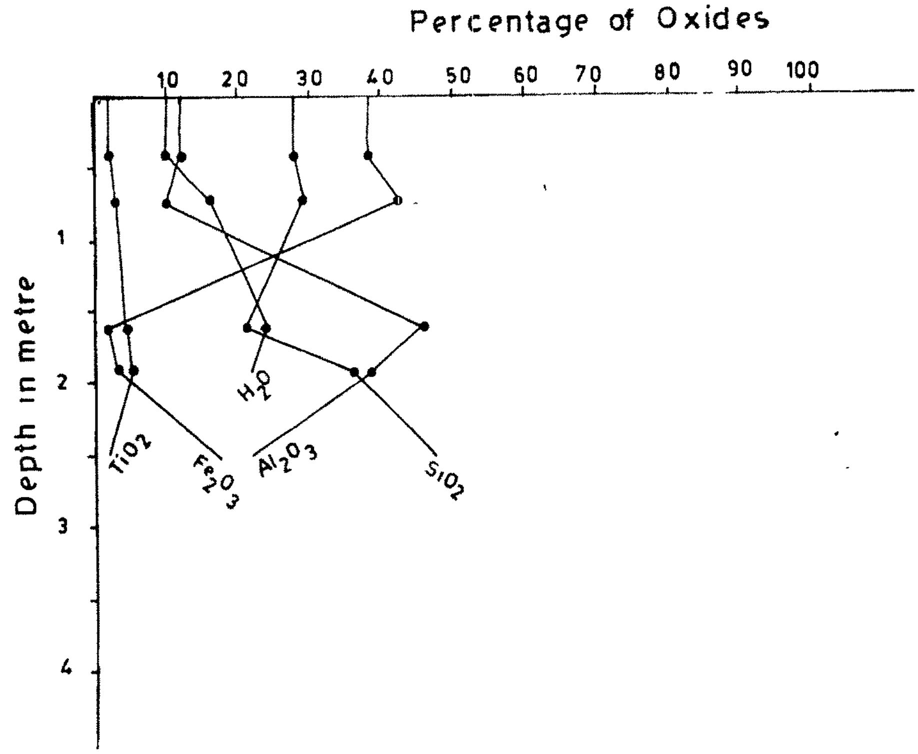
Chiyasar (In percent)

Depth	0m-0.4m	0.4m-0.7m	0.7m-1.6m	1.6m-1.9m	1.9m-
Horizon	Box	Box	Box	B	C
	Ferricrete	Ferricrete	Alucrete	Saprolite	Basalt
SiO_2	28.11	28.89	21.50	37.60	47.29
Al_2O_3	12.57	10.68	46.70	30.80	11.12
Fe_2O_3	39.22	42.28	2.22	4.10	17.28
TiO_2	.68	3.58	4.15	4.80	.29
MnO_2	.55	.38	.01	.01	.13
CaO	.08	.02	.46	.32	.53
MgO	5.53	1.16	.15	.10	4.77
K_2O	.02	.03	.28	.08	.01
Na_2O	.06	.03	.57	T	.12
P_2O_5	.14	.06	.22	.18	.02
CO_2	1.09	.25	1.03	.44	.41
H_2O	10.04	16.96	23.03	21.90	T
Total	104.32	100.32	100.32	100.33	81.97

Trace Elements (In ppm.)

Ba	30	30	40	60	80
Cu	60	60	60	60	60
Rb	ND.	ND.	ND.	ND.	T
Sr	5	10	10	10	20
Zn	60	65	70	70	80
Pb	20	20	30	40	50
Mn	40	30	25	25	25
Cr	30	20	20	20	10
Ni	50	50	80	80	100
Co	40	50	60	70	80
V	10	10	10	5	T
Zr	30	20	20	20	10

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **CHIYASAR** VILLAGE, ABDASA TALUKA, KUTCH DISTRICT



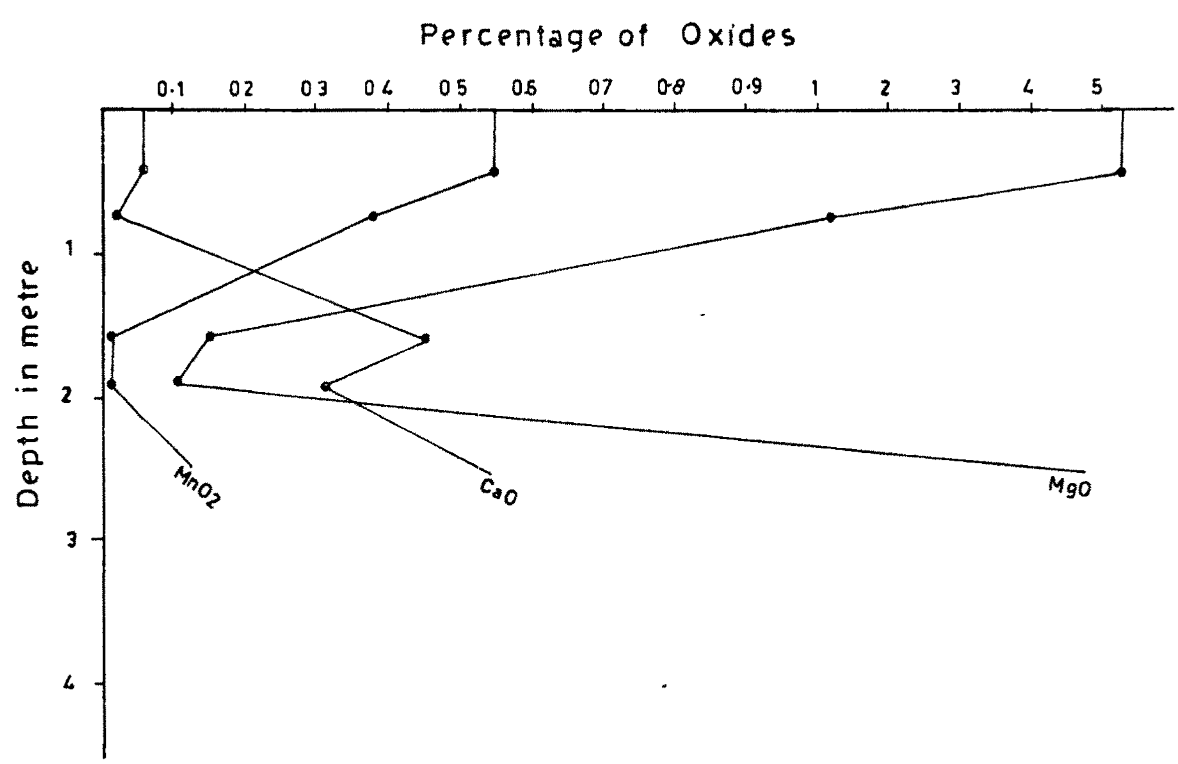


FIG. 7.5

VARIATION OF TRACE ELEMENT IN LATERITE PROFILE
AT **CHIYASAR** VILLAGE, ABDASA TALUKA KUTCH DIST

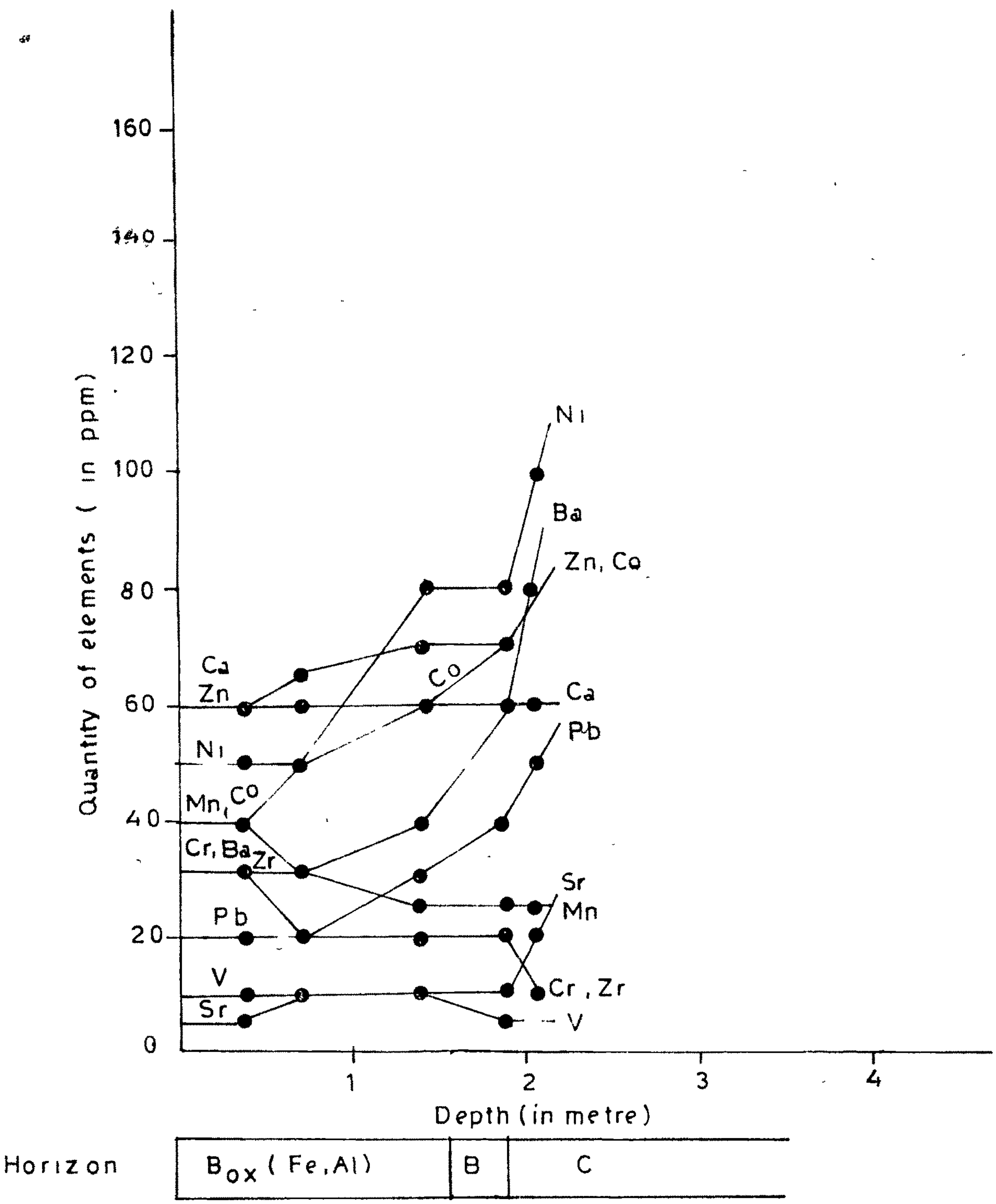


FIG 76

Table 38

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL

Taluka ABDASA Village. CHIYASAR
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of weathered profile . 175 m.

Depth	0-0.4m	0 4-0.7m	0 7-1 6m	1 6-1.9m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	H(Sap)	Remarks
SiO_2	-60 37	-69 45	-77 26	-60 24	Lost throughout the profile with a maximum mobility in the box zone.
Al_2O_3	24.64	:51.07	109.90	38.48	Mid-profile gain in the box(Alu) zone with an overlying depleted zone but with an underlying and topmost zone of gain
Fe_2O_3	51 31	22.33	-93 57	-88 13	Gains in the Box(Fer) horizon with underlying zones of depletion
TiO_2	516 09	517 24	615 51	727 58	Gains throughout the prfile with a maximum in the bottom zone.
MnO_2	182 65	46 15	-96 15	-96.15	Gains in the Box(Fer) zone with underlying horizons showing depletion.
CaO	-92 45	-98 11	-56 60	-69 81	Losses throughout with maximum mobility in the Box(Fer) horizon
MgO	22 71	-87 60	-98 42	-98 95	Top horizon of gain with underlying horizons of depletion
K_2O	33 33	50 00	1300 00	300 00	Overall gains with a maximum in the Box(Alu) and Hsap horizons
Na_2O	-66 66	-87.50	137 50	-	Mid-profile zone of gain in the Box (Alu)with overlying zones of depletion.
P_2O_5	366.66	50.00	450.00	350 00	Overall gains throughout the profile
Ba	-87 50	-81.25	-75 00	-62 50	Overall losses with mobility increasing higher in the profile.
Cu	C	C	C	C	-
Rb	-	-	-	-	-
Sr	-91 66	-75 00	-75 00	-75 00	Overall losses with mobility increasing higher in the profile.
Zn	-75.00	-59 37	-58 25	-56 25	Overall losses with mobility increasing higher in the profile.
Pb	-86 66	-80 00	-70.00	-60 00	Overall losses with mobility increasing higher in the profile
Mn	46.66	40 00	50.00	50.00	Increase higher in the profile.
Cr	-	-	-	-	-
Ni	-83 33	-75.00	-96.00	-96 00	Overall losses with maximum mobility in the two bottom horizons
Co	-83.33	-68.75	-62 50	-	C r, ll losses with mobility increasing higher in the profile.
V	-	-	-	-	-
Zr	-	-	-	-	

Table 39

Abdasa Taluka

Kharuva :-

Depth	0-0.8 m	0.8 - 1.3 m
Horizon	Box	Box
	Ferricrete	Alucrete
SiO_2	24.83	28.89
Al_2O_3	19.56	22.68
Fe_2O_3	38.21	40.28
TiO_2	3.42	3.58
MnO_2	.90	.38
CaO	.01	.02
MgO	1.78	.98
K_2O	.01	.03
Na_2O	.05	.03
P_2O_5	.22	.06
CO_2	.78	.25
H_2O	11.89	11.65
Total	108.83	108.83

In percent

Table 40

Abdasa Taluka.

Nundatar (LST)

Depth	0m-0.6m	0.6m-1.8m	1.8m-2.1m	2.1m-2.6m	2.6m-3.2m	3.2m-
Horizon	Box	Box	Box	B	B	C
	Ferricrete	Ferricrete	Alucrete	Saprolite	Saprolite	Basalt
SiO_2	20.20	19.96	12.72	30.70	39.00	42.30
Al_2O_3	15.80	15.46	49.92	27.10	25.20	19.60
Fe_2O_3	34.15	36.15	11.28	20.40	17.10	17.00
TiO_2	5.61	4.80	2.80	3.76	3.40	2.81
MnO_2	.02	.02	.08	.09	.05	.05
CaO	.18	.90	1.00	.91	.69	1.67
MgO	.10	.47	1.27	1.02	1.76	2.68
K_2O	.05	.07	T	.05	.89	1.93
Na_2O	.02	.10	T	.10	.71	1.00
P_2O_5	.17	.20	T	.52	.07	.57
CO_2	.48	.26	T	5.26	.65	2.00
H_2O	22.90	20.90	20.26	10.46	10.25	8.06
Total	99.29	99.33	99.33	100.37	99.77	99.67

Trace Elements (In ppm.)

Ba	40	40	60	80	80	90
Cu	70	70	70	60	60	50
Rb	10	10	10	30	30	40
Sr	60	70	90	90	90	100
Zn	50	45	45	40	40	30
Pb	T	T	5	5	5	5
Mn	80	70	55	55	55	35
Cr	80	70	70	70	70	70
Ni	40	60	70	70	70	90
Co	20	30	30	30	30	40
V	30	10	10	10	10	10
Zr	40	30	30	30	30	-

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **NUNDHATAN** VILLAGE, ABDASA TALUKA, KUTCH DISTRICT

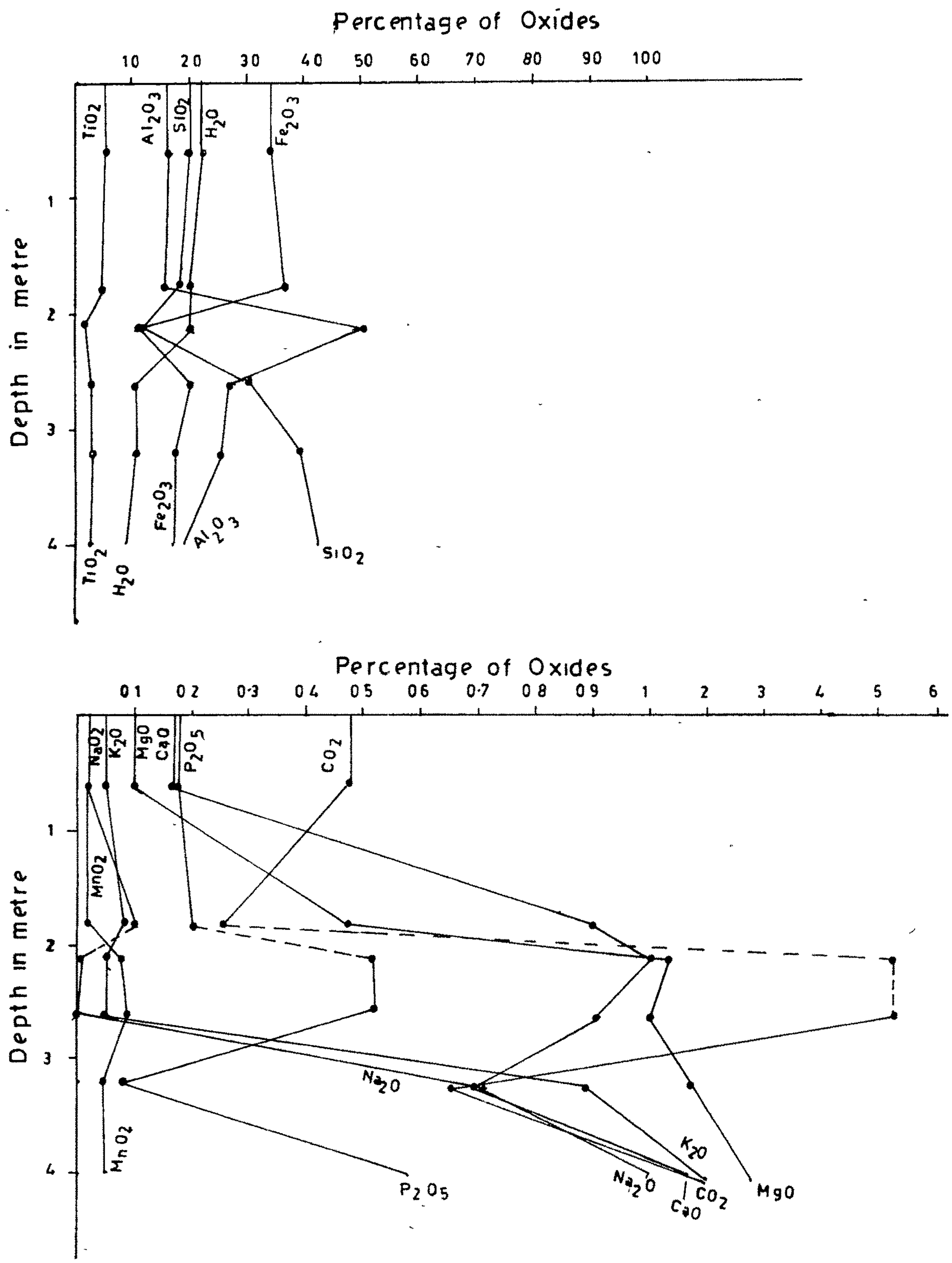


FIG. 77

VARIATION OF TRACE ELEMENTS IN LATERITE PROFILE AT **NUNDATAR** VILLAGE, ABDASA TALUKA KUTCH DIST.

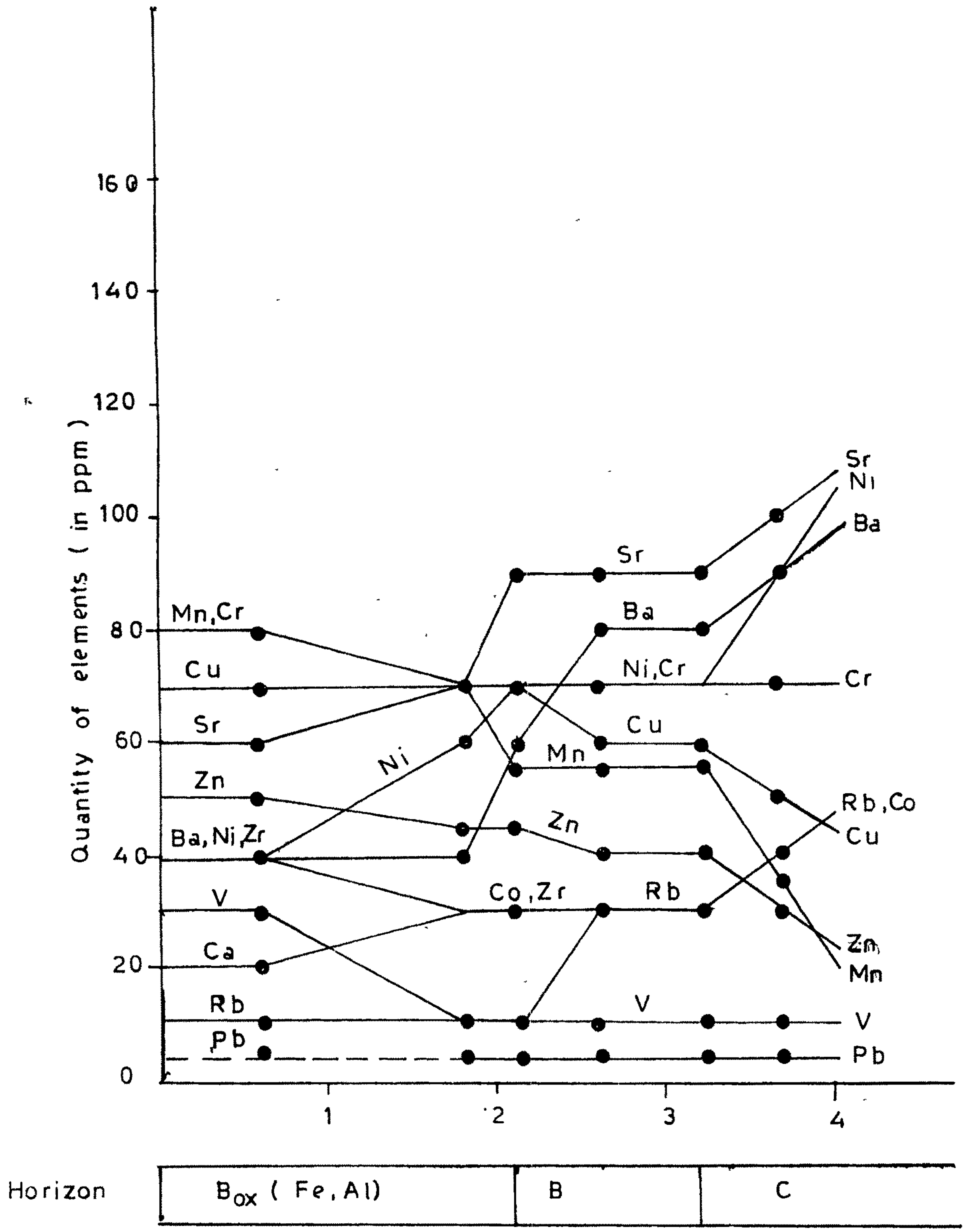


FIG 7B

Table 41

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL

Taluka ABDASA Village· MUNDATAR
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of weathered profile . 190 m

Depth	0-0 6m	0 6-1.8m	1 8-2 1m	2 1-2 6m	2 6-3.2m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	B(Sap)	B(Sap)	Remarks
SiO_2	-58 21	-52.81	-69.92	-27.42	-7.80	Lost throuhout the profile with maximum mobility in the Box horizon
Al_2O_3	-29 46	-21 12	154 69	38 26	28 00	Two top horizons of depletion with an underlying Box(Alu) zone of gain maxima followed by other zones of minor gains
Fe_2O_3	75 77	112 64	-33 64	20 00	-	Mid-profile Box(Alu) zone of loss with an overlying zone of gain maximum and with an underlying minor zone of gain
TiO_2	74 68	70.81-		33 80	20 94	Overall gain with two top horizons showing gain maximum
MnO_2	-35 00	-60 00	60 00	80 00	-	Two top horizons show losses,followed by two zones of gain with the bottom one showing a maximum.
CaO	-90 56	-46 10	-40 11	-45 50	-58 69	Lost throughout the profile with the top and bottom horizons showing maximum mobility
MgO	-96 73	-82 46	-52 45	-61 94	-34 33	Lost throughout the profile with mobility increasing higher in the profile
K_2O	-97 73	-96 37	T	-97 40	-53 89	Lost throughout the profile with mobility increasing higher in the profile
Na_2O	-98 25	-90 00	T	-90 00	-29 00	Shows same mobility as K_2O
P_2O_5	-73 90	-64 91	T	-8 77	-87 71	Lost throughout the profile with maximum mobility shown by the top and bottom zones
Ba	-61 11	-55.55	-33 33	-11 11	-11 11	Lost throughout with increasing mobility higher in the profile
Cu	22 50	40 00	40 00	20 00	20 00	Gains throughout with a maximum in the mid-profile
Rb	-78.12	-75 00	-75.00	-25 00	-25 00	Lost steadily upwards, with maximum mobility in the upper zones.
Sr	-47 50	-30 00	-10 00	-10 00	-10 00	Steady loss with maximum mobility in the upper horizons.
Zn	45 83	50 00	50 00	33 33	33 33	Steady gain higher in the profile
Pb	T	T	T	-	-	-
Mn	100 00	100 00	30 50	30 50	30 50	Steady gain upwards with a maximum in the top horizons
Cr	-	-	-	-	-	-
Ni	-61 11	-14 28	-22.22	-22 22	-22 22	Steady loss upwards with a maximum mobility in the top horizon.
Co	-50 00	-25 00	-25 00	-25 00	-25 00	Shows same mobility as Ni
V	162 50	-	-	-	-	

Table 42

Abdasa Taluka. (LST)

Balachor (in percent)

Depth	0m-0.9m	0.9m-1.6m	1.6m-2.9m	2.8m-3.2m	3.2m-
Horizon	Box	Box	Box	C	C
	Ferricrete	Ferricrete	Alucrete	Basalt	Basalt
SiO_2	31.70	25.30	31.50	40.30	47.29
Al_2O_3	18.70	22.00	56.70	22.50	21.12
Fe_2O_3	32.37	27.60	2.22	17.30	17.58
TiO_2	4.10	3.56	4.15	3.03	.29
MnO_2	.01	.15	.01	.05	.13
CaO	.15	.36	.46	1.13	.53
MgO	.21	.40	.15	2.28	.77
K_2O	.02	.03	.28	.76	.01
Na_2O	.01	.03	.57	.36	.12
P_2O_5	.12	.13	.22	.22	.02
CO_2	.28	13.10	1.02	1.15	.41
H_2O	23.23	8.16	13.03	10.70	12.08
Total	110.90	100.82	120.31	99.78	100.35

Trace Elements (in ppm.)

Ba	20	20	30	30	50
Cu	80	80	60	60	40
Rb	10	10	20	30	50
Sr	ND.	ND.	ND.	ND.	ND.
Zn	40	50	55	60	70
Pb	T	T	40	40	40
Mn	80	70	60	60	50
Cr	60	60	60	60	60
Ni	40	60	80	80	90
Co	100	120	120	120	130
V	5	5	5	5	5
Zr	30	30	20	10	T

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **BALACHOR** VILLAGE, ABDASA TALUKA, KUTCH DISTRICT

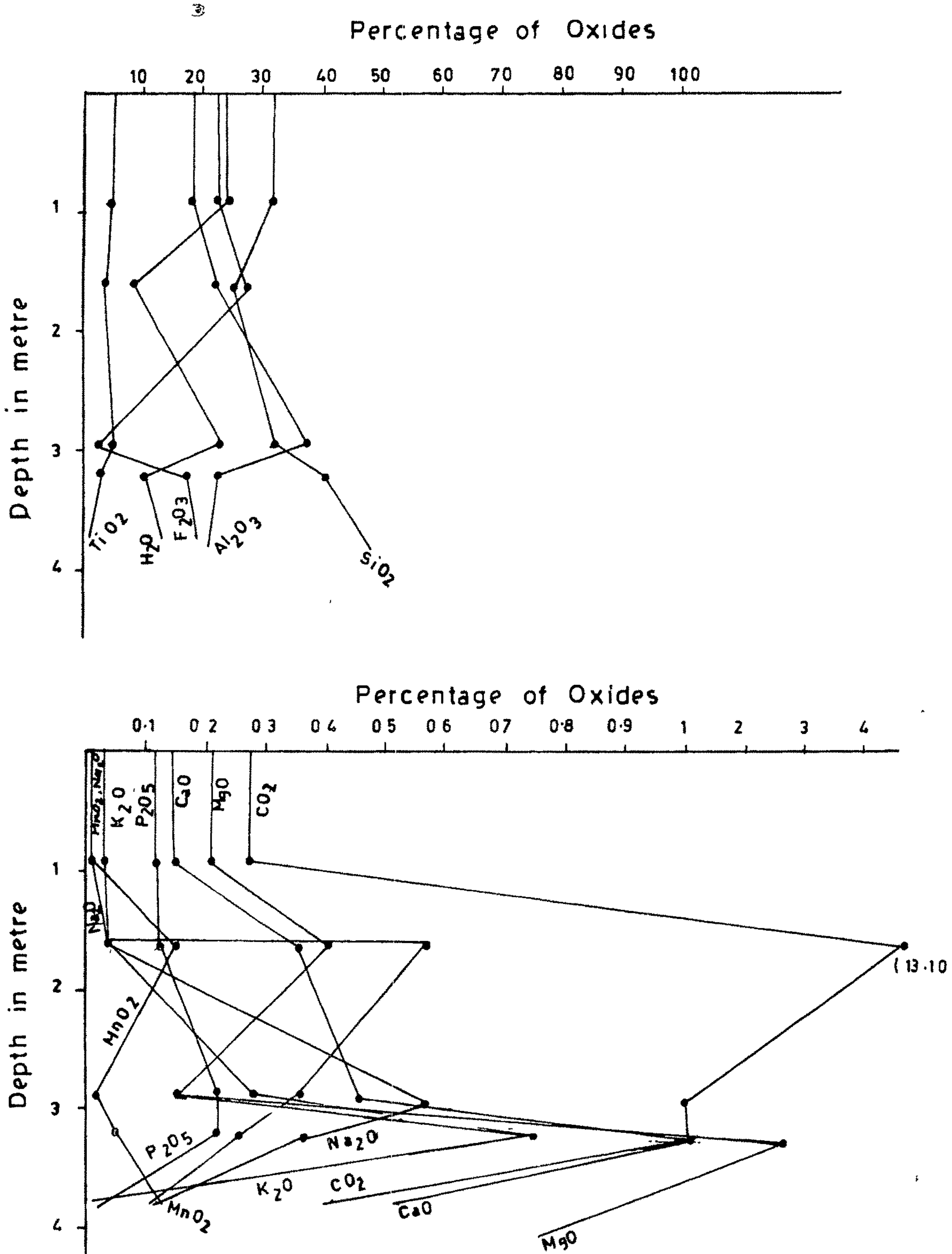
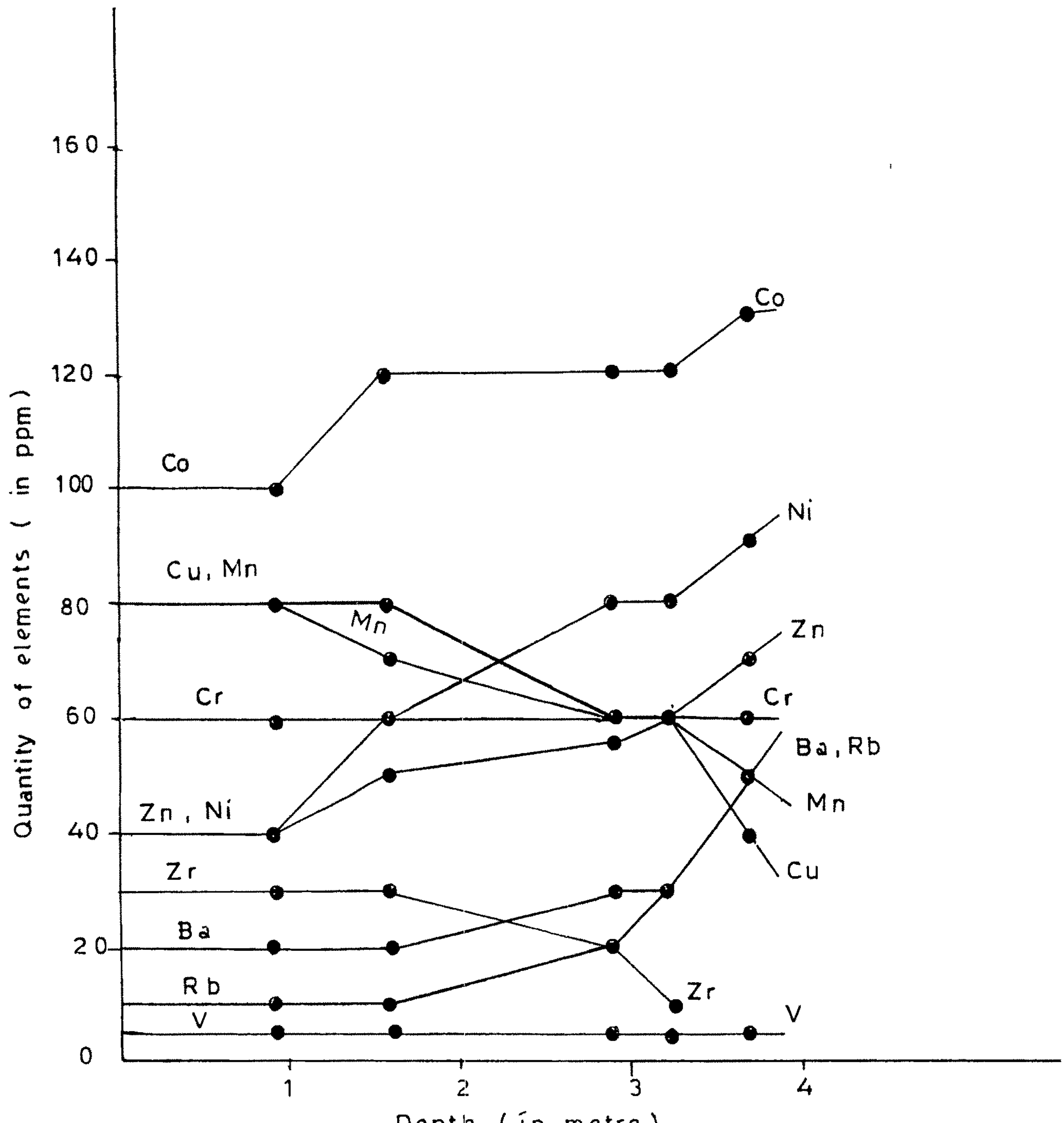


FIG. 79

VARIATION OF TRACE ELEMENTS IN LATERITE PROFILE. AT **BALACHOR** VILLAGE, ABDASA TALUKA KUTCH DIST.



Horizon	B_{ox} (Fe, Al)	C

FIG 80

Table 43

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL.

Taluka ABDASA Village BALACHOR
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile 160 m

Depth	0-0 9m	0 9-1 6m	1 6-2 9m	2 9-3 2m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	C(Bas)	Remarks
SiO_2	-32.96	-46 50	-33 38	-14 78	Lost throughout the profile with a top horizon mobility maximum
Al_2O_3	-11 45	4 16	168.46	6 53	Top horizon of losses with a mid-profile gain maximum in the Box(Alu) horizon
Fe_2O_3	84 12	57 11	-87 37	1 59	Botton horizons of losses with overlying zones of gains
TiO_2	1313 79	1127 58	1331.03	944 82	Enormous gains throughout the profile.
MnO_2	-92 30	15 38	-92 30	-61 53	Top and bottom horizons of losses with a mid-profile Box(Fer) zone of gain
CaO	-71 60	32 07	-13 20	113 20	Top and mid-profile zones of losses with a bottom horizon of gain Maximum mobility in the top horizon
MgO	-72 72	-46.05	-80 51	196 10	Top and mid-profile zones of losses with a bottom horizon of gain
K_2O	100 00	200 00	2700 00	7500 00	All round gains with maxima in the Box(Alu) and C horizons
Na_2O	-91 66	-75 00	375 00	200 00	Top horizons show losses with gains in the two bottom horizons
P_2O_5	500 00	550 00	1000 00	1000 00	Overall gains in the profile with maxima in the two bottom horizons
Ba	-60 00	-60 00	-40 00	-40 00	Lost throughout the profile with increasing mobility in the two top horizons
Cu	100 00	160 00	50 00	50 00	Overall gain with maxima in the two top horizons
Rb	-80 00	-80.00	-60 00	-40 00	Overall losses throughout the profile increasing higher in the profile
Sr	-	-	-	-	-
Zn	-42 85	-28.57	-21 42	-14.28	Overall loss with increasing mobility higher in the profile
Pb		-	-	-	-
Mn	60 00	40 00	20 00	20 00	Overall gain which increases higher in the profile
Cr		-	-	-	-
Ni	-61 90	-42.85	-23 80	-23 80	Overall losses with increasing mobility higher in the profile
Co	-23 07	-7 69	-7 69	-7 69	Mobility same as Co
V	-	-	-	-	-
Zr	1800 00	1800 00	1200 00	600.00	Overall gains which increase higher in the profile.

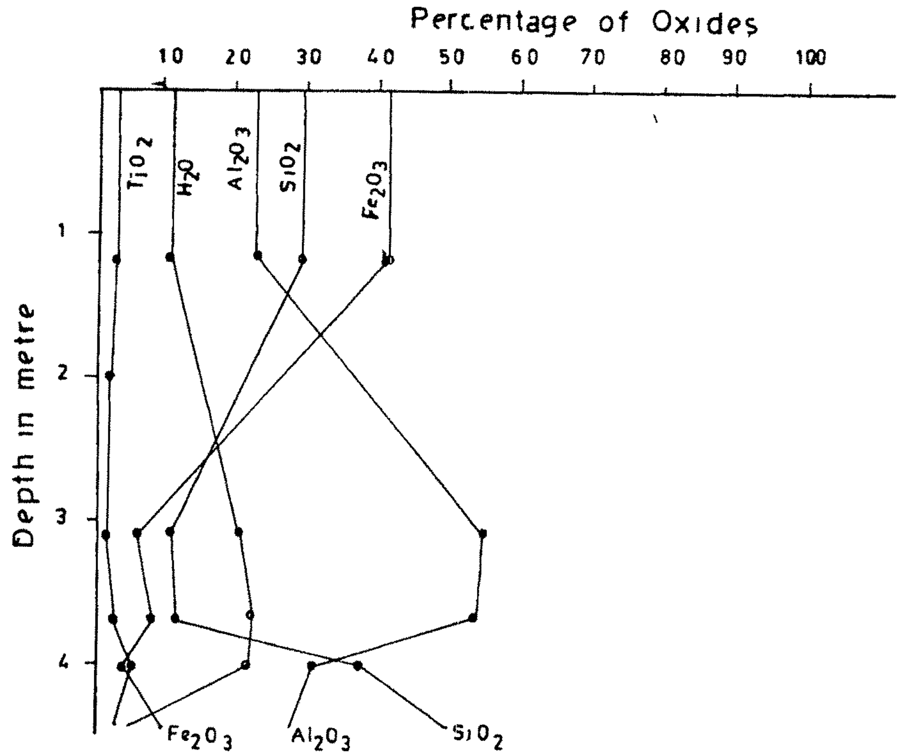
Table 44

Abdasa Taluka (LST)

Wamoti

Depth	0.0m-1.2m	1.2m-3.1m	3.1m-3.7m	3.7m-4m	4m-
Horizon	Box	Box	Box	B	C
	Ferricrete	Alucrete	Alucrete	Saprolite	Basalt
Major Oxides					
SiO_2	28.89	10.89	11.60	37.60	49.80
Al_2O_3	22.68	54.40	53.90	30.80	27.80
Fe_2O_3	40.08	6.00	8.00	4.10	9.80
TiO_2	3.58	3.42	2.90	4.80	3.60
MnO_2	.38	.03	.02	.01	T
CaO	.02	.60	.42	.32	1.02
MgO	1.16	.92	.76	.10	1.00
K_2O	.03	.64	.54	.08	.90
Na_2O	.05	.41	.38	T	.80
P_2O_5	.08	.72	T	.18	.34
CO_2	.18	1.00	1.14	.44	1.98
H_2O	10.18	20.08	20.21	21.90	4.98
Total	107.31	99.11	99.87	100.33	102.00
Trace Elements			(in ppm.)		
Ba	30	40	45	45	80
Cu	70	60	50	50	40
Rb	15	15	15	20	35
Sr	20	125	150	180	130
Zn	T	T	T	T	T
Pb	45	35	30	30	20
Mn	80	70	50	40	30
Cr	95	70	70	35	20
Ni	100	120	120	130	120
Co	T	T	T	T	T
V	20	10	5	5	5
Zr	20	20	10	5	5

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT WAMOTI (MOTI) VILLAGE, ABDASA TALUKA, KUTCH DISTRICT



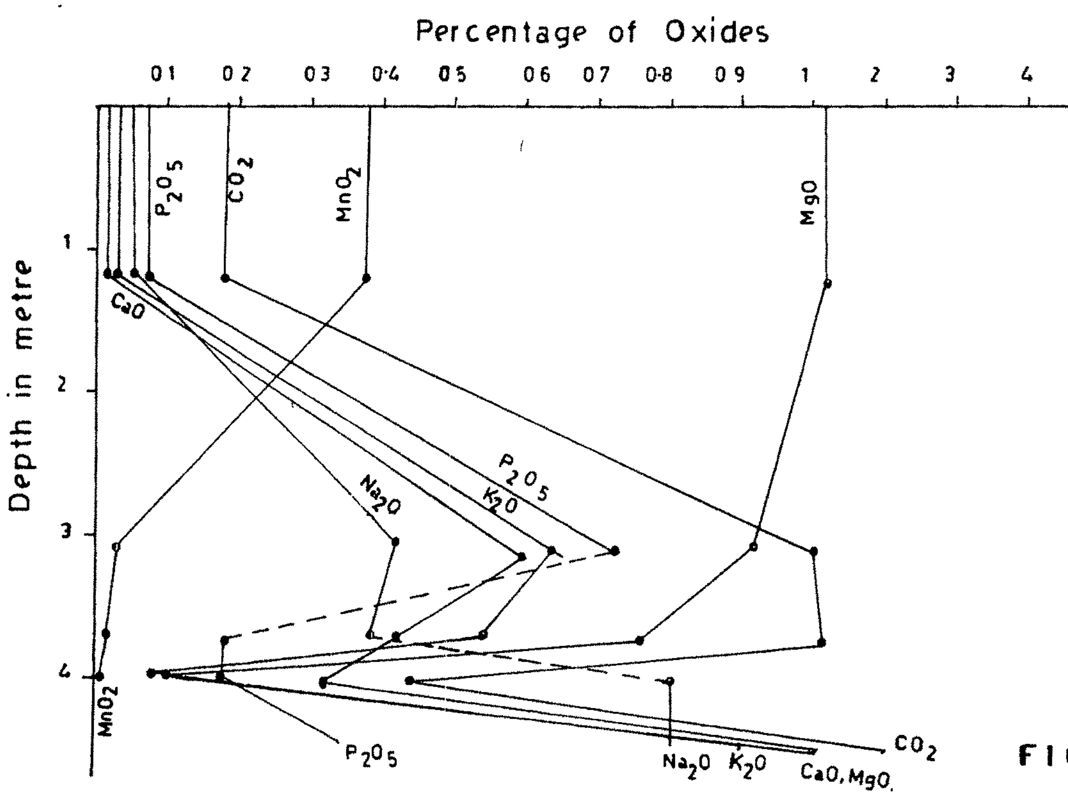


FIG. 81

VARIATION OF TRACE ELEMENTS IN THE LATERITE PROFILE AT WAMOTI VILLAGE, ABDASA TALUKA KUTCH DISTRICT.

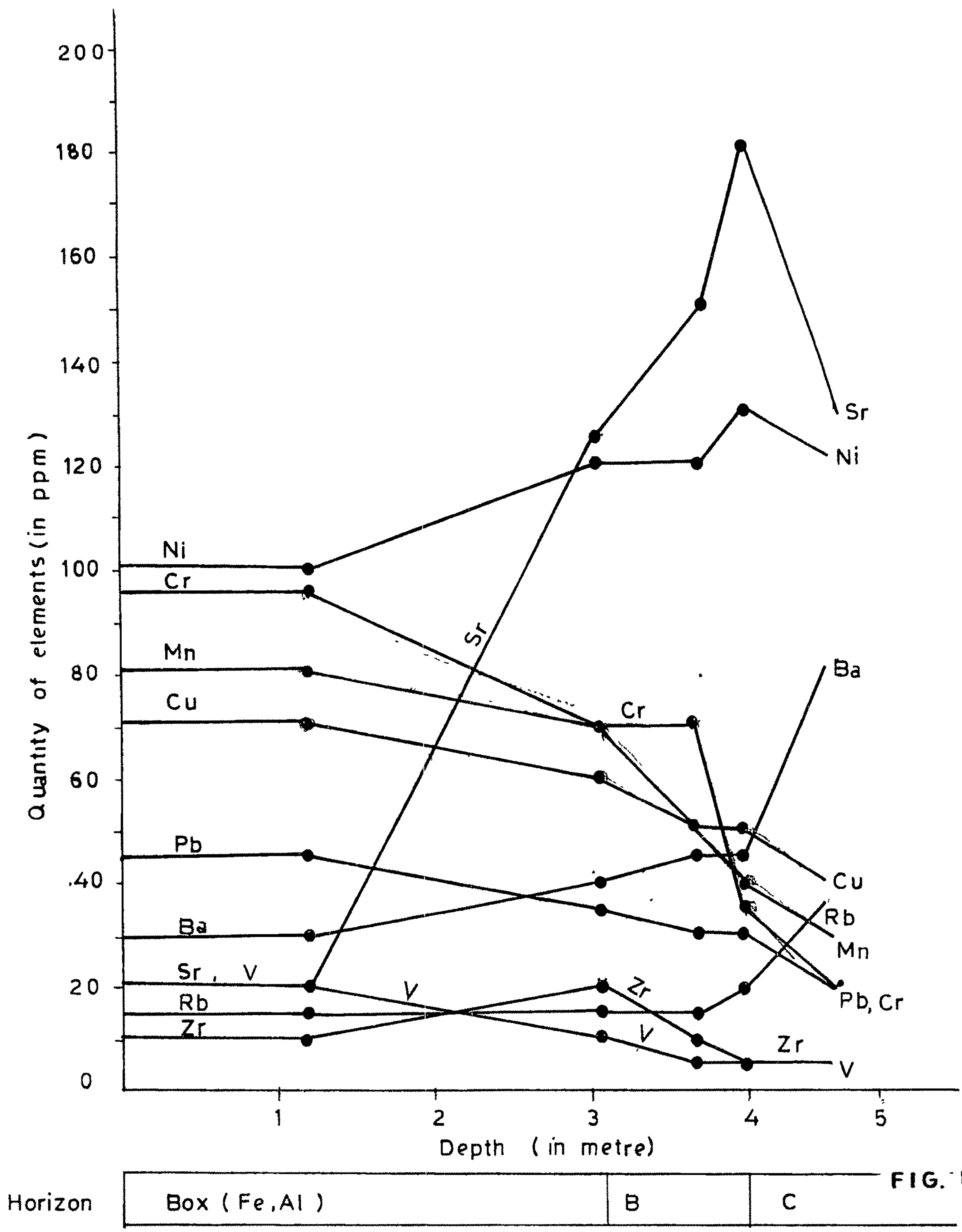


FIG. 8.2

Table 45

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL

Taluka ABDASA Village. WANOTI
LST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile . 180 m

Depth	0-1 2m	1.2-3.1m	3 1-3.7m	3 7-4m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	B(Sap)	Remarks
SiO_2	-87 78	-93 75	-93.34	-56.85	Overall loss throughout the profile.
Al_2O_3	-82 82	44.09	44 60	36 69	Top horizon of loss with three bottom horizons of gains
Fe_2O_3	13 89	-82.50	-76.67	-76 09	Top horizon of gain with bottom depleted zones
TiO_2	-79 00	-83 19	-88 23	-82 07	Overall loss throughout the profile.
MnO_2	-	-	-	-	-
CaO	-99 56	-83 19	-88.23	-82 07	Overall loss throughout the profile.
MgO	75.57	-73 71	-78.28	-94 28	Top horizon of gain with bottom depleted zones.
K_2O	-99 29	-79 68	-82.85	-94 92	Overall loss throughout the profile.
Na_2O	-98 68	-83 35	-86 84	-	Displays same mobility as K_2O.
P_2O_5	-95.04	39 49	-	-69 74	Top and bottom horizons of depletion with mid-profile gain
Ba	-92 10	-85.71	-83.92	-96 70	Overall loss throughout the profile.
Cu	63 15	57 14	64.28	28.57	Overall gain with a maximum in the Box.
Rb	-90.97	-87.75	-87.75	-67.34	Overall loss with mobility increasing higher in the profile.
Sr	-96.76	-72.52	67.03	20 87	Top Horizons of depletion with underlying zones of gain.
Zn	-	-	-	-	-
Pb	52.63	50.00	57.14	14.28	Overall increase with a maximum in the Box zone.
Mn	43 65	33 33	52 38	23 80	Overall gain with a mid-profile maximum.
Cr	-	-	-	-	-
Ni	-82.45	71.42	71.42	38.09	No fixed pattern observed.
Co	-	-	-	-	-
V	15.78	42 85	28.57	42.85	Increase higher in the profile.
Zr	15.78	186.71	42 85	42.85	Increase higher in the profile, with a mid-profile maxima

Table 46

Abdasa Taluka	X-ray data	Box - Ferricrete
Wamoti :-	LST Type Section	

2(0)	(d) Spacing (Ao)	Intensity % Observed Io	Intensity % Calculated Ic	Remark
25.10	3.5493	7.00	31.82	Kaolinite
26.40	3.3752	7.00	31.82	Kaolinite
26.80	3.3272	12.50	56.82	Quartz
27.90	3.1974	10.50	47.73	Maghemite
28.60	3.1211	4.00	18.18	Gibbsite
36.40	2.4695	15.50	70.46	Lepidocrocite
36.70	2.4296	11.00	50.00	Diaspore
37.50	2.3978	22.00	100.00	Gibbsite
39.20	2.2978	4.00	18.18	Kaolinite
40.00	2.2541	9.00	40.91	Kaolinite
41.60	2.1709	8.00	36.36	Gibbsite
44.00	2.0579	14.50	65.91	Sphene
45.30	2.0018	13.00	59.09	Geothite

Table 47

Abdasa Taluka X-ray data Box - Alucrete

Wamoti :- LST Type Section

2(0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
12.40	7.138	4.00	4.08	Kaolinite
14.50	6.0605	10.00	10.20	Boehmite
18.30	4.8484	98.00	100.00	Gibbsite
20.30	4.3677	11.00	11.22	Gibbsite
20.60	4.3115	5.00	5.10	Gibbsite
24.90	3.5773	3.50	3.57	Kaolinite
25.40	3.5073	7.00	7.14	Anatase
26.60	3.3517	1.50	1.53	Quartz
26.90	3.3114	2.00	2.04	Quartz
28.20	3.1646	6.00	6.12	Boehmite
29.50	3.0279	1.50	1.53	Calcite
36.70	2.4489	4.00	4.08	Geothite
37.20	2.4166	6.00	6.12	Gibbsite
37.80	2.3845	5.50	5.61	Anatase
38.40	2.3439	5.00	5.10	Boehmite
44.20	2.0492	3.00	3.06	Gibbsite
45.50	1.9935	3.00	3.06	Gibbsite
50.60	1.8037	3.00	3.06	Quartz
52.30	1.7493	3.50	3.57	Maghemetic

Table 48

Abdasa Taluka	X-ray data	Box - Alucrete

Wamoti :- LST Type Section

2(0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
20.40	4.3529	64.00	100.00	Kaolinite
25.40	3.5073	11.00	17.18	Anatase
26.70	3.3387	10.00	15.63	Gibbsite
27.00	3.3029	21.00	32.81	Gibbsite
28.10	3.1724	13.00	20.31	Bohemite
28.80	3.997	5.00	7.81	Kaolinite
29.60	3.0184	3.00	4.39	Calcite
31.80	2.8135	3.00	4.39	Calcite
36.70	2.4489	30.00	46.88	Gibbsite
37.20	2.4166	12.00	18.75	Gibbsite
37.80	2.3801	33.00	51.56	Gibbsite
39.50	2.2814	6.00	9.38	Hematite
40.30	2.2377	11.00	17.19	Maghemite
41.80	2.1612	15.00	23.49	Gibbsite
44.30	2.0448	23.00	35.94	Gibbsite
45.60	1.9894	20.00	31.25	Kaolinite
47.50	1.9143	13.00	20.31	Kaolinite
48.00	1.8955	3.00	4.69	Kaolinite
50.70	1.8008	19.00	29.69	Quartz
52.30	1.7493	19.00	29.69	Gibbsite

Table 49

Abdasa Taluka X-ray data B-Kaolinite

Wamoti :- LST Type Section

2(0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
19.95	4.4509	28.00	100.00	Kaolinite
24.20	3.6733	18.00	64.28	Kaolinite
24.40	3.6437	26.00	92.85	Goethite
24.60	3.614	20.00	71.42	Kaolinite
25.50	3.4956	3.00	10.71	Maghemite
25.80	3.449	4.00	14.28	Nontronite
26.50	3.3634	24.00	85.71	Maghemite
27.40	3.2512	26.00	92.85	Nontronite
31.80	2.8135	3.00	10.71	Calcite
32.60	2.7435	10.00	35.71	Maghemite
33.90	2.6412	11.00	39.28	Nontronite
34.10	2.6261	9.00	32.14	Kaolinite
34.50	2.5966	10.00	35.71	
35.50	2.5284	11.00	39.28	Kaolinite
39.40	2.2842	8.00	28.57	Anatase
39.80	2.2622	4.00	14.28	Goethite
40.50	2.2247	6.00	21.42	Beidellite
40.70	2.2142	6.00	21.42	Kaolinite
45.60	1.9894	5.00	17.85	Kaolinite
46.90	1.9374	10.00	35.71	Kaolinite

Table 50

Abdasa Taluka X-ray data C - Basalt

Wamoti :- LST Type Section

2(0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
18.60	4.7647	84.00	100.00	Quartz
19.90	4.4563	42.00	50.00	Quartz
21.30	4.1685	10.00	11.90	Nontronite
22.20	3.9907	9.00	10.70	Diaspore
23.80	3.7344	8.00	9.50	Ilmenite
26.60	3.3409	6.00	7.10	Quartz
27.50	3.2396	4.00	4.76	Sphene
28.00	3.1826	23.00	24.38	Maghemite
28.60	3.1174	6.00	7.14	Maghemite
29.00	3.0753	25.00	29.76	Nontronite
31.00	2.8813	8.00	9.52	Ilmenite
32.60	2.7435	9.00	10.70	Maghemite
33.40	2.6796	15.00	17.85	Sphene
34.50	2.596	10.00	11.90	
35.10	2.5536	8.00	9.50	Rutile
36.10	2.4851	6.00	7.10	Lepidocrocite
38.10	2.3021	18.00	21.40	Augite
39.20	2.2954	16.00	19.05	Rutile
40.20	2.2379	16.00	19.05	Maghemite

X-RAY DIFFRACTION TRACES OF VARIOUS HORIZONS OF LATERITIC PROFILE AT WAMOTI (ABDASA TALUKA) LST Type Section.

Depth in meter	Horizon	Dominating minerals
0–I.2m	Box – Ferricrete	Kaolinite Maghemite Lepidocrocite Goethite Gibbsite Quartz Sphene
I.2–3.Im	Box–Alucrete	Gibbsite Bohemite Kaolinite Quartz Goethite Maghemite Anatase Calcite
3.I–3.7m	Box–Alucrete	Gibbsite Kaolinite Bohemite Calcite Anatase Maghemite Hematite
3.7–4m	B–Kaolinite	Kaolinite Nontronite Beidellite Maghemite Goethite Anatase Calcite
4– m	C–Basalt	Maghemite Nontronite Lepidocrocite Quartz Sphene Rutile Ilmenite

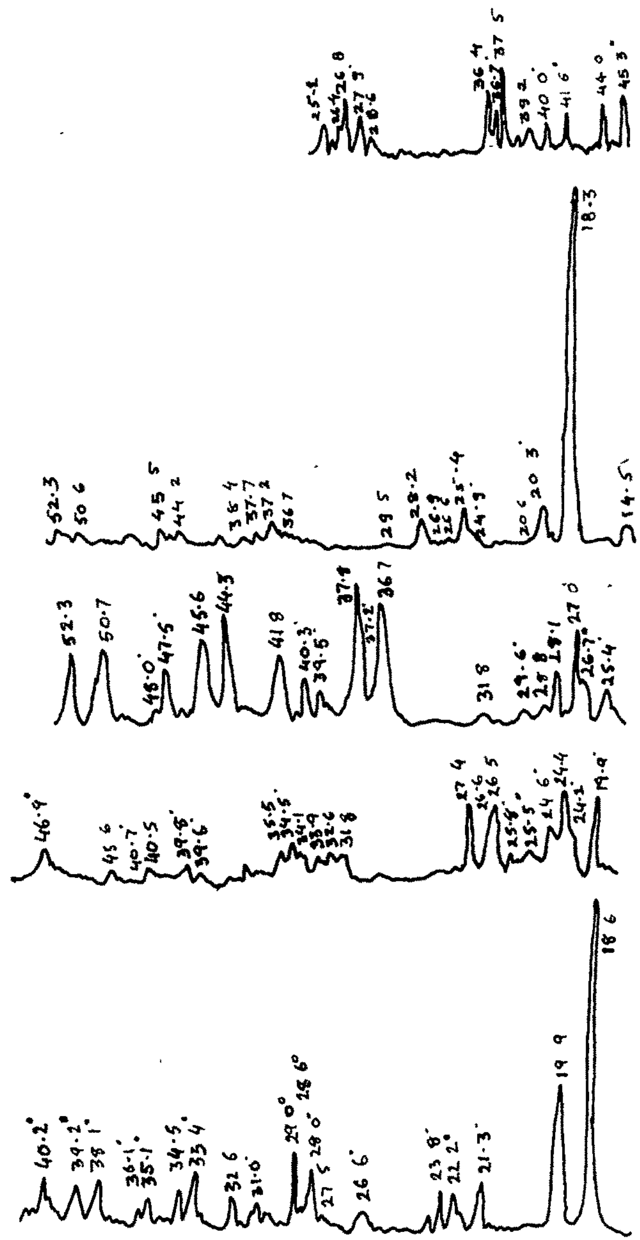


FIG. 83

Table 51

Abdasa Taluka

Namoti (Nani) :-

Depth	0-1.6m	1.6m-
Horizon	Box	Box
	Ferricrete	Alucrete
SiO_2	24.83	19.40
Al_2O_3	19.56	48.60
Fe_2O_3	36.20	2.38
TiO_2	3.66	3.14
MnO_2	.90	.02
CaO	.01	.86
MgO	1.78	.20
K_2O	.01	.30
Na_2O	.05	.48
P_2O_5	.22	T
CO_2	.76	.89
H_2O	12.03	32.89
Total	100.01	109.16

In percent

Table 52

Adbasa Taluka

Khappar :-

Depth	0-0.9m	0-9-1.6m	1.6m-2.2m	2.2m-
Horizon	Box	Box	Box	Box
	Ferricrete	Ferricrete	Alucrete	Alucrete
SiO_2	16.83	15.83	20.16	26.84
Al_2O_3	21.33	18.56	44.90	36.76
Fe_2O_3	38.29	39.21	9.00	19.82
TiO_2	3.32	3.70	2.90	2.60
MnO_2	.28	.90	.02	.02
CaO	.01	.01	.42	.36
MgO	.15	.78	.76	.68
K_2O	.02	.01	.54	.46
Na_2O	.02	.03	.38	.32
P_2O_5	.04	T	T	.64
CO_2	.21	.76	1.14	1.04
H_2O	20.14	20.30	20.21	11.02
Total	100.64	100.39	100.43	100.56

In percent

Table 53

Abdasa Taluka

Boha :-

Depth	0-1.2m	1.2m-1.6m	1.6m-
Horizon	Box	B	C
	Alucrete	Saprolite	Trap basalt
SiO_2	14.96	40.50	46.85
Al_2O_3	50.70	12.07	21.04
Fe_2O_3	14.95	16.00	16.88
TiO_2	3.15	.98	.29
MnO_2	.02	.33	.11
CaO	1.21	1.00	.29
MgO	.22	6.13	4.01
K_2O	.24	.01	.01
Na_2O	T	.04	.11
P_2O_5	.16	.06	.02
CO_2	1.76	2.88	.87
H_2O	13.20	20.06	9.87
Total	100.57	100.06	100.35

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT BOHA VILLAGE, ABDASA TALUKA, KUTCH DISTRICT.

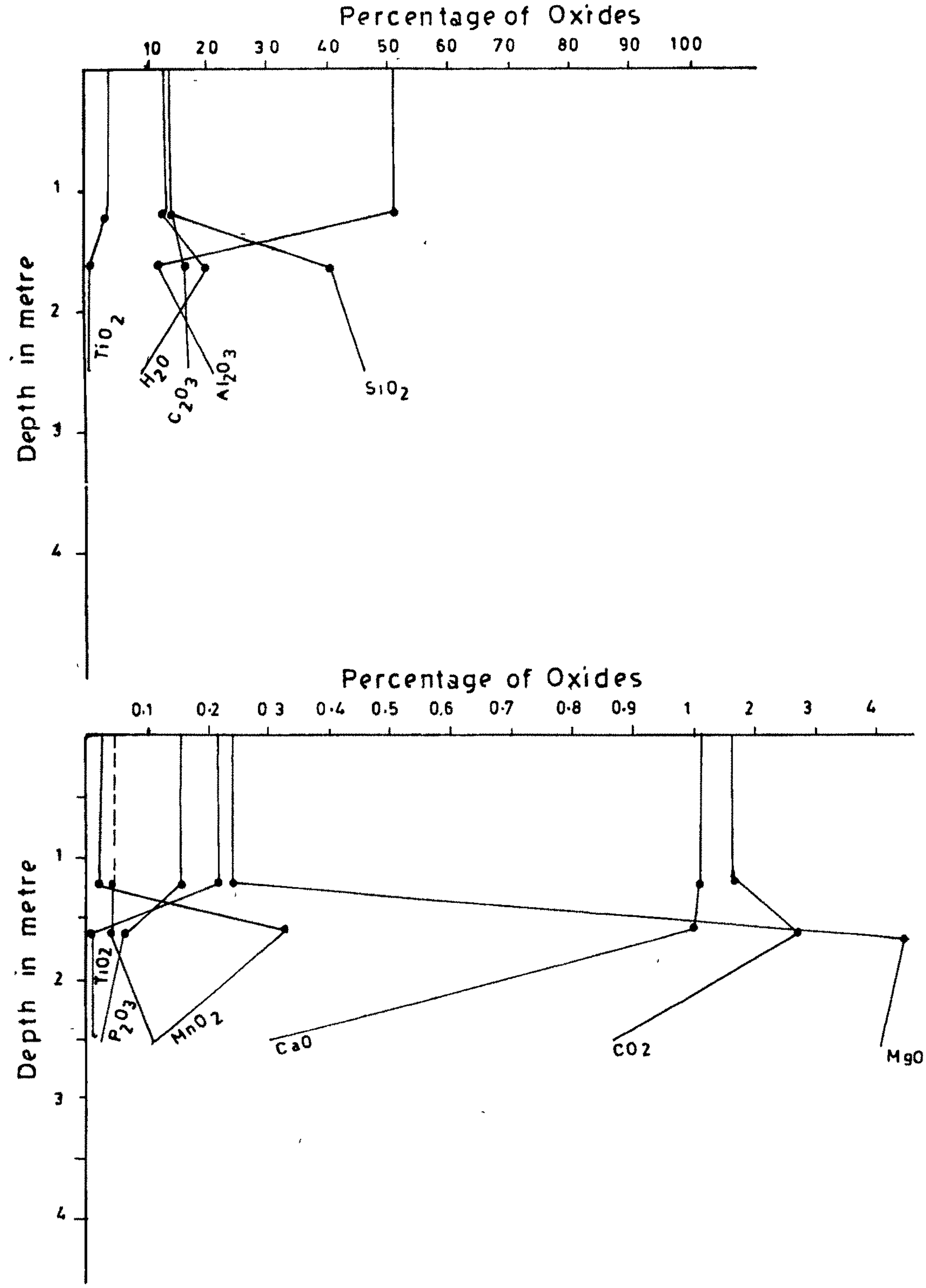


FIG 84

Table 54

Nakhatrana Taluka

Khanai :-

Depth	0-0.9m	0.9m-1.4m	1.4m-2.1m
Horizon	Box	Box	Box
	Ferricrete	Ferricrete	Ferricrete
SiO_2	38.11	28.11	27.97
Al_2O_3	12.57	11.42	11.96
Fe_2O_3	39.22	40.42	40.30
TiO_2	2.68	1.68	1.80
MnO_2	.55	.40	.50
CaO	.06	.12	.09
MgO	4.53	3.47	4.02
K_2O	.02	.04	.05
Na_2O	.06	.07	.09
P_2O_5	.14	.25	.16
CO_2	6.00	.98	.92
H_2O	.00	10.12	11.02
Total	103.94	97.08	98.88

In percent

Table 55

Lakhpat Taluka

Jhulrai :-

Depth	0-0.6m	0.6m-0.9m	0.9m-2.4m	2.4m-
	Ferricrete	Ferricrete	Alucrete	Saprolite Bentonite
SiO_2	30.11	28.96	24.80	28.60
Al_2O_3	9.57	10.92	52.50	47.80
Fe_2O_3	40.21	40.96	3.86	4.01
TiO_2	2.59	1.97	2.08	2.98
MnO_2	.67	.04	.03	.03
CaO	.05	5.21	.42	.38
MgO	.64	.42	.29	.20
K_2O	.02	.21	.30	.29
Na_2O	.05	.41	.52	.61
P_2O_5	.12	.21	.26	.19
CO_2	1.10	1.97	2.03	1.80
H_2O	13.09	12.62	13.69	14.00
Total	98.22	103.90	100.78	100.89

In percent

Table 56

Lakhpat Taluka

Saran :-

Depth	0-0.9m	0.9m-1.2m	1.2m-2.8m	2.8m-3.6m	3.6m-
Horizon	Box	Box	Box	Box	B
	Ferricrete	Ferricrete	Alucrete	Alucrete	Saprolite Bentonite
SiO_2	13.10	10.90	2.59	4.69	38.80
Al_2O_3	18.80	15.40	52.16	51.06	31.70
Fe_2O_3	39.50	44.06	11.04	12.64	10.80
TiO_2	4.11	2.11	2.01	2.97	4.20
MnO_2	.59	.62	.71	1.02	.01
CaO	.62	.70	.61	.63	.27
MgO	.00	.09	1.02	1.09	.31
K_2O	.07	.69	1.03	.97	.13
Na_2O	.00	.00	.00	.00	.14
P_2O_5	.21	.26	.30	.50	.04
CO_2	1.65	1.42	1.32	1.52	3.45
H_2O	21.97	21.97	31.60	30.56	10.45
Total	100.62	98.22	104.39	107.65	100.30

In percent

Table 57

Lakhpat Taluka

Samajirao :-

Depth	0-1.6 m	1.6m-
Horizon	Box	Box
	Ferricrete	Ferricrete
SiO_2	18.11	20.10
Al_2O_3	12.57	12.92
Fe_2O_3	39.22	38.92
TiO_2	1.68	1.42
MnO_2	.55	.72
CaO	.21	.32
MgO	.53	.54
K_2O	.69	.59
Na_2O	.97	1.03
P_2O_5	.86	1.01
CO_2	1.69	1.69
H_2O	19.97	18.67
Total	97.05	97.93

In percent

Table 58

Lakhpat Taluka

Rato Talov :-

Depth	0-0.4 m	0.4-0.9 m	0.9-2.4m	2.4-3 m	3 m
Horizon	Box	Box	Box	B	C
	Ferricrete	Ferricrete	Alucrete	Saprolite Bentonite	Trap basalt
SiO_2	20.10	20.25	22.70	26.86	40.28
Al_2O_3	17.62	18.92	51.80	39.88	20.71
Fe_2O_3	30.29	28.19	3.00	13.80	19.89
TiO_2	3.21	2.15	3.89	3.62	1.90
MnO_2	.48	.59	.01	.20	.09
CaO	1.89	1.98	.96	.84	.52
MgO	1.72	1.96	.84	.91	.46
K_2O	1.70	1.20	.50	.38	.24
Na_2O	1.16	1.24	.47	.42	.41
P_2O_5	.46	.32	.36	.29	.26
CO_2	1.04	1.40	1.02	1.03	.89
H_2O	19.96	19.62	15.00	11.92	15.01
Total	99.63	97.82	100.55	100.15	100.66

In percent

VARITION OF MAJOR OXIDES IN THE LATERITE PROFILE AT RATO TALAV VILLAGE, LAKHPAT TALUKA, KUTCH DISTRICT

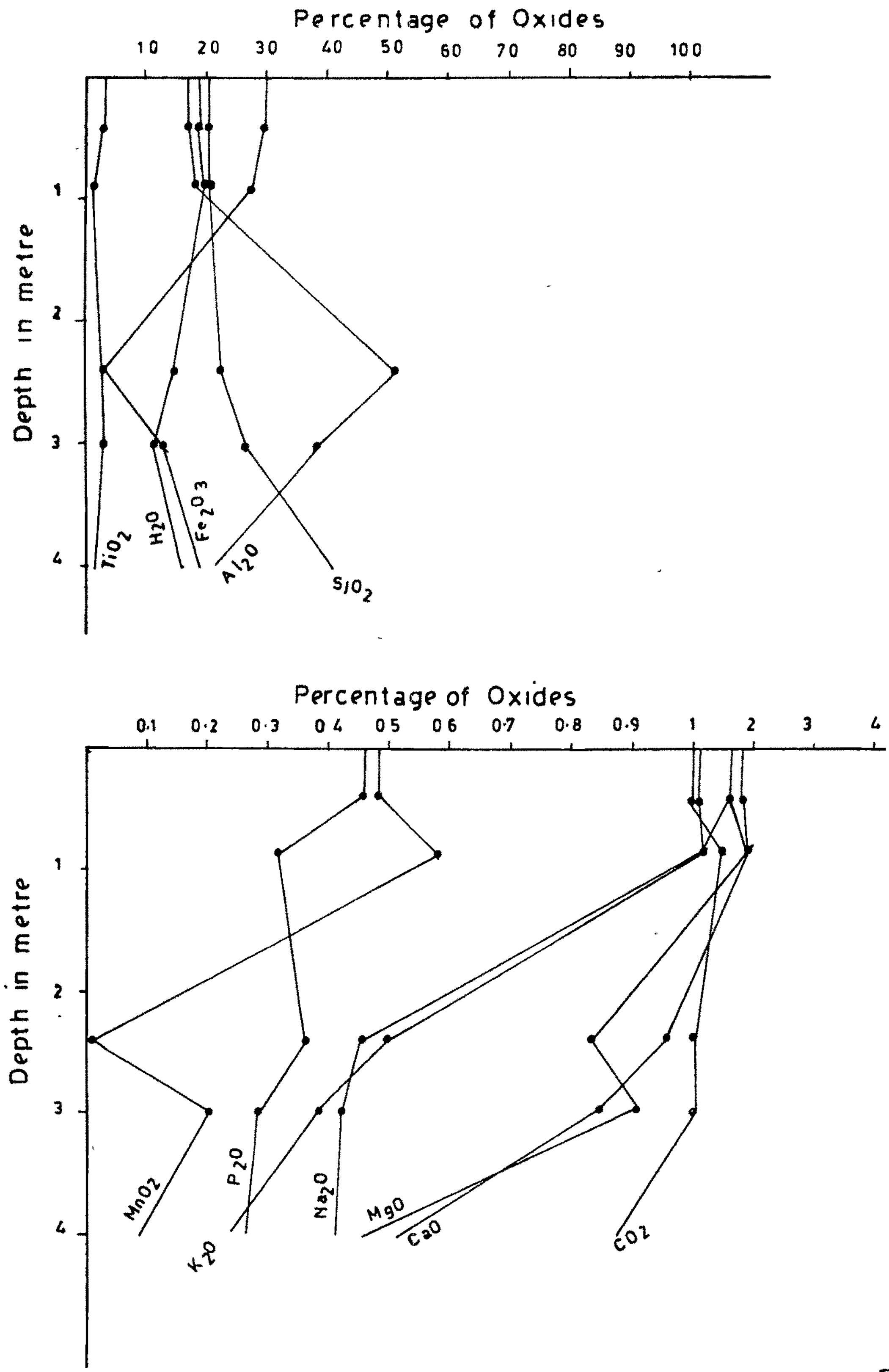


FIG. 8.5

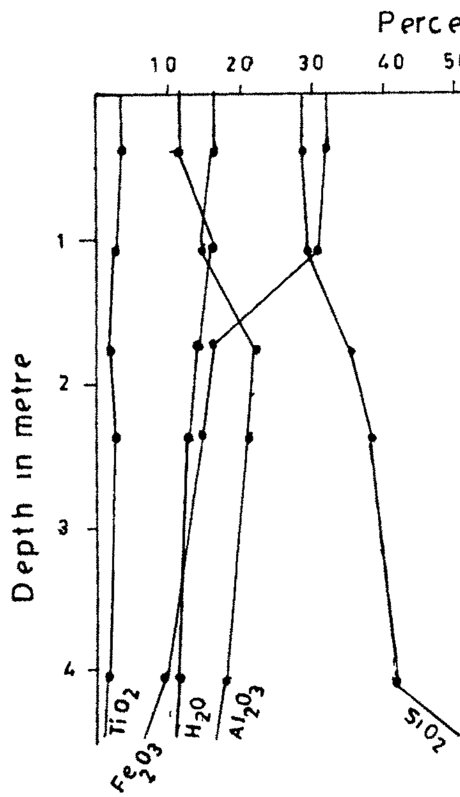
Table 59

Lakhpat Taluka (in percent)

Mata-No-Madh.

Depth	0.0m-0.4m	0.4m-1.1m	1.1m-1.8m	1.8m-2.4m	2.4m-4.2m	4.2m-
Horizon	Box	Box	B	B	B	C
	Ferricrete	Ferricrete	Saprolite Alucrete	Saprolite Kaolinite	Saprolite Bentonite	Basalt
Major Oxides						
SiO_2	29.10	29.25	35.25	38.25	46.25	51.46
Al_2O_3	16.62	14.92	22.68	20.90	18.23	16.02
Fe_2O_3	32.89	30.79	15.89	14.65	9.62	6.44
TiO_2	3.21	2.15	1.98	1.90	1.72	1.34
MnO_2	.48	.59	.68	.59	.69	.38
CaO	1.89	1.98	2.74	3.68	4.90	5.60
MgO	1.72	1.96	2.48	2.92	3.60	4.80
K_2O	1.90	1.20	2.48	2.92	1.80	1.80
Na_2O	1.16	1.24	1.46	1.62	-	-
P_2O_5	-	-	-	-	-	-
CO_2	-	-	-	-	-	-
H_2O	11.18	15.28	14.72	13.64	11.90	10.20
Total	100.15	99.36	99.24	99.56	100.41	100.34
Trace Elements					(in ppm.)	
Ba	20	20	20	40	40	60
Cu	80	70	60	60	60	40
Rb	5	10	10	20	20	20
Sr	25	30	30	45	45	55
Zn	50	45	45	40	40	30
Pb	T	T	T	T	T	T
Mn	60	50	45	45	45	25
Cr	90	80	80	80	80	80
Ni	50	70	80	80	80	100
Co	10	20	20	20	20	30
V	20	5	5	5	5	T
Zr	20	10	5	5	5	T

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE AT **MATA-NO-MADH** VILLAGE, LAKHPATH TALUKA, KUTCH DISTRICT.



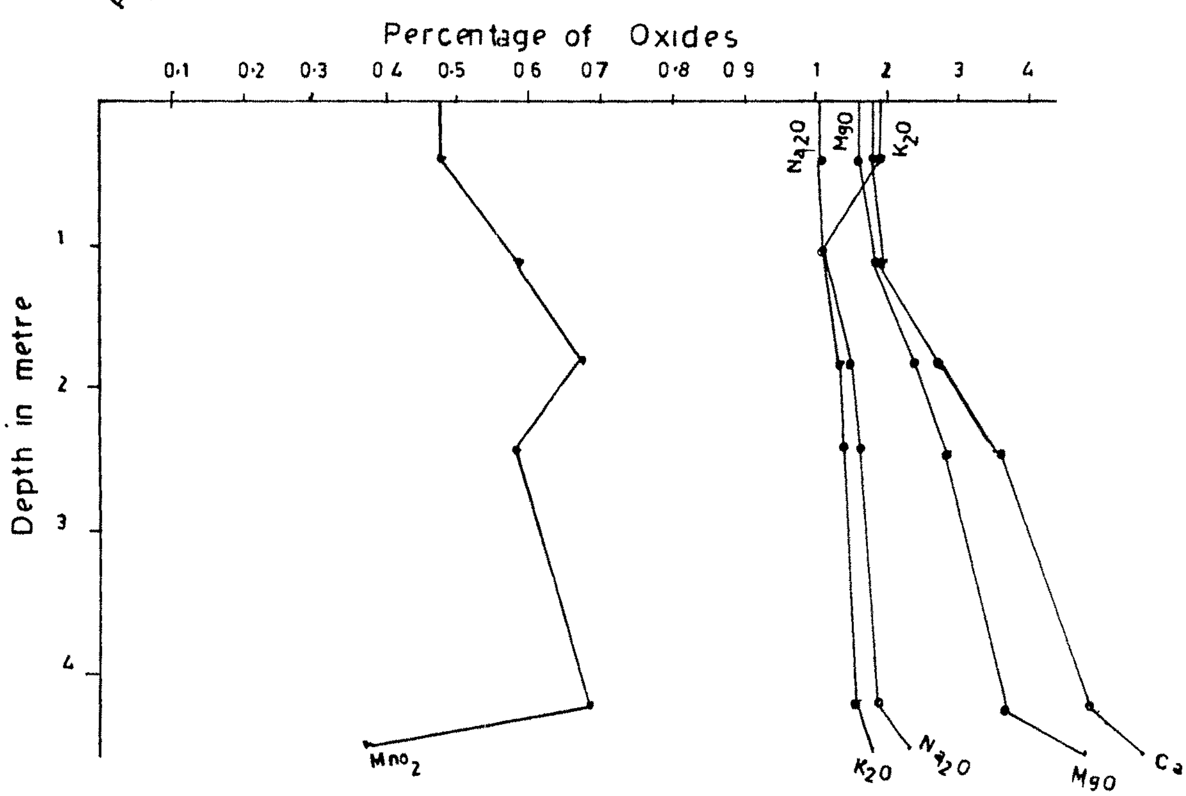


FIG. 86

VARIATION OF TRACE ELEMENTS IN THE LATERITE PROFILE AT **MATA-NO-MADH** VILLAGE, LAKHPAT TALUKA KUTCH DIST.

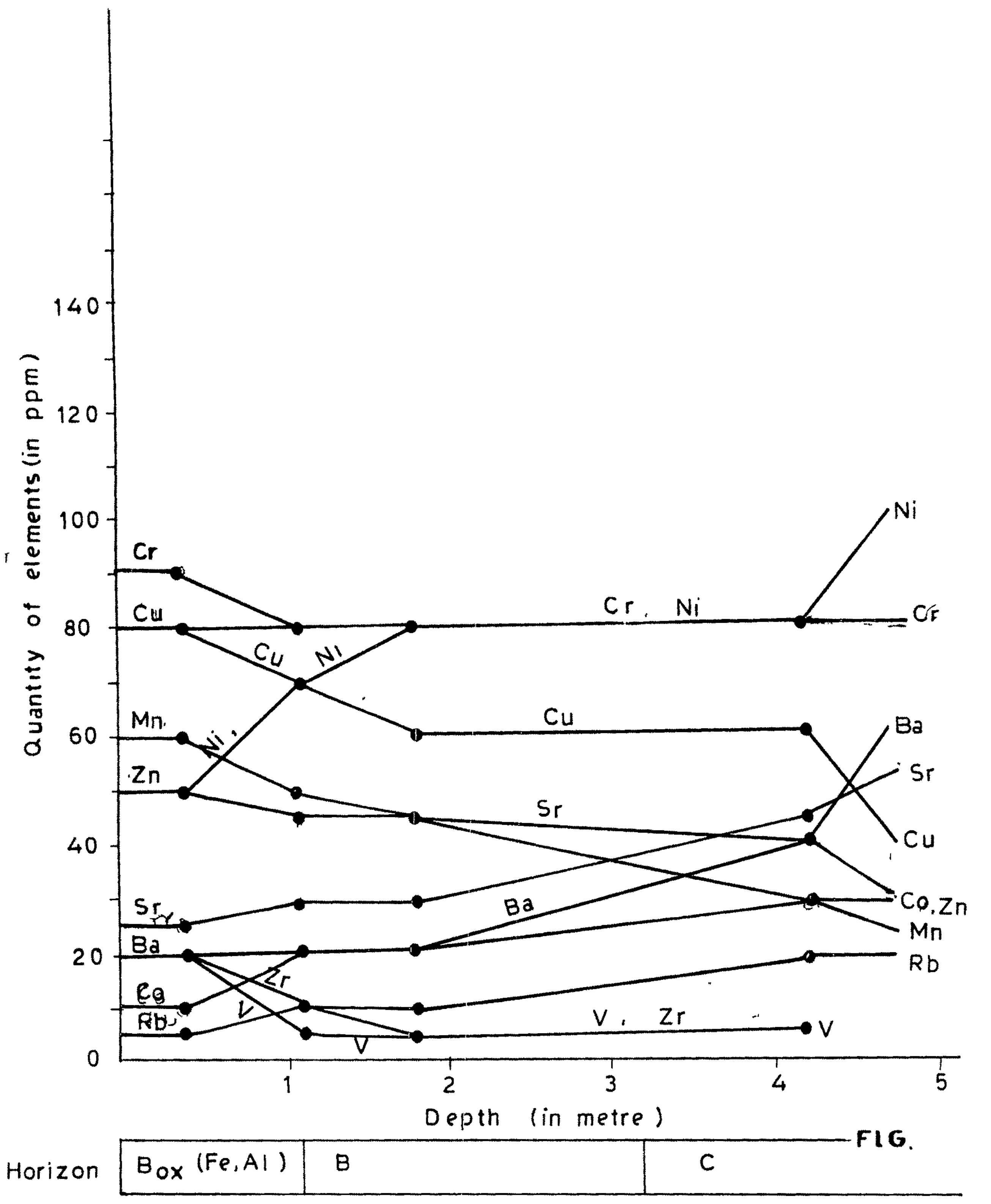


FIG. 87

Table 60

NET GAINS AND LOSSES OF MAJOR OXIDES AND TRACE ELEMENTS

BASED ON A Cr-RETAINED MASS BALANCE MODEL.

Taluka LAKHPAT Village. MATA-NO-MADH
HST TYPE SECTION

Bed rock thickness consumed to produce present thickness of the weathered profile . 160 m

Depth	0-0 4m	0 4-1.1m	1 1-1.8m	1 8-2 4m	2.4-4.2.m	
Horizon	Box(Fer)	Box(Fer)	Box(Alu)	B(Sap)	B(Sap)	Remarks
SiO_2	-49 73	-43.15	-31 50	-25 67	-10 12	Lost throughout the profile. Maximum mobility in the Box horizon
Al_2O_3	3 74	-6 86	41 57	30 46	13 79	Top horizon of loss followed by a zone of gain, with a maximum in the Box(Alu) horizon
Fe_2O_3	353 96	378 10	146 73	127 48	49 37	Gains throughout the profile. Increase with top horizon gain maximum higher in the profile.
TiO_2	112 93	60 44	47 76	41 79	28 35	Gains throughout the profile with a maximum in the top horizons
MnO_2	12 28	55 26	78.94	55 26	81 57	Gains throughout the profile, with mid-profile Box(Alu) and bottom Bsap maximum
CaO	-70 00	-64 64	-55 71	-34 28	-12 50	Lost throughout the profile, with an increase in mobility higher in the profile
MgO	-68 14	-59 16	-48.33	-39.16	-25 00	Shows the same mobility as CaO
K_2O	-6 17	-33 33	37 77	62 22	-11 11	Top and bottom horizons of losses with mid-profile gains with a maximum in the Bsap (lith) horizon.
Na_2O	-	-	-	-	-	-
P_2O_5	-	-	-	-	-	-
Ba	-70.37	-66.66	-66.66	-33.33	-33 33	Losses throughout the profile increasing higher in the profile
Cu	77.77	75.00	50.00	50.00	50.00	Gains throughout with a maximum in the Box horizon
Rb	-77 77	-50.00	-50.00	-	-	Losses throughout with a mobility maximum in the top horizons.
Sr	-59.59	-45.45	-45 45	-18 18	-18 18	Increase in losses higher in the profile.
Zn	-46 14	-71 42	-71 42	-52 38	-52 38	Lost throughout the profile with a mid-profile mobility maxima.
Pb	-	-	-	-	-	-
Mn	113 33	100 00	80.00	80 00	80 00	Increasing gains higher in the profile.
Cr	-	-	-	-	-	-
Ni	-55.55	-30 00	-20.00	-20 00	-20 00	Lost throughout the profile with a mobility maximum in the top horizon
Co	-70 37	-33 33	-33 33	-33 33	-33 33	Mobility same as Ni
V	-	-	-	-	-	-

Table 61

Lakhpat Taluka | X-ray data | Box - Ferricrete

Mata - no - Madh | HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Intensity % Calculated Ic	Remark
25.10	3.5493	7.00	31.82	Kaolinite
26.40	3.3752	7.00	31.82	Kaolinite
26.80	3.3272	12.50	56.82	Quartz
27.90	3.1974	10.50	47.73	Maghemite
28.60	3.1211	4.00	18.18	Gibbsite
36.40	2.4695	15.50	70.46	Lepidocrocite
37.00	2.4298	11.00	50.00	Diaspore
37.50	2.3978	22.00	100.00	Gibbsite
39.20	2.2978	4.00	18.18	Kaolinite
40.00	2.2541	9.00	40.91	Kaolinite
41.60	2.1709	8.00	36.36	Gibbsite
44.00	2.0579	14.50	65.91	Sphene
45.30	2.0018	13.00	59.09	Goethite

Table 62

Lakhpat Taluka X-ray data Box - Alucrete

Mata - no - Madh HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
20.40	4.3529	64.00	100.00	Kaolinite
25.40	3.5073	11.00	17.18	Anatase
26.70	3.3387	10.00	15.63	Gibbsite
27.00	3.3029	21.00	32.81	Gibbsite
28.10	3.1724	13.00	20.31	Boehmite
28.80	3.0997	5.00	7.81	Kaolinite
29.60	3.0184	3.00	4.69	Calcite
31.80	2.8135	3.00	4.69	Calcite
36.70	2.4489	30.00	46.87	Gibbsite
37.20	2.4166	12.00	18.75	Gibbsite
37.80	2.3801	33.00	51.56	Gibbsite
39.50	2.2814	6.00	9.38	Hematite
40.30	2.2377	11.00	17.19	Maghemite
41.80	2.1612	15.00	23.49	Gibbsite
44.30	2.0448	23.00	35.94	Gibbsite
45.60	1.9894	20.00	31.25	Kaolinite
47.50	1.9143	13.00	20.31	Kaolinite
48.00	1.8955	3.00	4.69	Kaolinite
50.70	1.8008	19.00	20.69	Quartz
52.50	1.7493	19.00	29.69	Gibbsite

Table 63

Lakhpat Taluka — X-ray data — B - Kaolinite

Mata - no - Madh — HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Intensity % Calculated Ic	Remark
19.90	4.4509	22.00	50.00	Kaolinite
20.40	4.3529	39.00	88.64	Kaolinite
21.40	4.1513	37.00	84.09	Kaolinite
23.20	3.8334	18.00	40.91	Kaolinite
23.80	3.7697	10.00	22.73	Maghemite
25.00	3.5624	44.00	100.00	Maghemite
25.50	3.4956	30.00	68.18	Maghemite
26.50	3.3634	10.00	22.73	Maghemite
28.80	3.0997	2.00	4.55	Quartz
31.80	2.8153	6.00	12.63	Calcite
35.10	2.556	18.00	40.91	Kaolinite
35.50	2.5284	14.00	31.82	Kaolinite
36.00	2.4948	20.00	45.45	Kaolinite
37.90	2.3779	9.00	20.45	Kaolinite
38.50	2.3354	32.00	72.72	Kaolinite
39.30	2.2923	18.00	40.91	Anatase
45.60	1.9894	9.00	20.45	Maghemite
46.90	1.9374	2.00	4.55	Kaolinite
48.00	1.8955	4.00	9.09	Kaolinite
49.50	1.8441	3.00	6.82	Kaolinite
51.10	1.7874	2.00	4.55	Kaolinite
55.10	1.668	13.00	29.55	Kaolinite

Table 64

Lakhpat Taluka X-ray data B - Bentonite

Mata - no - Madh HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
19.80	4.4789	40.00	86.96	Nontronite-Montm.
20.50	4.3272	12.00	26.00	Beidellite
21.20	4.1859	9.00	29.57	Goethite
24.20	3.6733	9.00	19.57	Illite-Montm.
26.60	3.3409	46.00	100.00	Maghemite
27.50	4.2396	9.00	19.70	Maghemite
28.60	3.1174	4.00	8.70	Nontronite
29.40	3.0344	9.00	19.70	Nontronite
30.60	2.9181	10.00	21.74	Montmorillonite
31.50	2.8367	6.00	13.04	Ilmenite
32.00	2.7935	8.00	17.39	Illite-Montm.
33.20	2.6913	8.00	17.39	Nontronite
34.50	2.593	8.00	17.39	Hematite
34.80	2.5749	9.00	19.70	Montmorillonite
35.20	2.5431	10.00	21.74	Beidellite
35.80	2.505	7.00	15.21	Hematite

Table 65

Lakhpat Taluka X-ray data C - Basalt

Mata - no - Madh HST Type Section

2 (0)	(d) Spacing (Ao)	Intensity % Observed Io	Calculated Ic	Remark
18.60	4.7647	79.00	100.00	Quartz
19.90	4.4763	12.00	15.19	Quartz
20.50	4.3272	6.00	7.60	Maghemite
21.30	4.1665	8.00	1.10	Labradorite
22.30	3.9907	4.00	5.06	Diaspore
23.80	3.7344	11.00	13.92	Ilmenite
24.10	3.6884	13.00	16.46	Augite
24.60	3.6145	3.00	3.79	Augite
26.50	3.3409	9.00	11.39	Quartz
27.00	3.2984	9.00	11.39	Augite
27.50	3.2396	9.00	11.39	Sphene
28.00	3.1826	4.00	5.06	Maghemite
28.60	3.1174	4.00	5.06	Maghemite
29.00	3.0753	4.00	5.06	
31.00	2.8813	7.00	8.86	Ilmenite
32.60	2.7435	6.00	7.60	Maghemite
33.90	2.6412	6.00	7.60	Sphene
34.50	2.596	8.00	10.10	
35.10	2.5536	8.00	10.10	Rutile
36.20	2.4785	8.00	10.10	Lepidocrocite
38.10	2.5561	21.00	26.58	Augite

X-RAY DIFFRACTION TRACES OF VARIOUS HORIZONS OF LATERITIC PROFILE AT MATA-NO-MADH (LAKHPAT TALUKA) HST Type Section

Depth in meter	Horizon	Dominating minerals
0–I.Im	Box-Ferricrete	Goethite Maghemite Lepidocrocite Kaolinite Gibbsite Diaspore Sphene
I.I–I.8m	Box-Alucrete	Gibbsite Kaolinite Bohemite Calcite Hematite Maghemite Quartz
I.8–2.4m	B-Kaolinite	Kaolinite Maghemite Calcite Quartz Anatase
2.4–4.2m	B-Bentonite	Nontronite Montmorillonite Beidellite Hematite
4.2– m	C-Basalt	Augite Labradorite Maghemite Lepidocrocite Ilmemite Quartz Rutile Sphene

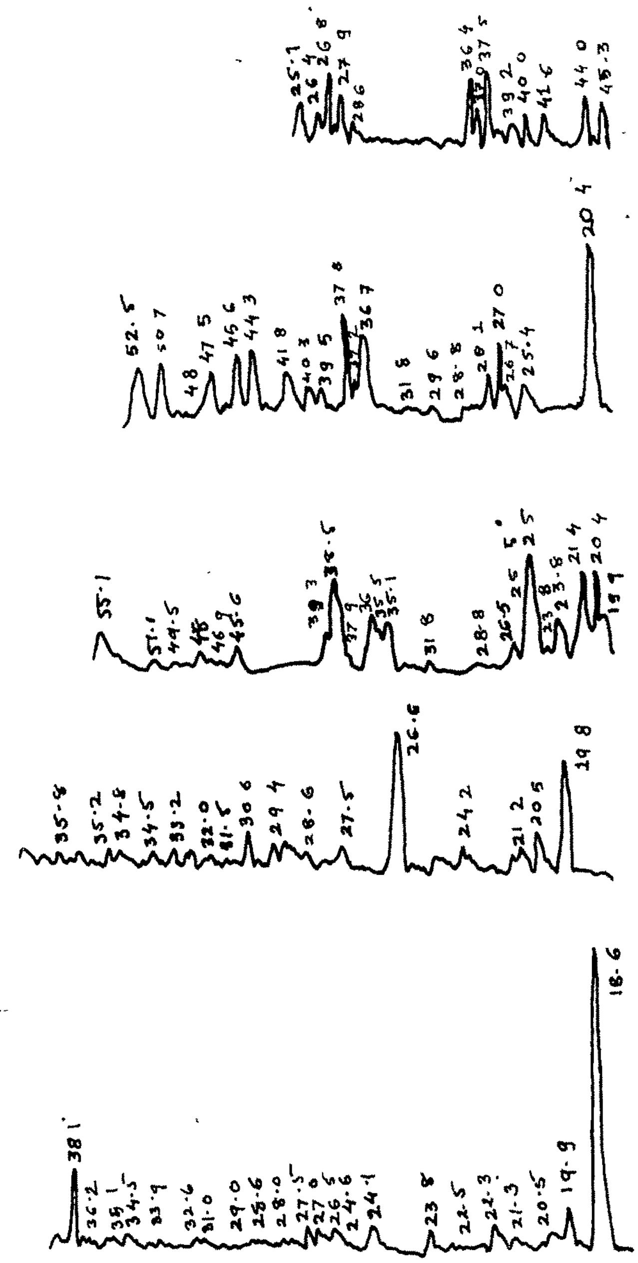


FIG. 88

Table 66

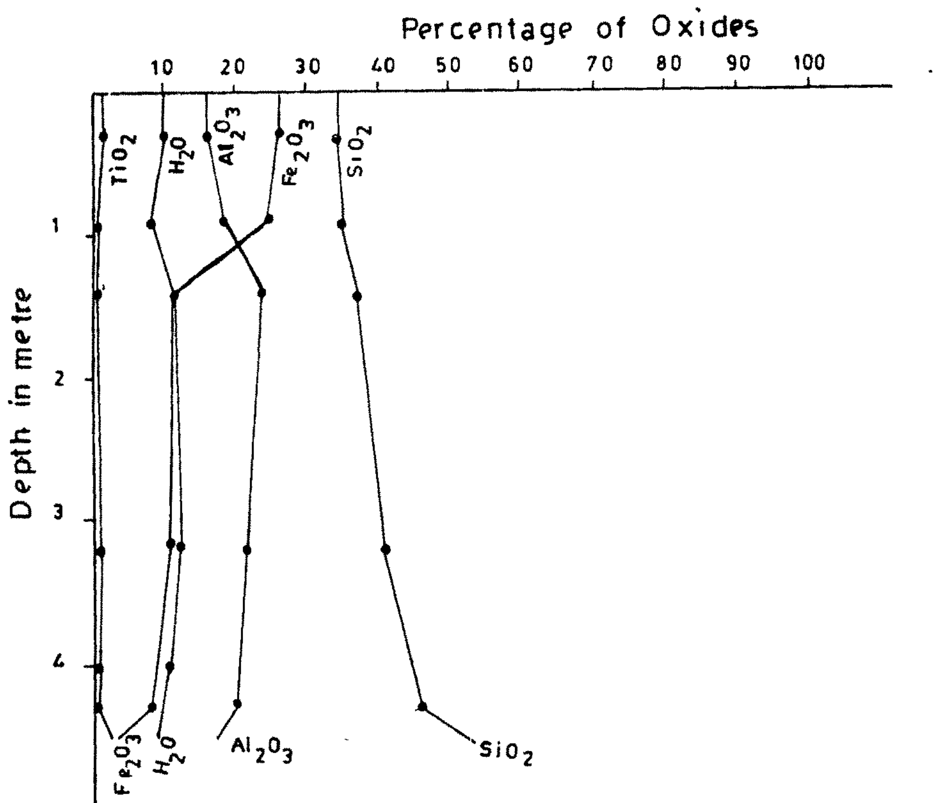
Lakhpat Taluka

Mata-no-Madh :-

Depth	0-0.3 m	0-3-0.9 m	0.9-1.4 m	1.4-3.2 m	3.2-4.3 m	4.3 m
Horizon	Box	Box	B	B	B	C
	Ferricrete	Ferricrete	Saprolite Lithomarge	Saprolite Bentonite	Saprolite Bentonite	Trap basalt
SiO_2	34.08	35.88	37.88	40.88	46.88	52.09
Al_2O_3	17.74	18.68	24.89	22.68	20.80	18.54
Fe_2O_3	26.68	25.40	12.70	11.68	8.12	3.78
TiO_2	2.10	1.94	1.89	1.72	1.58	1.96
MnO_2	1.96	1.78	1.92	1.12	1.98	.07
CaO	2.64	2.92	3.12	3.64	3.81	4.92
MgO	1.72	1.89	2.91	3.68	4.10	4.96
K_2O	.68	.98	1.00	1.24	1.42	1.67
Na_2O	1.12	1.24	1.48	1.64	1.89	2.10
P_2O_5	-	-	-	-	-	-
CO_2	-	-	-	-	-	-
H_2O	10.42	9.49	12.68	11.10	10.70	9.89
Total	99.14	100.20	100.47	99.38	101.28	99.98

In percent

VARIATION OF MAJOR OXIDES IN THE LATERITE PROFILE
AT **MATA-NO-MADH** VILLAGE, LAKHPAT TALUKA, KUTCH DISTRICT



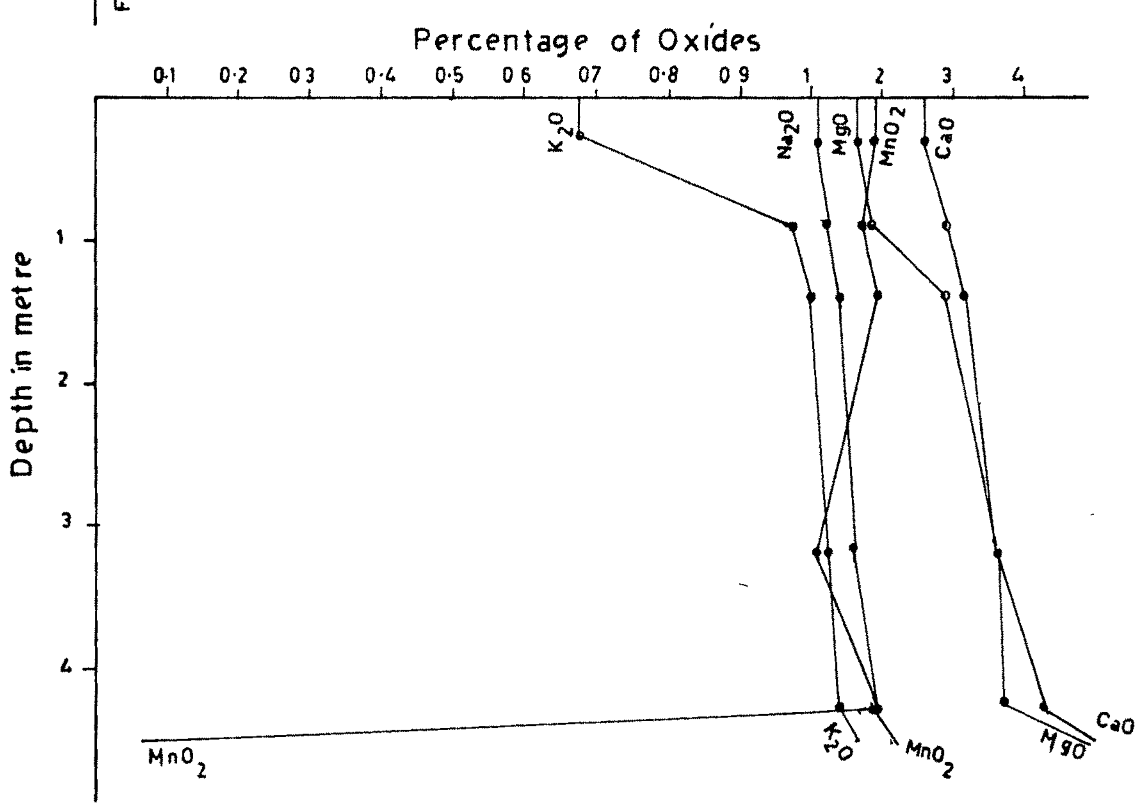


FIG. 89

Table 67

Lakhpat Taluka

Fulra :-

Depth	0-0.3 m	0.3m
Horizon	Box	Box
	Ferricrete	Alucrete
SiO_2	25.73	10.42
Al_2O_3	18.46	50.60
Fe_2O_3	36.46	3.86
TiO_2	3.56	3.89
MnO_2	1.08	.04
CaO	.15	.82
MgO	4.12	1.80
K_2O	.01	.70
Na_2O	.03	T
P_2O_5	.05	.84
CO_2	2.17	.89
H_2O	10.12	26.80
Total	101.94	100.66

In percent

DISCUSSION ON THE MOBILITIES OF VARIOUS MAJOR OXIDES AND TRACE ELEMENTS IN HST AND LST SECTIONS BASED ON Cr-RETAINED MASS BALANCE MODELS

This discussion has been divided into two parts viz.

i) Variation of mobilities in HST, and (ii) in LST sections, in order to bring to light variations, if any.

HST Section : (SiO_2/Al_2O_3/Fe_2O_3/TiO_2)

The two HST sections selected are from Hamla in Mandvi taluka and Mata-no-Madh in Lakhpat taluka. These two sections are similar in the sense, that there are 5 units present in them, viz.

```
Ferricrete  (laterite))
                       )Box (Fe,Al)
Alucrete (bauxite)     )

Saprolite   lithomarge)
                      )B.
            bentonite )

Basalt                 C.
```

From the Cr-retained mass balance models, it can be seen that 160 m of rock thickness was consumed to produce the present thickness of the weathered profile in both cases.

SiO_2 : There is an overall loss of this oxide throughout the profile, with maximum mobility in the Box zone. The increased mobility of SiO_2 in the Box zone can be indicative of freer drainage conditions. Further at Mata-no-Madh and Hamla, whereas there are gains shown by Al_2O_3 and Fe_2O_3 in the Box zone, SiO_2 shows depletion, indicative of an inverse relation to both of them.

Further, minimum mobility is observed in the near bottom horizon i.e. Bsap bentonite, indicative that quite a lot of silica must be going into the reconstitution of the neo-formed mineral assemblages, and that the drainage must have been sluggish in contrast to the freer drainage conditions in the upper horizons. According to Okamoto et. al. 1957, the presence of Si and Al in small amounts would cause immediate co-precipitation. This indicates that the removal of Si predates Al accumulation in the profiles. It could also mean that Si and Al are not both in true solution. If Al is for example, organically bound it could be simultaneously mobilised with Si in solution (Mefarlane, 1989).

Al_2O_3 : The behaviour of Al_2O_3 in the two HST sections is not anomalous. At Hamla there is an overall gain with a maxima in the Box (Al) horizon, whereas at Mata-no-Madh there is a zone of Box(Fe) overlying the Box(Al) zone showing depletion.

At Mata-no-Madh an overlying zone of depletion and top most horizon of minimum mobility, can be attributed to an overhead source of accumulation, which is logical as there is a land reduction of 160m. But such a conclusion cannot be made in the case of Hamla, where there must have been some local conditions at play. McFarlane (1976) has stated that iron and alumina may behave antipathetically, increase of iron content being matched by decrease of alumina and vice-versa. This is not true for the two HST profiles under discussion.

Fe_2O_3 : The behaviour is generally the same in both profiles with increases upwards in the profile, with the exception at Hamla where there is also a bottom horizon in B sap, of minor gain as compared to the mid - profile region. In accordance with laboratory leaching experiments, Fe and Al are inseparable, as is displayed by the two HST sections under discussion. This could be due to that adequate leaching and other organic conditions were not amenable for the leaching of either Fe or Al, during the formation and stabilization of these sections.

TiO_2 : The behaviour of TiO_2 is allied to Fe in all respects with an increase higher in the profile. TiO_2 has often been regarded as an ideal resistant index mineral, but in Kutch, it is clearly mobile, rendering it unfit for use in any mass-balance studies. Anatase is secondary after ilimenite, yet at Hamla, ilimenite is found in the top horizon and anatase in the middle one. There is a possibility that ilimenite could be present in the middle horizon, but beyond XRD detection limit. Its recognition in the top indicates that anatase in the top was leached out. This is another example of the surprising survival of primary forms in upper horizons, where secondary forms (theoretically more stable) are leached out. The presence of TiO_2 as a primary form in the basalt (ilimenate) argues for residual origin, as in the case of Hartman's (1955) study.

CaO, MgO, K_2O, Na_2O :

These are generally showing variable mobilities, with some cases of CaO, K_2O, Na_2O gains in various parts of the profile. The overall pattern of increasing loss higher in the profile, and the gains shown at variable depths can be attributed to local factors, which remain inexplicable geochemically. Perhaps this pattern is a later overprint associated with increased aridity.

Trace Elements :

Ba : The two sections show inverse mobilities, with Hamla showing gains with a mid-profile maxima, and Mata-no-Madh showing increasing upward losses. This differential behaviours explicable in geochemical terms, and can be attributed to some local conditions which are not properly understood.

Cu : Both the profiles show an overall gain with a maxima in the upper most horizon. Its behaviour can be correlatable with that of Fe.

Rb : Upward increases in losses throughout both the profiles.

Sr : Overall loss in both the profiles.

Zn : At Mata-no-Madh, this element is lost throughout the profile with a mid-profile increase in mobility. But in Hamla, there is a top horizon depletion with an immediately underlying horizon of gain. From this an overhead source for mid-profile accumulation can be deduced.

Pb : While at Mata-no-Madh Pb is found completely lost from the profile, at Hamla increasing losses higher in the profile are seen.

Mn : Both profiles show overall gains with two-top horizon maxima. This behaviour is similar to iron. This points towards a general oxidizing environment (Burridge and Ahn, 1965). Further, although a high humus content of the surface material favours loss of manganese (Heintze, 1946) plants may under certain circumstances be responsible for its uptake and accumulation in the soil (Tiller, 1963). This is an indication of the presence of vegetal cover during the process of lateritization.

Ni : At Mata-no-Madh there is an overall loss with increasing mobility higher in the profile while at Hamla it is completely lost from the profile. The increased mobility in the upper horizons can be suggestive that nickel went into solution at the top, and was carried along with the circulating waters, but since neither magnesia and silica were stable in these profiles, no redeposition at Hamla and slight redeposition at Mata-no-Madh is seen (Fisher, 1958, de Vletter, 1955). This solution of nickel is a continuous process, wherein, ncikel,is lost due to the lack of silica and magnesia, along with the reduction of the landsurface (de Vletter, 1955).

Co : Co is found to be lost throughout the profile with maximum mobility in the top horizon. This behaviour is akin to that of Ni.

V : In both the profiles, the behaviour of V differs, with complete losses in Mata-no-Madh,and overall gains with a mid-profile maxima in Hamla. This behaviour could be again due to some local conditions which are not understood.

Zr : This element shows similar behaviour to that of V, with complete losses in Mata-no-Madh and overall gains with a mid-profile maxima in Hamla. The behaviour of Zr is allied to titanium (Read, 1947). As Zr has been depleted as a primary resistant form in the parent rock, the mid-profile accumulation of Zr at Hamla, argues for a purely residual origin. **LST profiles** : There are two types of LST profiles with variation in the Box viz (a) with the alucrete sandwiched in between ferricrete, and the other (b) with the alucrete underlying the ferricrete and overlying either the saprolite or parent rock. 8 LST sections have been taken up for Cr-retained mass balance studies, out of which 7 are of the (a) type and 1 is of the (b) type.

Differential bed rock consumption is exhibited varying between 140m - 190m, in contrast to the constant consumption exhibited by the HST sections.

SiO_2 : The behaviour of this oxide is consistent, as it is mobile throughout the profile, with maximum mobility, in a majority of the cases, in the Box(Al) horizon. This indicates freer drainage conditions in the upper horizons. The accumulation of Fe_2O_3 and Al_2O_3 in the Box zone and the increased mobility of SiO_2 in this horizon, indicates an antipathetic behaviour.

Al_2O_3 : Except at Satpar and Goniasar, Al_2O_3 shows a consistent behaviour, with a depleted zone overlying the Box (Al) horizon. Even at Satpar and Goniasar, though there is no overlying zone of depletion, there is a quantum increase in Al_2O_3 in the Box (Al)zone, as compared to the overlying horizons. From this, an overhead source of accumulation accompanied by land reduction can be safely assumed. Further, since no zones of depletion are seen below the zone of enrichment, upward enrichment can be firmly ruled out.

Fe_2O_3 : Except at Satpar and Goniasar, Fe_2O_3 shows a gain maxima in the Box(Fe) horizon, with underlying zones of depletion or comparatively less gains indicating an antipathetic behaviour in comparision to Al. This can possibly be attributed to post-incision leaching. At Satpar and Goniasar, the behaviour of Fe_2O_3 is the same as that of Al_2O_3, showing gains. But even here, the gains in the Box(Fe) horizon are considerably more than those of the underlying zones.

TiO_2 : The behaviour of TiO_2 in the LST profiles is erratic, with two showing top horizon gains (Goniasar, Nundatar), one with a top and mid-profile gain (Balachor), one with a mid-profile gain maxima (Satpar), two showing bottom horizon gain maxima (Chiyasar, Naredi), and two showing losses throughout the profile with Wamoti showing downwards, and Nandra showing upwards increasing mobility. The variations could relate to preferred rutes if redeposition, reasons for which are not properly understood.

It is very difficult to draw any conclusions from this erratic behaviour. This is in contrast to the consistent behaviour, shown in the HST profiles.

CaO, MgO, K_2O, Na_2O : The overall pattern is that of losses, increasing upwards in the profile, with some cases of certain horizons showing gains of CaO, MgO, K_2O, and Na_2O. This anomalous behaviour can again be attributed to local conditions, which remain inexplicable.

P_2O_5 : This oxide shows variable behaviour, with some profiles showing top-and mid-profile gains (Satpar, Chiyasar), one showing bottom horizon gain (Balachor), one showing top horizon (Goniasar), one showing mid-profile gains with top and bottom zones of depletion (Wamoti), Nundatar showing overall depletion with top and bottom horizons of maximum mobility, Naredi showing depletion with a bottom horizon of maximum mobility and Nandra also exhibiting overall losses with increasing mobility upwards.

Trace Elements

Ba : The behaviour of this element is consistent, in the sense that it is either completely lost from the profile or shows losses with increasing mobility higher in the profile.

Cu : The behaviour is consistent with increases upwards, especially in the Box zone. A couple of profiles also show mid-profile along with top-horizon gains.

Rb : The behaviour of this element is consistent, as it either shows complete losses from the profiles or increasing losses higher in the profile.

Sr : The behaviour resembles that of Rb.

Zn : Zn is either completely lost from the profile or shows upwards increasing losses with the exception of Nundatar where there are all round gains, with a mid-profile maximum.

Pb : This is another element which is either completely lost from the profile or shows upwards increasing losses. The exception is that of Wamoti where all round gains are seen with top-and mid-profile gain maximum. Mn : Mn shows consistent behaviour with all round gains with a maximum in the top horizons. This behaviour is similar to that shown in the two HST profiles. The same discussions are valid for the LST profiles.

Ni : The behaviour is more or less consistent, with profiles showing complete losses, or losses increasing upwards. This is similar to the variation shown by the HST profiles. A reduction of landsurface (de Vletter, 1955) can be inferred.

Co : With the sole exception at Satpar, where overall gains with a maximum in the top horizon is seen, in all profiles, Co is either completely lost or shows upwards increasing losses. This behaviour is similar to that shown by the HST profiles.

V : The behaviour is erratic with 5 profiles showing complete losses (Satpar, Chiyasar, Naredi, Nandra, Balachor). The other 3 profiles at Goniasar, Nundatar, and Wamoti, show overall gains with a maximum in the top horizon. This sort of behaviour can be attributed to local conditions.

Zr : 4 profiles at Satpar, Goniasar, Chiyasar, and Nundatar show complete loss from the profile. At Naredi, Nandra and Balachor there is overall gain with a maximum in the top horizons. At Wamoti, there is an overall gain, but there is a mid-profile maximum.