OFFICE DE LA RECHERCHE SCEINTIFIQUE
ET TECHNIQUE OUTRE-MER

CENTRE ORSTOM DE CAYENNE

GUIDE TO THE FIELDTRIP OF SURINAME SOIL SURVEY DEPARTMENT IN FRENCH GUYANA

MARCH 21-26 1977

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BOULET (R.) HUMBEL (F.X.)

MARS 1977

PROGRAM

March 21

Welcome to the Surinam delegation at Saint-Laurent at 10.30 a.m

Fieldtrip in Saint-Laurent area

Stop 1 - Visit to Pinus plantation (National Office of Forest) on Sanderij Formation (Yellow soil). Hydric data and roots repartition available. Profil SLM.

Stop 2 - Visit to I.R.A.T. reclamation on pedological covers having superficial and lateral water dynamic on migmatite :

- Study of one toposequence : SL 4, SL 5, SL 6 (appendix) ;
- Observation of contact between Zanderij formation and migmatitic derived material.

Stop 3 - Visit to an old and very poor reclamation (citrus orchard). Observation of death lemon tree root system. Observation of the supposed initial profile under forest. No Laboratory data available.

Return to Saint-Laurent in the late afternoon.

March 22

Fieldtrip in Saut-Sabbat area

Stop 1 - Study of a roadcutting : pedological cover on migmatite :

- Lithorelictual nature of iron nodules ;

- imbalance of the ferrallitic cover (see "the pedological environment of french Guyana" p. 14, fig. 6 and appendix).

Stop 2 - Toposequence on pedological cover having superficial and lateral water dynamic on migmatite HSS 17 - 18 - 25. Hydric data and roots repartition available.

Stop 3 - Intermediate soil between soil having superficial and lateral water dynamic and soil having slackened vertical drainage on migmatite
HSS 20. Some hydric and granulometric data.

Stop 4 - Toposequence on migmatite with soil having slackened vertical drainage on the plateau and well drained soil on the slope. Some hydric data. See cross section in appendix. HSS 15, 23 and possibly 24.

Stop 5 - Soils on Zanderij formation
HSS 4 : Yellow soil (hydric data and roots repartition.
HSS 6 : Podzol

Stop 6 - Soil having good vertical drainage on crystalline rock. HSS 10. Hydric data and roots repartition.

Return to Saint-Laurent in the late afternoon.

March 23

Fieldtrip on Saint-Elie road

3 toposequences on Bonidoro schist (hydrological water shed, Saint-Elie road). No data available.

Arrival to Cayenne in the late afternoon.

Lodging of gests in Kettay and Neptima Hotels.

Informal rendez-vous at Cité Stanis n° 11 for guests.
Time 8 p.m.

March 24

Stop 1 - Study of a soils system on sand offshore bar (Lelydorp formation) at Pariacabo. Data available in TURENNE's thesis).

Stop 2 - Visit to O.N.F. (National Office of-Forest) plantation at "Savane changement". Soils systems on Lelydorp.

Return to Cayenne in the afternoon.

Evening free.

March 25

Visit to I.R.A.T. Station at Cabassou.

Transformation of ferrallitic cover by underground leaching. See "The pedological environment of french Guyane" p. 11 - 14.

In the afternoon, visit to ORSTOM Center and general discussion.

Dinner at 8 p.m. in La Fregate Restaurant.

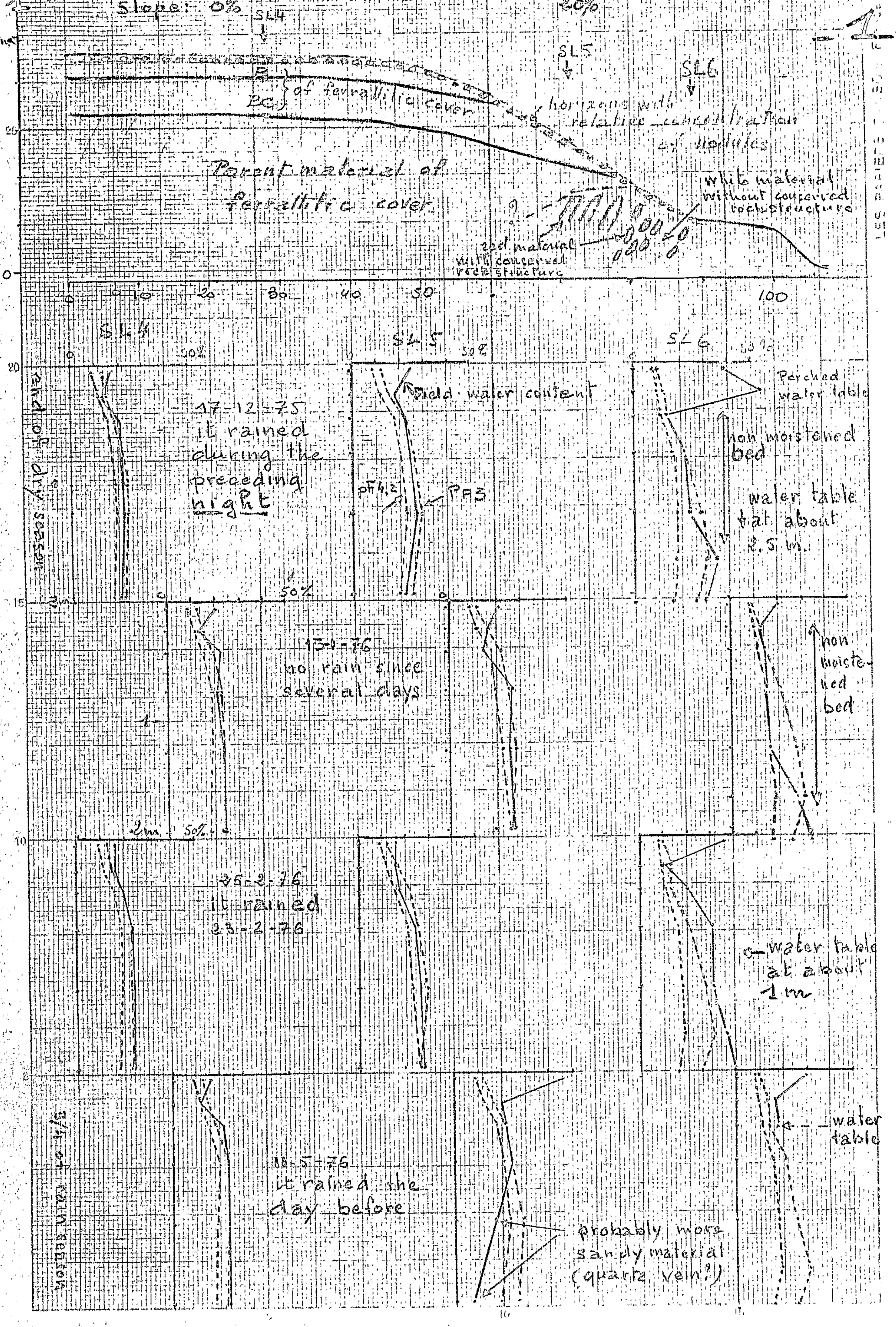
March 26

Return of guests to Suriname.

SL4-5-6 MARCH 21. St of 2 - TRAT concession under forest 5

fig 1

-1-



PROFILE SL 4 (Migmatite)

0 - 13 cm - Dark brown (10YR 3/3) - Very rich in hard nodules, size 3 cm, with red-purplish blue matrix, with fine quartz skeleton grains, with porphiproskelic fabric and irregular distribution of skeleton grains which generaly are without junction. - The fraction inferior to 2 mm is scarce, sandy clay - Very fine subangular blocky structure (5 mm) - High tubular and interstitial porosity - Roots are extremly abundant in upper 5 cm, still numerous underneath.

13 - 35 cm - Medium to high contrast, transition on 5 cm - Brown (10YR 5/4) - Very rich in iron nodules, size inferior to 3 cm, equal to preceding ones - The fraction inferior to 2 mm is scarce, more clayisch - The same structure and porosity - Common fine roots and few large roots.

35 - 80 cm - Medium to high contrast, transition on 10 cm - Yellowish brown (7.5YR 5/6) - Numerous iron nodules, either red (2.5YR 4/8 and 3/6) and not very hard, or red purplish blue (10R 3/6) and harder ; this nodules are less abundant than in horizons above and, contrary to the preceding ones, they cling close to the matrix in which they are scattered - The fraction inferior to 2 mm dominates, it is clayish - Massive structure with polyhedral braak surfaces - Common tubular voids - The roots are decreasing down the horizon.

80 - 250 cm - Low contrast, gradual transition - Brown, clearer and slightly more red (5YR 7/5), yellow mottles (10YR 5/7) - Two kind of nodules are present : 1. Isolated nodules above like, 5 cm ; 2. Anastomosed nodules, which make reticular volumes ; the fabric of this volumes looks like a very simple ironpan fabric - The fraction 2 mm is clayish - Polyhedral structure with sharp edges and smooth surface with only few tubular voids - Few clayskins.

250 - 400 cm - Medium contrast, transition on 5 cm - Light brown (10YR 7/6) with small white polygonal mottles (felspars pseudomorphs with yellow brown volumes with almost preserved rock structure, and with reticular discontinuous mottles ; this mottles are either red purplish blue (10R 3.5/7) with white weatherable minerals pseudomorphs, not hardened, or red (2.5YR 4.5/8) slightly hardened - Clayish (Slightly less than above). The same stmucture and porosity.

N.B. : Texture terminology

Sandy	argile 12%
Clayish sand	12% argile 25%
Sandy clayish	25% argile 40%
Clayish	argile 40%.

FICHE ANALYTIQUE

PROFIL

3L.4

	Horizon		9									HR2
	Groupe		13									GR
	Sous-groupe		17									SG
	(Famille)		21									FM
	(Série)		25									SR
	(Région)		29									RG
	Numéro du sac		33	41	42	43	44	45	46			SAC
	Profondeur minimale en cm		37									PMI
	Profondeur maximale		41									PMA
Granulométrie en 10^{-2}	Refus		45	85,65	76,26	40,58	44,88	45,89	61,13			REF
	Carbonate de calcium		49									CDC
	Argile		53	25,53	31,00	42,26	50,91	42,73	36,76			ARG
	Limon fin	2 à 20 µ	57	4,97	5,55	5,39	9,58	13,86	19,89			LMF
	Limon grossier	20 à 50 µ	61	3,14	3,78	2,93	2,50	3,67	4,85			LMG
	Sable fin	50 à 200 µ	65	20,70	21,72	14,78	7,20	8,06	16,62			SBF
	Sable grossier		69	43,56	36,73	34,21	29,65	32,51	28,53			SBG
			75	1	1	1	1	1	1	1	1	CARTE
Matières organiques en 10^{-3}	Carbone		13	31,74	14,61							C
	Azote		17	2,24	1,36							N
	~~Acides humiques~~ MO		21	54,75	25,20							AH
	~~Acides humiques bruns~~ C/N		25	14,2	10,7							AHB
	Acides humiques gris		29									AHG
	Acides fulviques		33									AF
Acidité	pH eau 1/2,5		37	4,35	4,60	4,80	5,10	5,00	4,91			PHE
	pH chlorure de potassium		41									PHK
Cations échangeables en mé	Calcium	Ca ++	45	0,13	0,08	0,05	0,05	<0,01	<0,01			CAE
	Magnésium	Mg ++	49	0,30	0,21	0,10	0,07	0,03	0,04			MGE
	Potassium	K +	53	0,13	0,06	0,02	0,02	<0,01	0,01			KE
	Sodium	Na +	57	0,40	0,42	0,10	0,08	0,08	0,05			NAE
	Capacité d'échange		61	7,50	4,15	2,60	2,18	3,95	2,05			T
Acide phosphorique en 10^{-3}	Phosphore total		65	0,24								PT
	SBE en mé		69	0,96	0,77	0,27	0,22	0,11	0,10			PAT
			75	2	2	2	2	2	2	2	2	CARTE
	S/T		13	12,80	18,55	10,39	10,09	2,79	4,88			PAO
	~~Phosphore ass. citrique~~ H 105°		17	2,25	1,19	0,82	9,65					PAC
Éléments totaux (triacide) en 10^{-2}	Perte au feu		21	9,19	7,73	8,32	9,90					PRT
	Résidu		25	66,19	61,16	52,97	35,48					RSD
	Silice	SiO_2	29	10,35	13,50	17,69	25,58					SI
	Alumine	Al_2O_3	33	9,04	12,22	17,10	23,43					AL
	Fer	Fe_2O_3	37	2,87	3,40	4,22	5,58	3,81	3,65			FE
	Titane	TiO_2	41									TI
	Manganèse	MnO_2	45									MN
	Rapport SiO_2/Al_2O_3		49	1,95	1,88	1,75	1,85					FEL
en mé	Calcium	Ca ++	53									CA
	Magnésium	Mg ++	57									MG
	Potassium	K +	61									K
	Sodium	Na +	65									NA
Structure et caractéristiques hydriques	Porosité en 10^{-2}		69									PRS
			75	3	3	3	3	3	3	3	3	CARTE
	pF 2,5		13									PF2
	pF 3		17									PF3
	pF 4,2		21									PF4
	Instabilité structurale		25	0,13								IS
	Perméabilité		29	89,71								PMB
Sels solubles, extrait pâte saturée en mé	Conductivité L en m-mho/cm		33									L
	Chlorures	Cl^-	37									CL
	Sulfates	SO_4^{--}	41									SO4
	Carbonates	CO_3^{--}	45									CO3
	Bicarbonates	HCO_3^-	49									HCO
	Calcium	Ca ++	53									CAS
	Magnésium	Mg ++	57									MGS
	Potassium	K +	61									KS
	Sodium	Na +	65									NAS
H au Champ	~~extrait au 1/10ème - Conductivité L 1/10 en m-mho/cm~~		69	3,23	3,45	3,40	3,49	4,03	5,39			L 10
			75	4	4	4	4	4	4	4	4	CARTE

PROFILE SL 5

(Migmatite)

0 - 10 cm : Dark grayish brown (10YR 3.5/2.5) - Very rich in hard nodules with red purplish blue matrix, equal to those of SL 4 - The fraction inferior to 2 mm is scarce, clayish sand - Fine subangular blocky structure - High tubular and interstitial porosity - Roots are very abundant.

10 - 28 cm - Low contrast, transition on 2 cm - Lighter brown (10YR 4/3) - Very rich in hard nodules, size 1-2 cm, equal to the preceding ones - The fraction 2 mm is scarce, sandy clay - The same structure - The porosity is slightly less developped - Much fine roots.

28 - 53 cm : Medium contrast, gradual transition - Yellowish brown (10YR 5/4) - NOdules are less abundant, they cling close to the matrix in wich they are scattered ; they are not so hard than above - The fraction 2 mm dominates, sandy clay to clay - Polyhedral structure, 0.5 to 1 cm - Common tubular void - The roots are decreasing down the horizon.

53 - 120 cm : High contrast, transition on 10 cm - Yellowish red (5YR 5/8) with red (2.5YR 5/8) and yellow (10YR 8/8) mottles - The same nodules than above, but less hard ; they can be brocken with hands ; their cement is red (2.5YR 4/8) and red purplish blue (10R 4/8) - The fraction 2 mm is more clayish - Polyhedral structure with sharp edges and smooth surface with only few tubular voids - Few roots.

120 - 220 cm : Medium contrast, transition on 20 cm - Yellow (10YR 7/7) with beige mottles (10YR 7.5./4) - Red volumes slightly hardened, with red purplish blue and harder heart - Fraction 2 mm is less clayish - Polyhedral structure equal to above - Tubular voids are most rares.

220 - 400 cm : High contrast - Transition on 20 cm - Nearly whyte (10YR 6/1) with yellow mottle (10YR 6/8) - On lateral section, there are reticulate and red volumes slightly hardened ; on the sections wich are higher or lower on the slope, this red volumes are subverticaly oriented ; in this red volumes, the parent rock organization car be recognized ; it is not possible or most difficult in the white material - Polyhedral structure - Compact.

FICHE ANALYTIQUE

PROFIL

SL,5

	Horizon		9									HRZ
	Groupe		13									GR
	Sous-groupe		17									SG
	(Famille)		21									FM
	(Série)		25									SR
	(Région)		29									RG
	Numéro du sac		33	51	52	53	54	55	56	57		SAC
	Profondeur minimale en cm		37									PMI
	Profondeur maximale		41									PMA
Granulométrie en 10^{-2}	Refus		45	83,12	77,34	78,89	45,87	30,69	22,43	45,72		REF
	Carbonate de calcium		49									CDC
	Argile		53	23,40	33,90	38,26	58,88	39,29	35,37	25,24		ARG
	Limon fin	2 à 20 µ	57	4,79	6,70	8,29	17,46	23,48	26,40	30,06		LMF
	Limon grossier	20 à 50 µ	61	2,55	3,80	4,32	3,88	6,61	6,47	7,58		LMG
	Sable fin	50 à 200 µ	65	13,80	18,98	17,72	6,94	5,75	14,99	15,67		SBF
	Sable grossier		69	52,47	34,47	30,78	13,78	23,75	20,25	22,19		SBG
			73	1	1	1	1	1	1	1	1	CARTE
Matières organiques en 10^{-3}	Carbone		15	2347	2207							C
	Azote		17	1,89	1,61							N
	~~Acides humiques~~ MO		21	40,48	38,07							AH
	~~Acides humiques bruns~~ C/N		25	12,4	13,7							AHB
	Acides humiques gris		29									AHG
	Acides fulviques		33									AF
Acidité	pH eau 1/2,5		37	4,80	4,70	5,00	4,95	4,70	4,90	4,79		PHE
	pH chlorure de potassium		41									PHK
Cations échangeables en mé	Calcium	Ca^{++}	45	0,21	0,17	0,06	0,04	0,04	0,07	0,03		CAE
	Magnésium	Mg^{++}	49	0,25	0,19	0,05	0,04	0,05	0,02	0,06		MGE
	Potassium	K^{+}	53	0,15	0,14	0,05	0,02	<0,01	<0,01	0,03		KE
	Sodium	Na^{+}	57	0,20	0,45	0,10	0,09	0,06	0,04	0,14		NAE
	Capacité d'échange		61	6,20	4,85	4,45	5,50	3,05	2,50	9,70		T
Acide phosphorique en 10^{-3}	Phosphore total		65	0,10								PT
	SBE en mé		69	0,81	0,95	0,26	0,19	0,15	0,13	0,26		PAT
			73	2	2	2	2	2	2	2	2	CARTE
	S/T		13	13,06	19,59	5,84	3,45	4,92	5,20	2,68		PAO
	~~Phosphore ass. citrique~~ H 105°		37	1,97	1,91	2,15	2,50	2,01	2,70	2,36		PAC
Éléments totaux (triacide) en 10^{-2}	Perte au feu		21	8,26	8,67	7,90	11,70	9,45	10,01	9,68		PRT
	Résidu		25	68,33	59,69	53,84	19,23	32,70	25,60	31,42		RSD
	Silice	SiO_2	29	10,75	14,33	17,38	33,59	28,68	29,35	29,13		SI
	Alumine	Al_2O_3	33	8,86	14,87	16,11	23,02	25,94	27,12	25,13		AL
	Fer	Fe_2O_3	37	2,11	2,71	3,15	4,15	3,02	2,72	4,79		FE
	Titane	TiO_2	41									TI
	Manganèse	MnO_2	45									MN
	Rapport SiO_2/Al_2O_3		49	2,05	1,88	1,83	2,10	1,88	1,83	1,97		FEL
en mé	Calcium	Ca^{++}	53									CA
	Magnésium	Mg^{++}	57									MG
	Potassium	K^{+}	61									K
	Sodium	Na^{+}	65									NA
Structure et caractéristiques hydriques	Porosité en 10^{-2}		69									PRS
			73	3	3	3	3	3	3	3	3	CARTE
	pF 2,5		13									PF2
	pF 3		17									PF3
	pF 4,2		21									PF4
	Instabilité structurale		25	0,20								IS
	Perméabilité		29	51,14								PMB
Sels solubles, extrait pâte saturée en mé	Conductivité L en m-mho/cm		33									L
	Chlorures	Cl^{-}	37									CL
	Sulfates	$SO4^{--}$	41									SO4
	Carbonates	$CO3^{--}$	45									CO3
	Bicarbonates	$HCO3^{-}$	49									HCO
	Calcium	Ca^{++}	53									CAS
	Magnésium	Mg^{++}	57									MGS
	Potassium	K^{+}	61									KS
H au Champ	Sodium	Na^{+}	65									NAS
	~~extrait au dixième Conductivité L 10 en m-mhos/cm~~		69	3,14	3,95	3,75	5,15	4,22	4,49	4,56		L 10
			73	4	4	4	4	4	4	4	4	CARTE

PROFILE SL 6

(Migmatite)

0 - 30 cm : Gray (10 YR 4/2) - Sand to clayish sand, rich in quartz ferruginized gravels - Polyhedral structure 0,5 - 1 cm - medium porosity (tubular and interstitial) - Roots very abundant in upper 5 cm, and disappear almost at about 30 cm.

30 - 90 cm : High contrast, very gradual transition (30 cm) - Very pale gray (10YR 6,5/1,5). Few ferrugineous and friables quartz blocks. Clayish sand to sandy clay. Polyhedral structure, 1 to 2 cm - Few tubular voids.

90 - 170 cm : No contrast concerning soft material. Appearance of volumes of red and slightly hardened material such as SL 5. Sandy clay to clay. More large polyhedral structure. Compact - Plastic.

N.B. : The morphological study shows that red material with conserved rock structure is changed into white material. This transformation shall appear down slope another toposequences on schist.

FICHE ANALYTIQUE

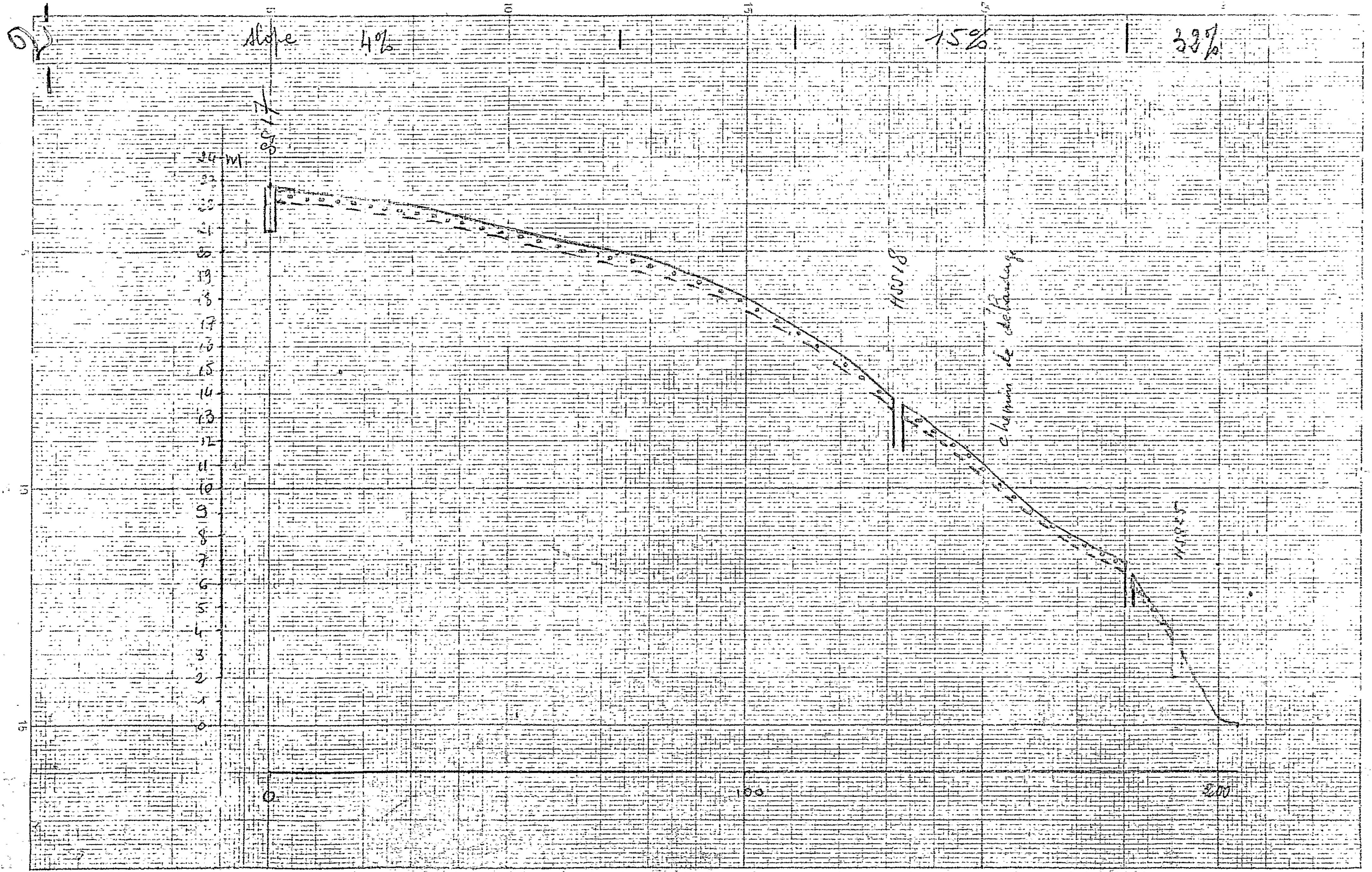
PROFIL

SL 6

	Horizon		9									HRZ
	Groupe		13									GR
	Sous-groupe		17									SG
	(Famille)		21									FM
	(Série)		25									SR
	(Région)		29									RG
	Numéro du sac		33	61	62	63						SAC
	Profondeur minimale en cm		37									PMI
	Profondeur maximale		41									PMA
Granulométrie en 10^{-2}	Refus		45	56,49	47,52	20,65						REF
	Carbonate de calcium		49									CDC
	Argile		53	16,30	27,56	38,10						ARG
	Limon fin	2 à 20 µ	57	4,13	8,81	18,99						LMF
	Limon grossier	20 à 50 µ	61	2,18	2,36	3,07						LMG
	Sable fin	50 à 200 µ	65	13,14	9,89	5,58						SBF
	Sable grossier		69	62,62	51,98	34,88						SBG
			73	1	1	1	1	1	1	1	1	CARTE
Matières organiques en 10^{-3}	Carbone		13	1833								C
	Azote		17	1,36								N
	~~Acides humiques~~ MO		21	3161								AH
	Acides humiques bruns C/N		25	135								AHB
	Acides humiques gris		29									AHG
	Acides fulviques		33									AF
Acidité	pH eau 1/2,5		37	4,45	4,95	4,90						PHE
	pH chlorure de potassium		41									PHK
Cations échangeables en mé	Calcium	Ca ++	45	0,14	004	005						CAE
	Magnésium	Mg ++	49	0,12	0,03	0,08						MGE
	Potassium	K +	53	0,16	0,02	0,02						KE
	Sodium	Na +	57	0,47	0,09	0,05						NAE
	Capacité d'échange		61	4,10	2,95	4,40						T
Acide phosphorique en 10^{-3}	Phosphore total		65	0,15								PT
	[illegible] en mé		69	0,89	0,18	0,20						PAT
			73	2	2	2	2	2	2	2	2	CARTE
	S/T		13	21,71	5,10	4,55						PAO
	Pho[illegible]		17	1,58	0,57	1,04						PAC
Éléments totaux (triacide) en 10^{-2}	Perte au feu		21	5,50	4,57	7,68						PRT
	Résidu		25	73,82	67,58	48,76						RSD
	Silice	SiO_2	29	8,51	14,44	23,69						SI
	Alumine	Al_2O_3	33	6,38	12,28	20,90						AL
	Fer	Fe_2O_3	37	0,21	3,23	1,79						FE
	Titane	TiO_2	41									TI
	Manganèse	MnO_2	45									MN
	Rapport SiO_2/Al_2O_3		49	3,26	1,99	1,92						FEL
en mé	Calcium	Ca ++	53									CA
	Magnésium	Mg ++	57									MG
	Potassium	K +	61									K
	Sodium	Na +	65									NA
Structure et caractéristiques hydriques	Porosité en 10^{-2}		69									PRS
			73	3	3	3	3	3	3	3	3	CARTE
	pF 2,5		13									PF2
	pF 3		17									PF3
	pF 4,2		21									PF4
	Instabilité structurale		25	9,17								IS
	Perméabilité		29	79,73								PMB
Sels solubles, extrait pâte saturée en mé	Conductivité L en m-mho/cm		33									L
	Chlorures	Cl^-	37									CL
	Sulfates	$SO4^{--}$	41									SO4
	Carbonates	$CO3^{--}$	45									CO3
	Bicarbonates	$HCO3^-$	49									HCO
	Calcium	Ca ++	53									CAS
	Magnésium	Mg ++	57									MGS
	Potassium	K +	61									KS
Hau champ	Sodium	Na +	65									NAS
	~~extrait au dixième Conductivité L 10 en m-mho/cm~~		69	1,10	218	1,44						L 10
			73	4	4	4	4	4	4	4	4	CARTE

fig 2

MARCH 22 STOP 2 HSS 17-18-25



PROFILE HSS 18

0 - 11 cm : Brown (10YR 3.5/4) - Sandy to clayish sand. Almost single grain structure. Moist. Very porous. Roots are extremly abundant in upper 5 cm, still numerous below.

11 - 20 cm : Medium contrast, transition on 3 cm. Yellowish and slightly greenish brown (10YR 3.5/4). Very rich in hard nodules with irregular shape, with red purplish blue cement in the middle (10R 3/4) and red (2.5YR 3.5/6) cement at the periphery, with fine quartz skeleton grain scattered in the matrix. The fraction 2 mm is scarce, sandy clay. Fine polyhedral structure delimited by nodules surfaces. Moist. Tubular porosity. Many roots.

20 - 46 cm : Medium contrast, transition on 10 cm. Reddish yellow (7.5YR 5/6). Nodules slightly less abundant, equal to preceding ones -clay- Polyhedral structure 1 cm - Moist - Few tubular voids. Roots less abundant, but still numerous.

46 - 95 cm : Medium contrast, transition on 20 cm. Red yellow (5YR 5/6). Nodules very less abundant, with the same sight but the red periphery is less hardered. Clay. Polyhedral structure with sharp edges and smooth surfaces, with only few tubular voids. Moist - The roots almost disappeare down the horizon.

95 - 130 cm : Medium contrast ; abrupt and wavy boundary. Red (2.5YR 4.5/6). The same nodules but very less hardened (they can be cut with a knife). Clay - The same structure and porosity. Dry by the touch. Very few roots.

130 - 190 : Low contrast, transition on 5 cm. Slightly more red (2.5YR 4/8). The same nodules but they are softer - Clay - The same structure and porosity.

HSS 20 (Migmatite)

0 - 10 cm : Dark yellowish brown (10YR 3.5/4) ; in places, dark ochreous brown mottles with very low contrast. Sandy to clayish sand. Subangular blocky structure 1 cm - Moist - Medium tubular and interstitial porosity. Roots are abundant in upper 5 cm, less numerous below but well distributed.

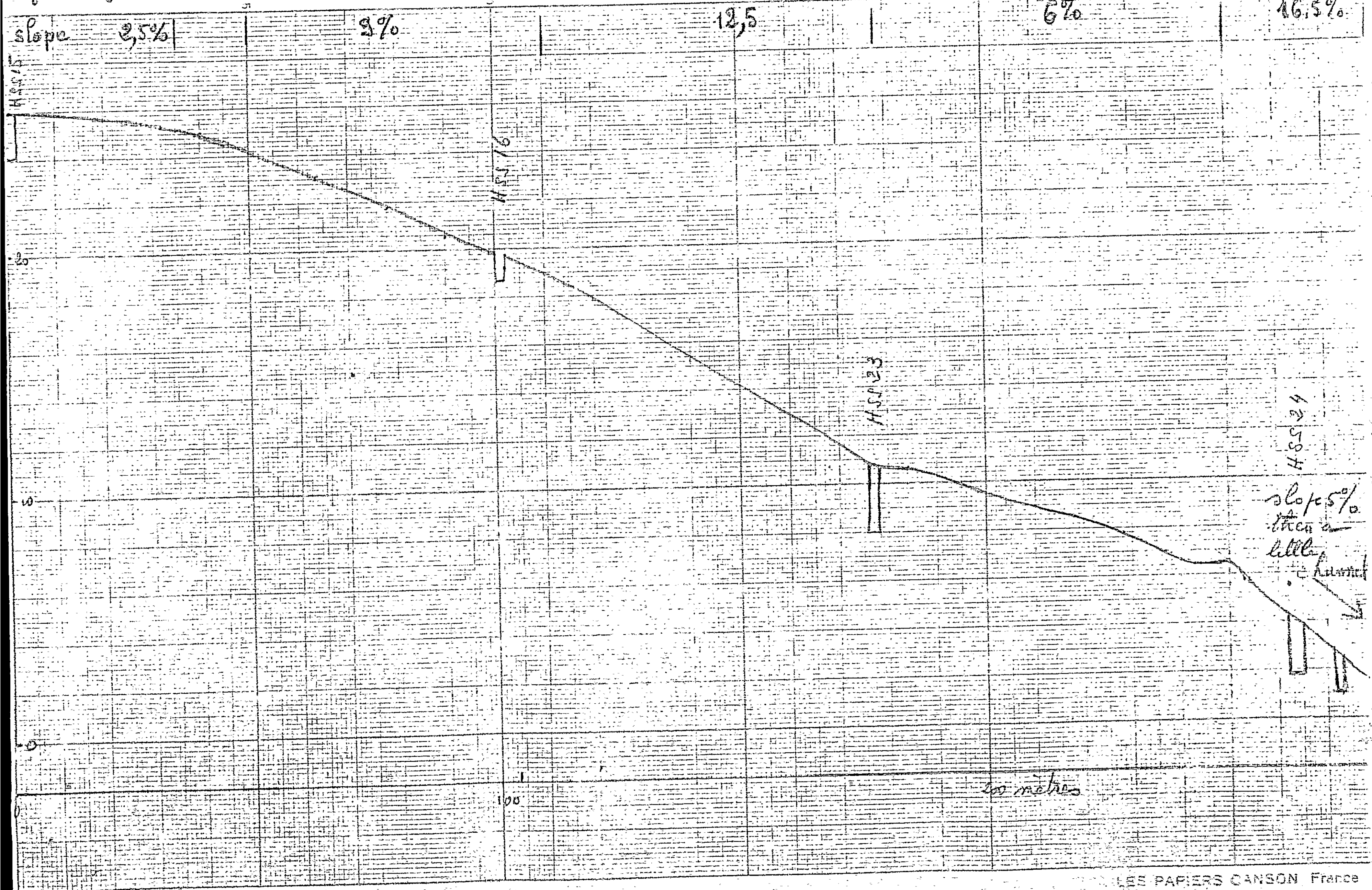
10 - 20 cm : Transition horizon (10YR 5/5). Clayish sand to sandy clay. Subangular polyhedral structure 1-2 cm - Moist - Medium tubular porosity. Common well distributed roots.

20 - 40 cm : Yellow 7.5YR 5/6. Clay. The same structure - Numerous brown agrotubules, tubular porosity well developped. Numerous pseudo carbonized roots Ø 1 cm, subhorizontal - Moist - Roots slightly decrease down.

40 - 95 cm : Medium contrast, transition on 20 cm. Reddish yellow (7.5 - 5YR 5/8). Clay - Polyhedral structure 1 cm. Moist. The same tubular porosity and pseudo carbonized roots. Few well distributed roots.

95 -170 cm : Medium contrast, transition on 20 cm. Red (2.5YR 4/6). Clay Polyhedral structure with sharp edges and smooth surfaces with only few tubular voids. At 150 cm subhorizontal quartz vein ; after that, appearance of red purplish blue nodules very soft with the same sight than in SL 18 profil (deep horizon). Moist up to 150 cm, dry by the touch below.

fig 3 MARCH 22 STOP 4. HSS 15-23-24



HSS 15 (Migmatite)

0 - 10 cm : Dark brown (10 YR 3.5/4). Clayish sand to sandy clay. Polyhedral structure size 1 - 2 cm ; the polyhedrons are formed by compact assemblage of small (3-4 mm) granular, angular and little porous peds. Moist. Craze planes prosity, some big anastomosed tubular voids, some washed sands on structural surfaces. Roots are abundant in upper 5 cm, less numerous below, but well distributed.

10 - 40 cm : Medium contrast, transition on 5 cm. Yellowish brown (10YR 4,5/6). Sandy clay. Polyhedral structure, 1-2 cm. With the same organization than above. Moist. Few tubular voids, compact surfaces. Common roots.

40 - 88 cm : Medium contrast, transition on 5 cm. Reddish yellow (7,5YR 5/8). Clay. Massive structure with mamillated break surfaces. Moist. Tubular porosity ; the biggest voids have sometime argillans. Roots less abundant, well distributed.

88 - 134 cm : Low contrast, transition on 20 cm. More red (5-7,5YR 4,5/8). The same texture. Massive structure with polyhedral break surfaces ; some little channels filled with microped size 1/3 to 1/2 mm. Moist. More developped prosity ; it is tubular and interstitial (between micropeds). Few roots.

134 - 200 cm : Low contrast, gradual transition. More red (5YR 4,5/8). The same texture. Polyhedral structure, many little channel with micropeds. The same porosity. Few roots.

HSS 23 (Migmatite)

0 - 6 cm : Brownish gray (10YR 3,5/3). Sandy to clayish sand. Polyhedral rounded structure 3 to 10 mm sized. Moist. Few tubular voids in the aggregates, important porosity between the aggregates. Some washed sands under the litter. Very much roots.

6 - 45 cm : High contrast, transition 1 cm. Brown (7,5YR 5/6). Sandy clay. Subangular polyhedral structure, 0,5-5 cm ; -Moist- aggregates surface generaly compact but nosmooth, few tubular voids, the biggest with cutans. Then roots are abundant, the structure is more little, the aggregates are separated by tortuous channels sometime filled with micropeds. Rare little lithorelictual nodules at about 40 cm. Few large roots, common fine roots.

45 - 70 cm : Medium contrast, transition on 10 cm. Yellowish brown (7,5YR 5/8). Some lithorelictual nodules or quartz 1 cm. A little more clayish. Polyhedral structure size 0,5-2 cm ; the polyhedrous are formed by compact assemblage of small (1-2 mm) granular, angular and little porous peds. This under structure already exists in preceding horizon. The aggregates surface is granular (not smooth) -Moist- Medium tubular porosity few channel with micropeds and interpedic porosity. Few fine and medium roots.

70 - 100 cm : Medium contrast, transition 10 cm. Reddish yellow (5YR 5/8). -Clay- The same structure, the under structure with angular peds disappears, more channels with micropeds. Tubular and intermicropedic porosity, well developped -slightley less moit. Few roots.

Nodules : higher concentration in a irregular band ; iron nodules with conserved rock structure, watherable mineral pseudomorphs or fine oriented muscovite. Some oriented lithorelics are obliquely aligned. Some angular or prismatic quartz more or less ferrugineous, sometime hyaline.

100 - 130 cm : Low contrast, gradual transition. A little more red (5YR 5/7). More clayish. Polyhedral structure 1 cm, friable. Few tubular voids. Very much little channels with microped, high porosity. -Moist-

130 - 200 cm : Low contrast, gradual transition. More red, (2,5YR 4,5/7). Clay.- polyhedral structure, friable, some volumes with massive structure and mamillated break surface, Micropiedic organization very developped (maximum). -Moist- Very abundant lithorelics more or less weathered with transformation into red material. The most part of them - has a macrocristalline rock facies (1 to 3 mm) slightly oriented but there is veins of microcristaline and micaceous weathered rock.

PROFILE HSS 4 (Zanderij formation)

0 - $\left\{\begin{matrix}5\\12\end{matrix}\right.$ cm : Brown (10YR 4,5/4), numerous white washed sands. Sandy. Polyhedral structure size 0,5 to 2 cm, with single grain tendancy - high tubular and interstitial porosity. Roots are very abundant.

$\left.\begin{matrix}5\\12\end{matrix}\right\}$-40 cm : Medium contrast, transition to 2 cm. Yellowish brown (10YR 5/5). Clayish sand to sandy clay. Massive structure with polyhedral break surfaces. Porosity less developped, tubular voids and compact little surfaces. Slightly hard. Common roots.

40 - 57 cm : Transition horizon. Juxtaposition of yellow (10YR 6/8) material and brown (10YR 5/4) material. Sandy clay. The same structure and porosity. Slightly more hard. Few roots.

57 - 92 cm : Yellow (10YR 6/8). A little more clay. The same hard~~l~~ness (in dry season this horizon is the most hard[*]). The same texture, structure and porosity. Few roots.

92 - 160 cm : Medium contrast, transition on 10 cm. Yellow (7,5YR 7,5/8). The same texture. Massive structure with polyhedral a mamillated break surfaces. Tubular porosity, more developped. Not hard. Very few roots.

160 - 300 cm : Low contrast, transition on 20 cm. Reddish yellow (7,5YR 5/8) a little more red). The same texture. Massive structure with polyhedral break surfaces. Tubular porosity well developped ; perhaps microped. Very few roots.

300 - 350 cm : Very lowcontrast, gradual transition. A little more red, at the lower part, appearance of yellow (10YR 6/6) mottles with abrupt boundary. A little more sandy. The same structure Tubular porosity well developped.

350 - 425 cm : Low contrast, gradual transition. Reddish yellow (5YR 5/8). Yellow (10YR 7/6) mottles increasingdown the horizon. More sandy. Massive structure with mamillated break surfaces. Tubular porosity well developped.

---

[*] This hardness variations are very weak.

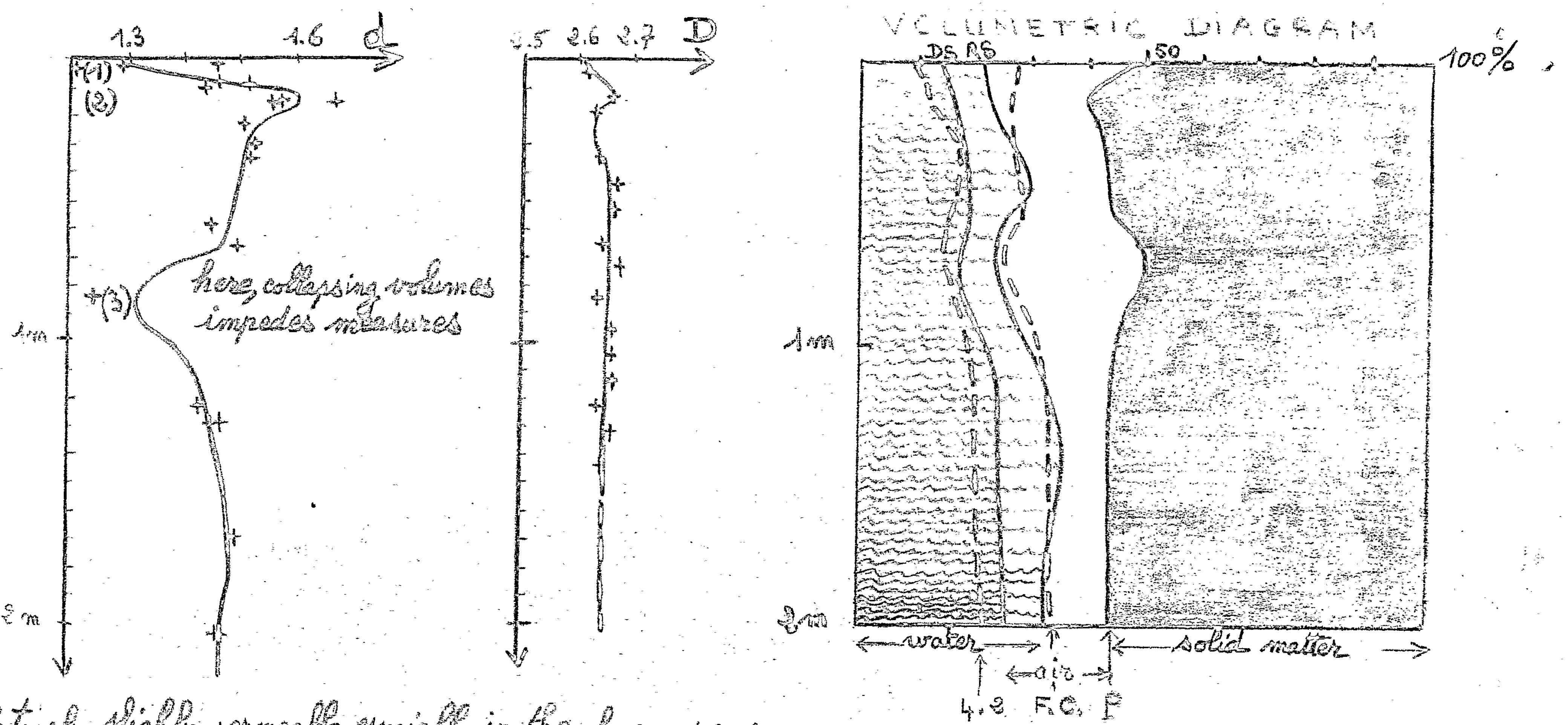
At the lower part :

1 - Line of nodules, 1-3 cm size, with red purpish blue iron matrix, with sandstone facies, (skeleton grain with junction and interstices filled with cement).

2 - About 5 cm below fine and ondulated rounded pebble level.

425 - 540 cm : High contrast, abrupt boundary. Migmatitic weathered material : pale reddish brown (5YR 6,5/6) or pale yellow (10YR8/6). In the yellow volume, there are little islands of material with conserved rock structure, more or less obliterate.

Lithorelictual red purplish blue nodules with weatherable minerals pseudomorphs. Sandy clay. Weak tubular porosity.



1) relatively slightly permeable, especially in the low areas of the "microrelief"

2) thin, superficial and slightly accentuated, compacted horizon. No perched water table after a rain!

3) lot of cavities, with roots bowls, or volumes filled with loose sandy material (biological or eluvial origin?)

See also figures 9, 10 and 11 –

COMMON LEGEND TO FIGURES 4, 5, 6, 7

d = bulk density (measured on 1 dm^3 volumes)

D = solid density

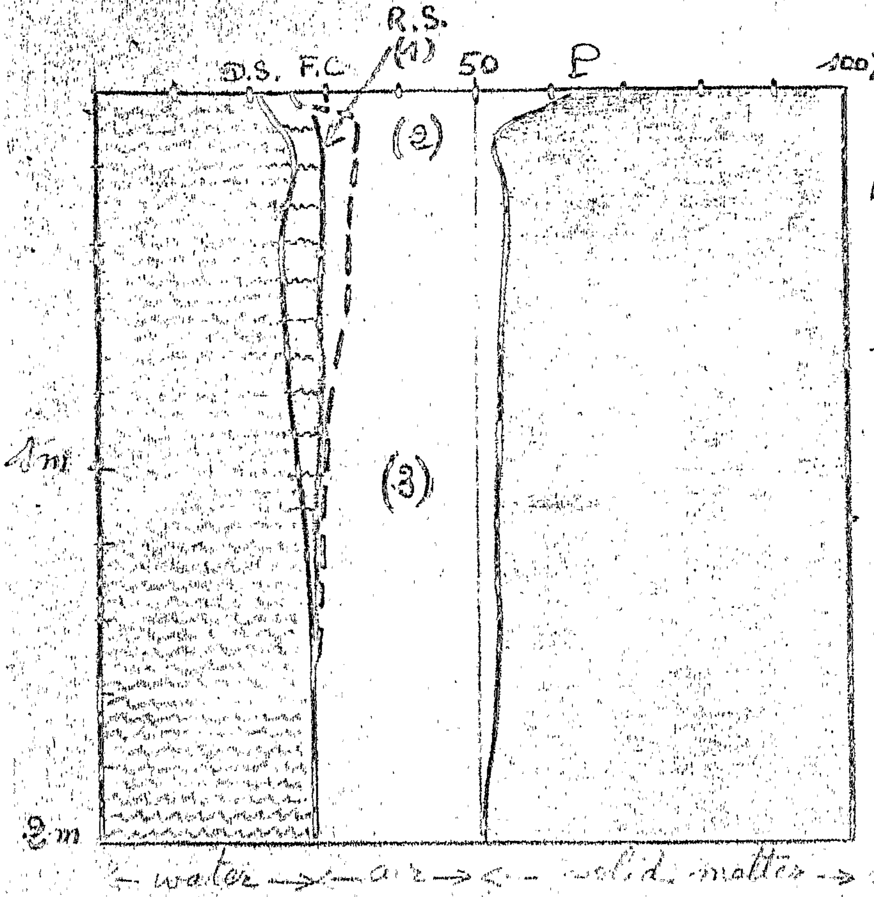
P = global porosity = 1 – d/D, in %

F.C. = Field Capacity (48 h after flooding)

4.2 = water content at 16 bars pressure

FIGURE n° 4 : DATA CONCERNING THE "MALGACHES PINE PLANTATION" SOIL : Carribean pines, 3 years old, after anthropic (?) savannah – yellow soil on Zanderij deposit.

ORSTOM 1992



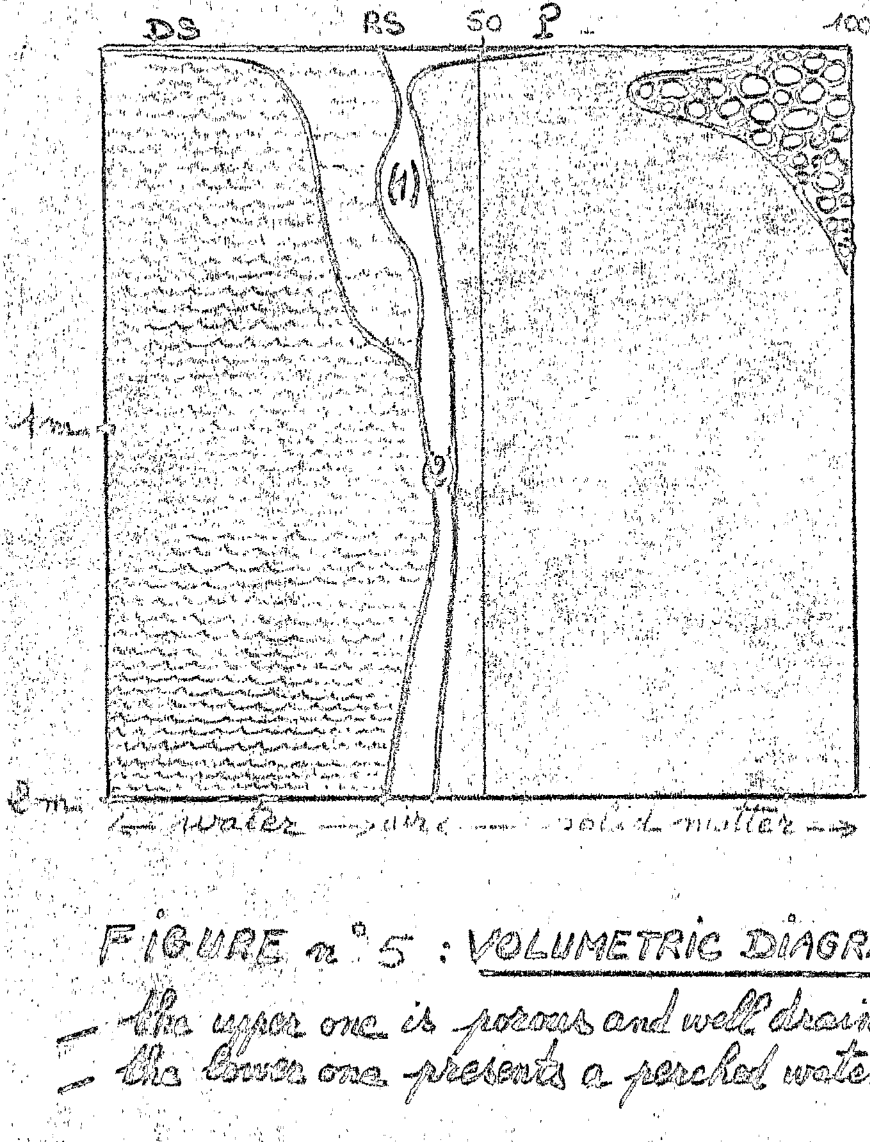
SS10 (well drained)

homogenous material (granite??)
coarse squeleton
micropedic B horizon

(1) this water content was measured in January 77, during a non-pluvious period: so it is inferior to the average

(2) the compacted horizon is slightly developed, no water table is observed

(3) lot of micropeds



SS18 (poorly drained)

heterogenous m. (migmatite?)
fine and rare squeleton -
under 0,8m: horizon without macro-porosity

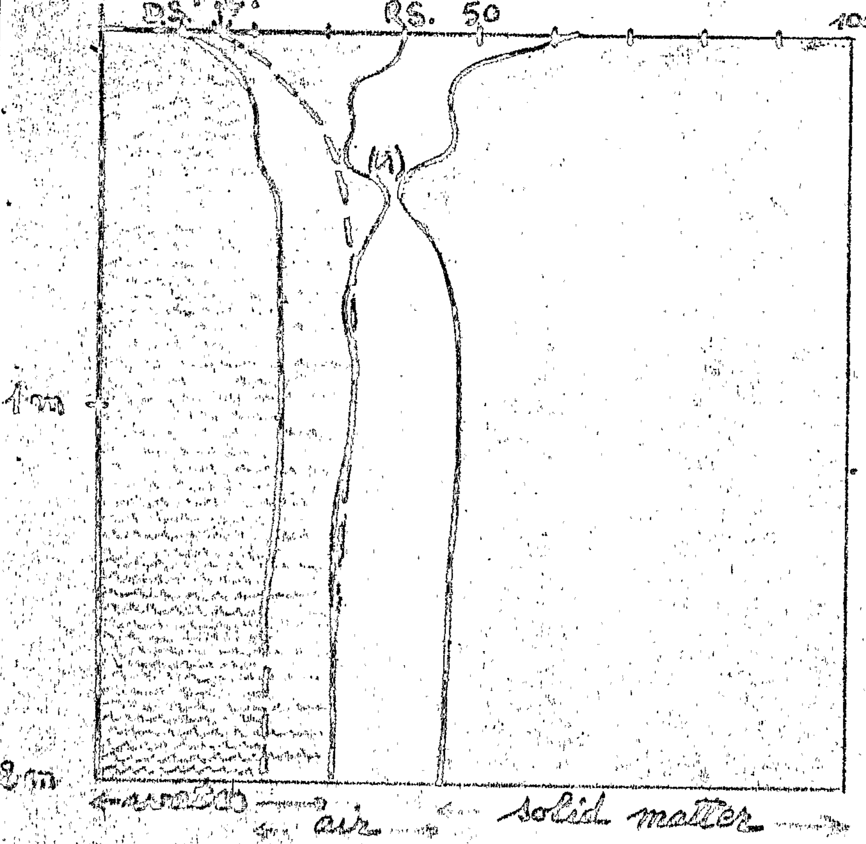
(1) here is observed a water table several days after a rain. The same after flooding (see figure 13)

(2) in this red horizon, Porosity, Fieldcapacity and perhaps pF4.2 are close to one another: the porosity is very fine

FIGURE n° 5 : VOLUMETRIC DIAGRAMS OF TWO DIFFERENT SOILS

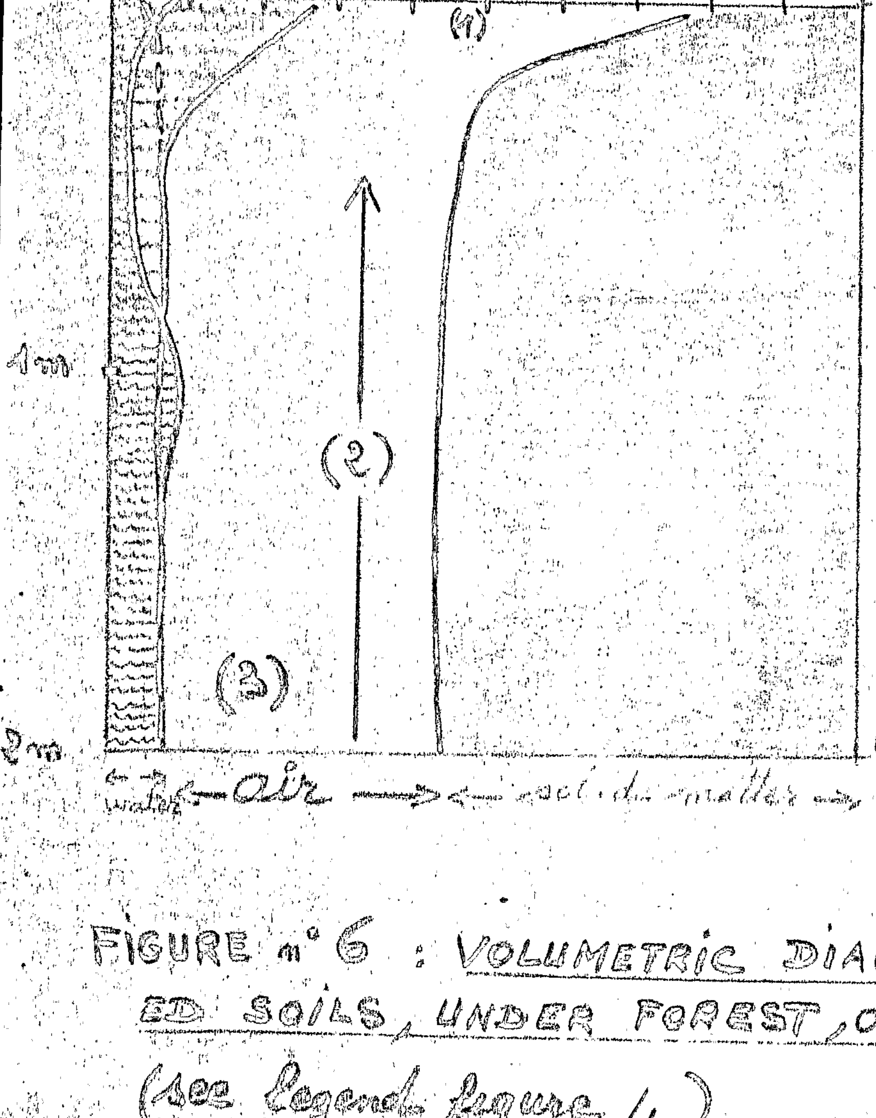
- the upper one is porous and well drained as an african ferralitic soil
- the lower one presents a perched water table on an impermeable red horizon

ORSTOM 1977



SS4 (yellow, sandy-clayish)

(1) compacted horizon, with
perched water table
in some places
a few hours after
the rain (see also figure 12)



SSP (podzol, coarse sandy)

(1) organic horizons (under
the leaves of the litter)
are included in this diagram
(bulk density of the upper
horizon = 0,42)

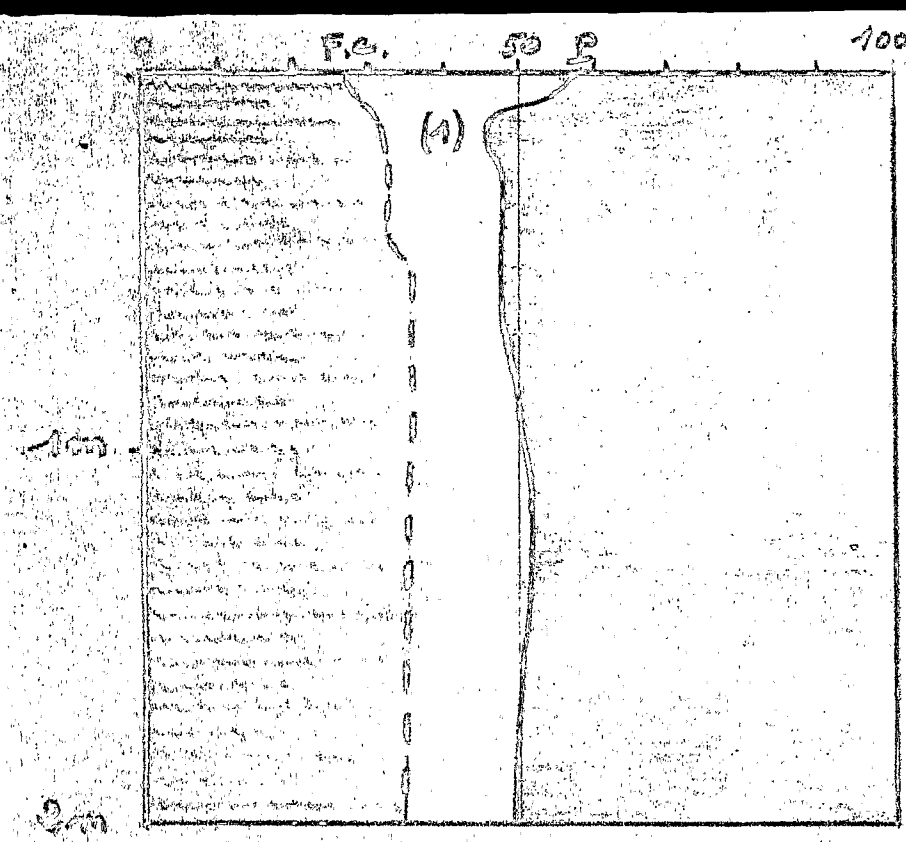
(2) collapsing horizon
when air-dried

(3) no water table observed (here)
(a water-slice of 2500 mm is
equivalent to the macroporosity of
7 m of this horizon)

FIGURE n° 6 : VOLUMETRIC DIAGRAMS OF TWO WELL DRAINED SOILS, UNDER FOREST, ON ZANDERIJ DEPOSIT

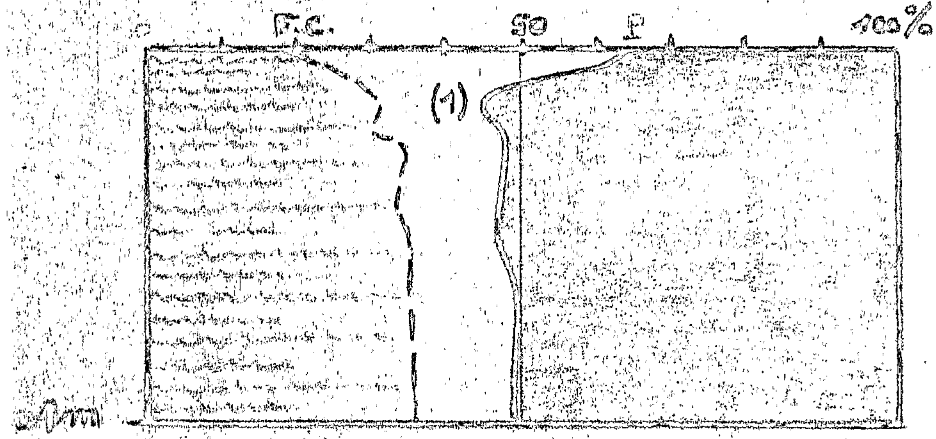
(see legend figure 4)

ORSTOM 1977

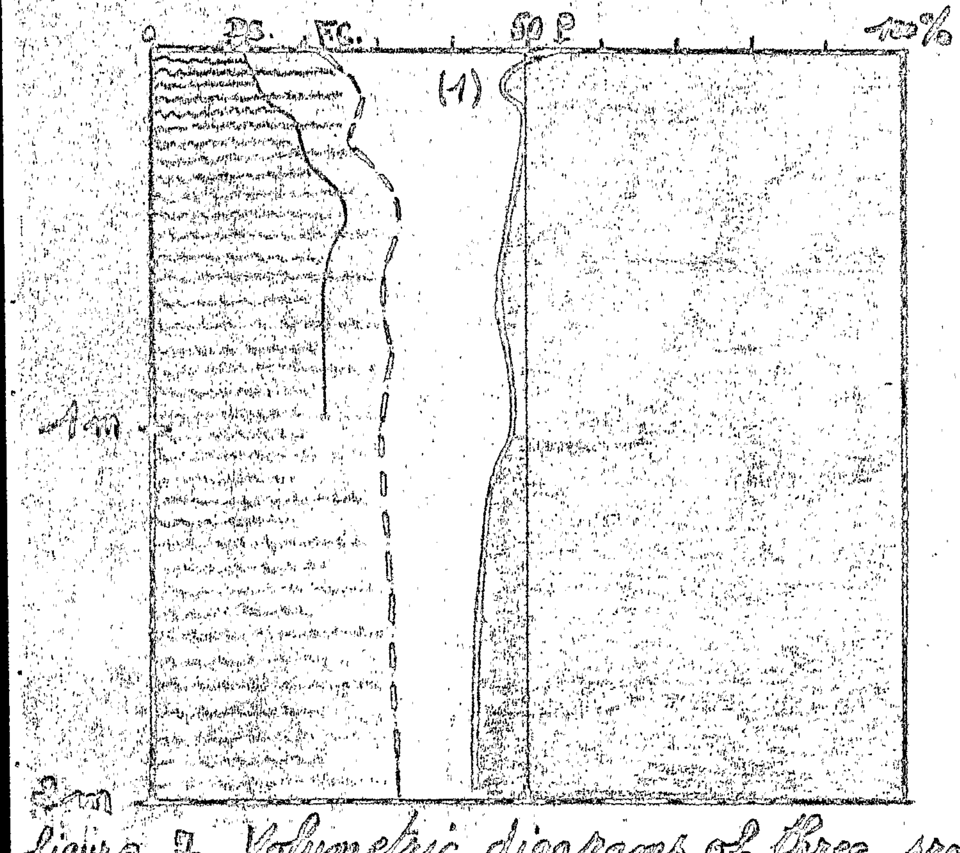


SS15 (summit)

(1) compacted thin horizon



SS16 (slope, under SS15)



SS 8 (front slope)

- see legend figure 4
- see figure 3 the topographical cut

figure 7 Volumetric diagrams of three profiles derived from a heterogeneous rock material, and belonging to a pedological cover in equilibrium

PROFILE	SSP	SLM	SS4	SS10	SS18
LITTER : leaves	13.7	15.4	3.7	4.9	3.9
débris	5.0	7.6	3.6	1.2	2.7
branches	2.4	2.0	1.7	1.6	2.9
Total	21.1	25.0	9.0	7.7	9.5
ROOTS : 1st horizon	0–15 cm 32.2	0–15 cm 10.9	0–5 cm 15.4	0–10 cm 17.1	0–15 cm 28.1
Complement to 20 cm	7.5	1.3	21.5	5.4	3.7
0– 20 cm	39.7	12.2	36.9	22.5	31.8
20– 40 cm	6.7	1.3	4.8	6.2	1.7
40– 60 cm	5.4	0.8	3.7	1.3	0.71
60– 80 cm	0.7	0.7	1.5	1.2	0.33
80–100 cm	1.1	0.3	0.8	0.5	0.11
Total 20–100 cm	13.9	3.1	10.8	9.2	2.8
Total 0– 1 m	53.6	15.3	47.7	31.8	35.8
100–120 cm	0.66	0.42	0.65	0.27	0.080
120–140 cm	0.58	0.15	0.66	0.33	0.040
140–160 cm	0.51	0.14	0.68	0.20	0.040
160–180 cm	0.42	0.19	0.37	0.21	0.038
180–200 cm	0.30	0.09	0.25	0.18	0.012
Total 1–2 m	2.48	0.99	2.61	1.19	0.21
Total 0–2 m	56.1	16.3	50.3	33.0	36.0

TABLE N° : WEIGHT OF LITTER AND ROOTS, OF DIFFERENT KINDS OF SOILS, NEAR SAUT-SABBAT.

Matter dried at 105°C., Measures on two contiguous sqare meters, between trees, expressed in tonnes by hectare – Stems (not measured) and superficial big roots (not representative), excluded.

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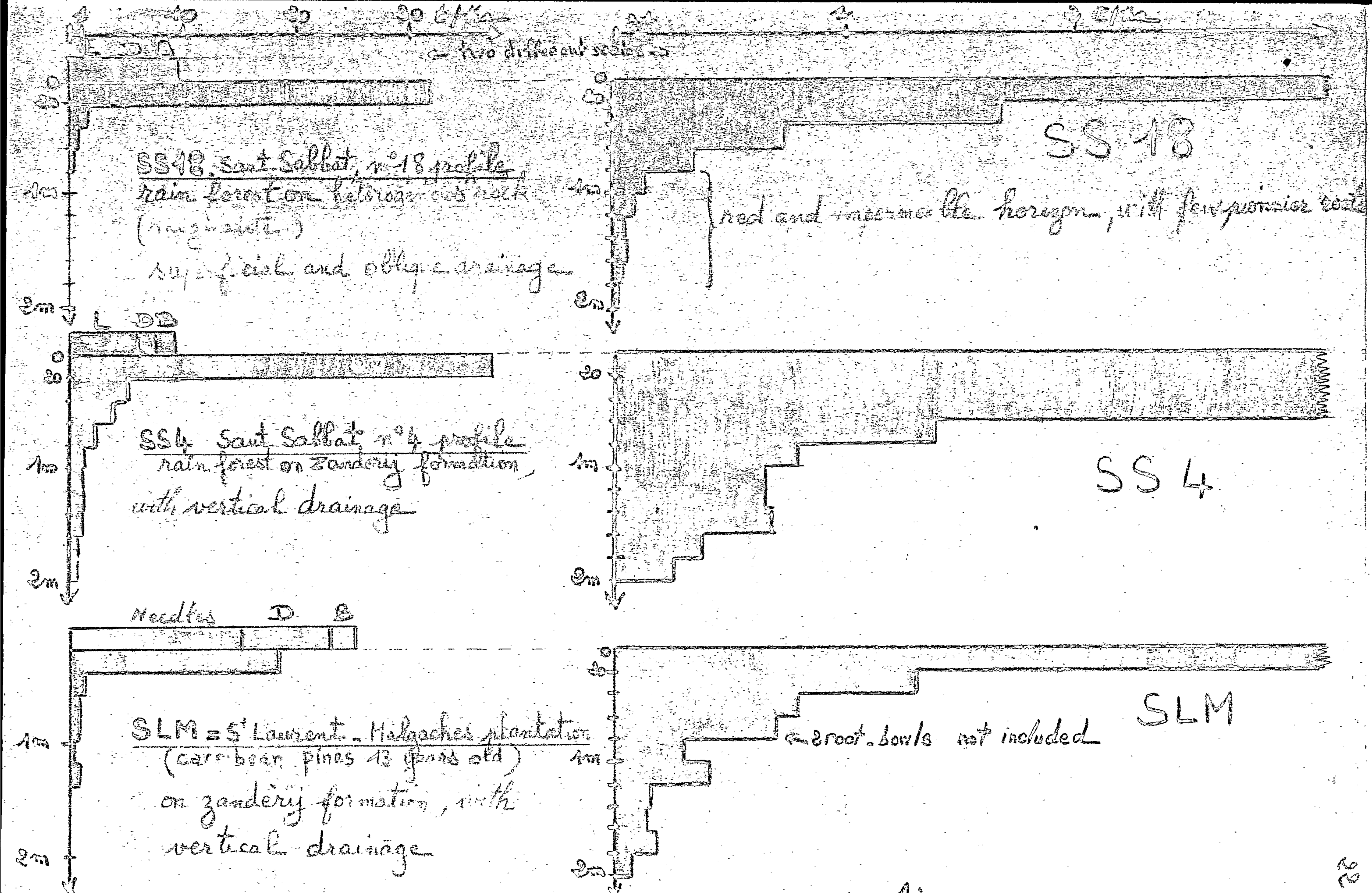

FIGURE n° 8 ROOTS DISTRIBUTION, in weight, by 20cm soil-slices

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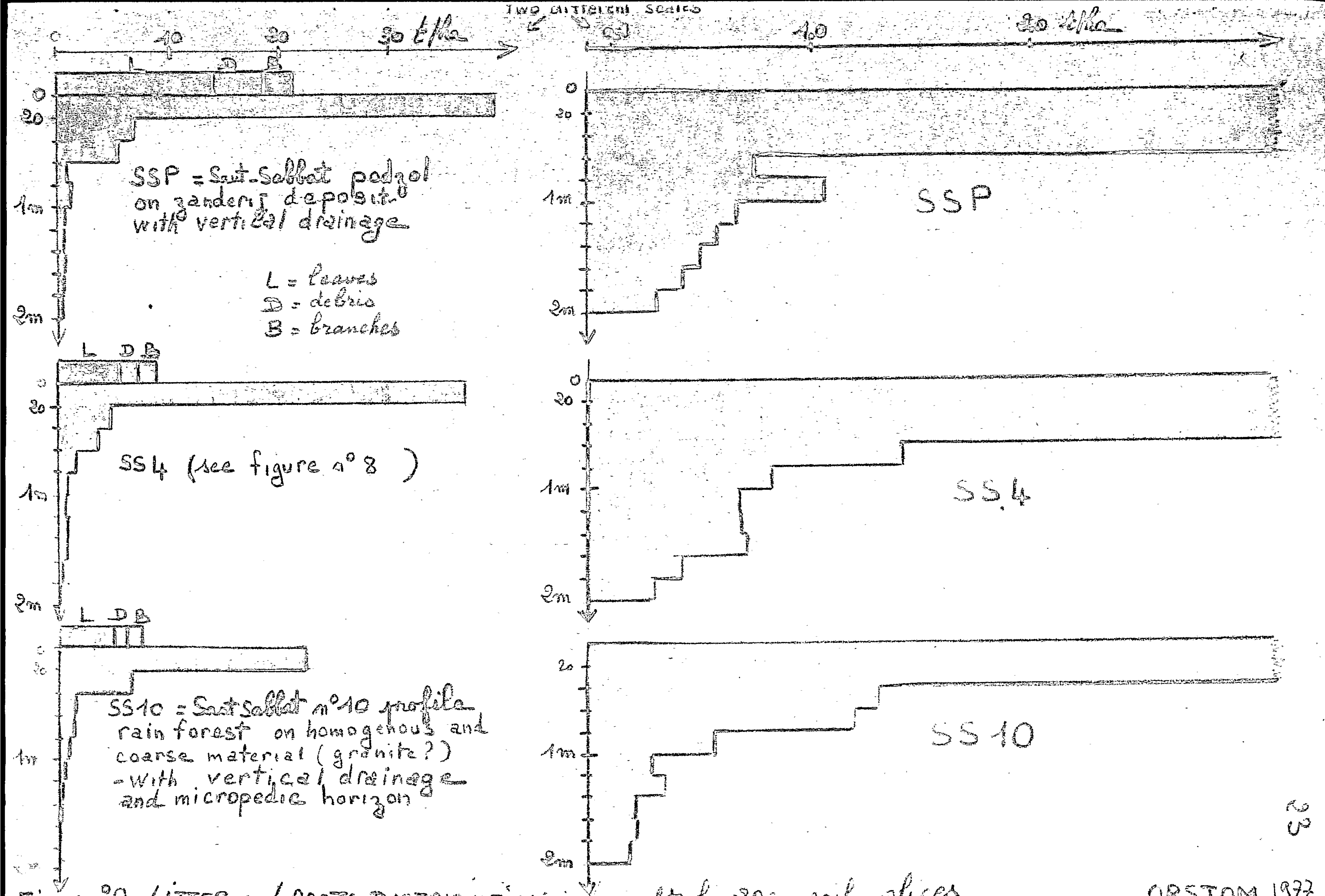

Figure n°9: LITTER and ROOTS DISTRIBUTION, in weight, by 20cm. soil - slices

ORSTOM 1977

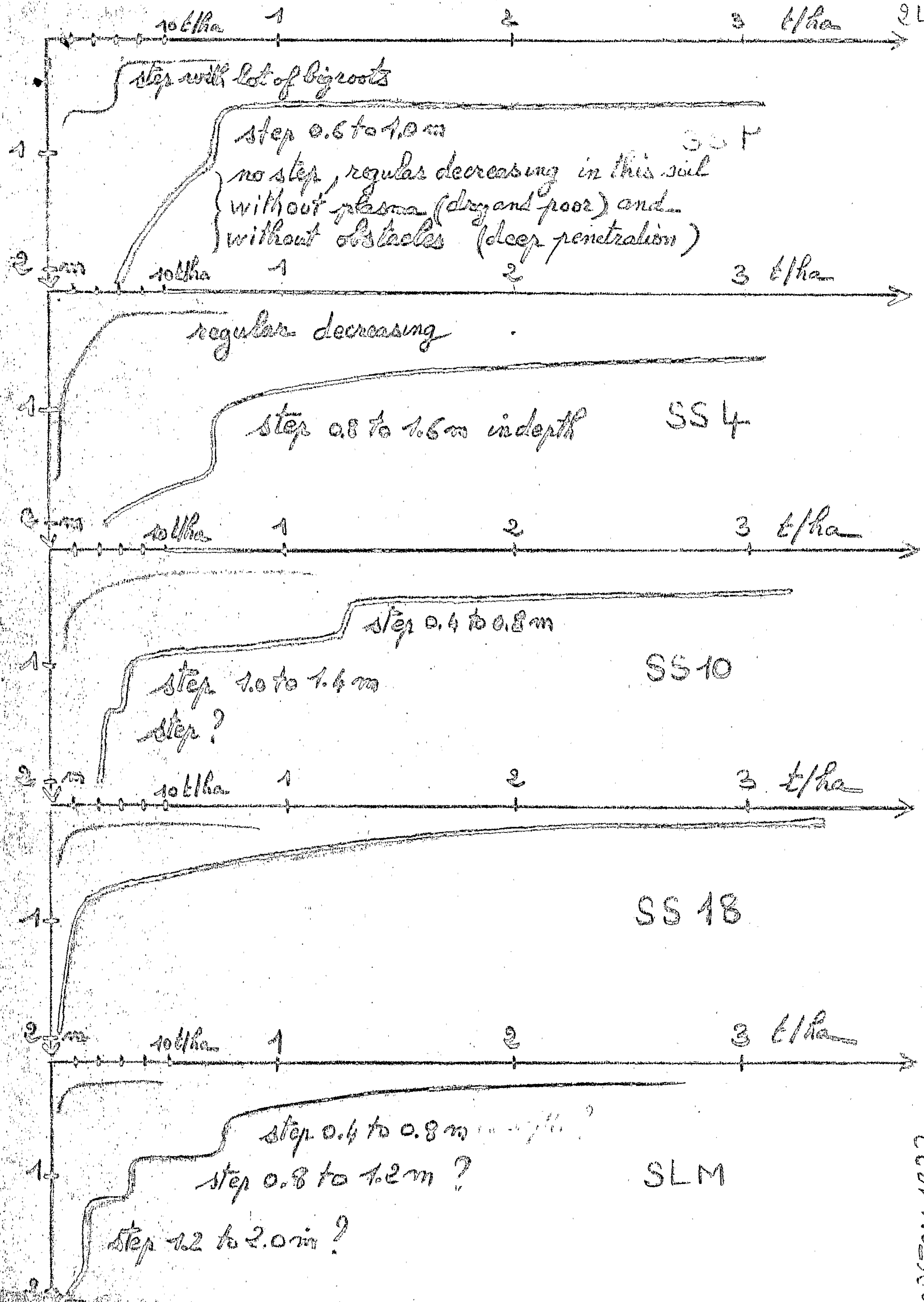

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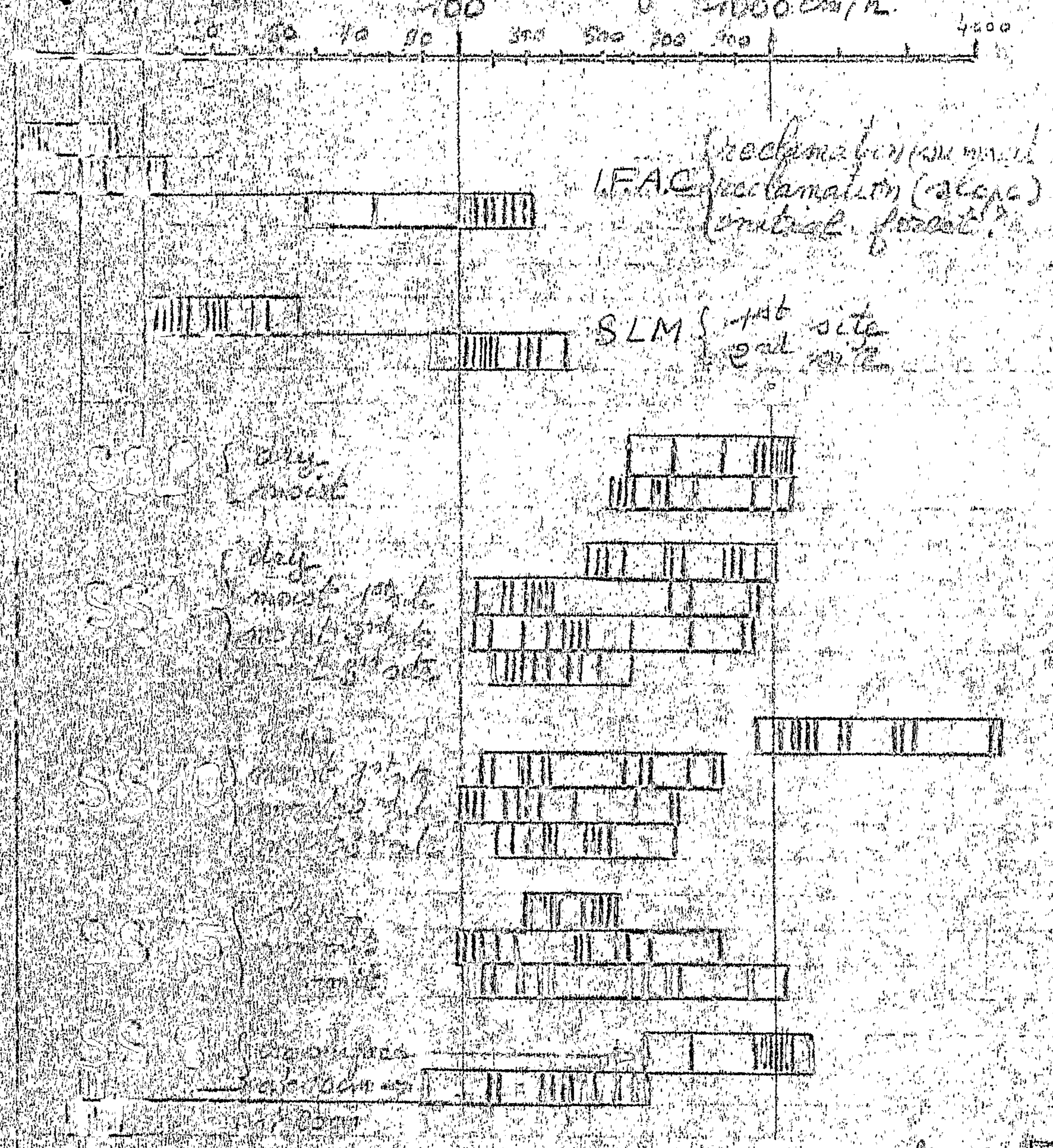
Figure n° 10 : Interpretation of histograms figures n° 8 and 9

F. GUYANE SOILS

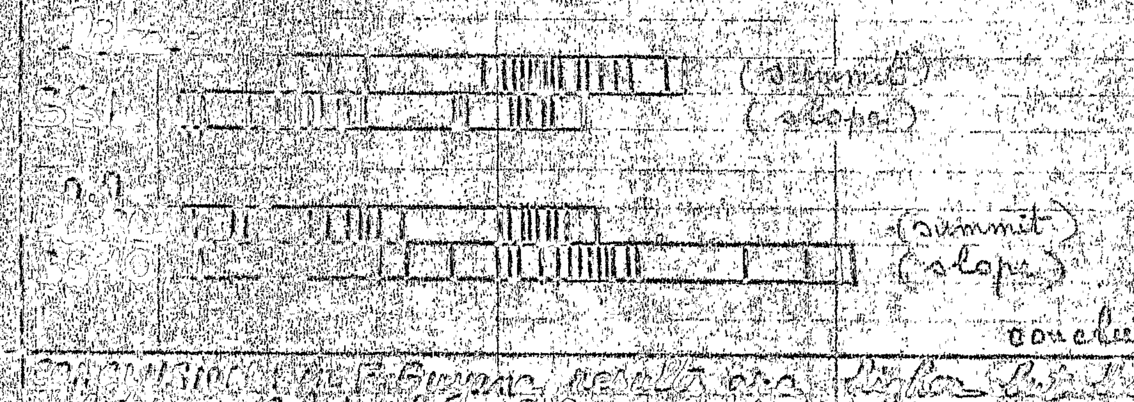
(!) 2 different scales are being used: 0-100 & 100-4000 cm/h.



		M	m	i
I.F.A.C.	reclamation (summit)	1.8	1.5	3.0
	reclamation (slope)	8.1	4.0	9.7
	initial forest	191	206	133
SLM	1st site	29	29	18
	2nd site	261	202	143
SS2	dry	1058	1000	322
	moist	776	665	255
SS1	dry	727	720	336
	moist 1st ...	403	360	458
	...	541	455	343
	...	353	315	181
SS10		2300	1000	1440
		390	400	399
		342	289	382
		419	375	145
SS15		418	305	134
		374	360	393
		538	[illegible]	425
SS		1229	1000	274
		477	477	310
		2.6	2	8

conclusion: mostly m > i

AFRICAN SOILS (Cameroon)

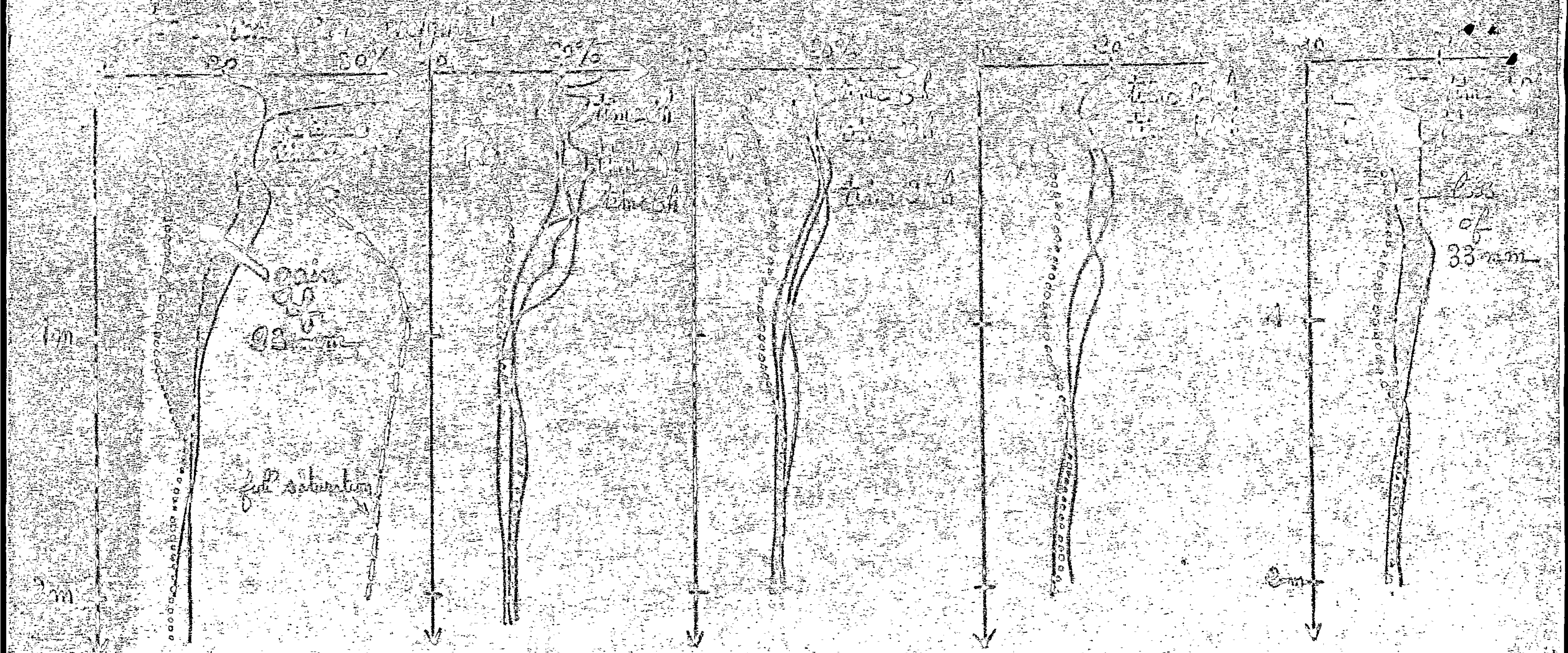


		M	m	i
SS1	(summit)	249	206	432
	(slope)	95	65	86
SS10	(summit)	119	94	132
	(slope)	395	224	339

conclusion: m << i

CONCLUSION: in F. Guyane results are higher than in Africa (in relation with [illegible])

FIG. 14. PERMEABILITY TESTS IN FIELD, AT SURFACE OF STUDIED SOILS.
Distribution of the results; M = Average, m = median, i = interquartile [illegible] on each site, without external cylinder [illegible]



gain of water inside the 1st meter time 0 = end of infiltration

rapid and partial drainage of the gain untill time 6h

Vertical distribution untill 48h, taken as Field capacity

exhaustion of the gain, by slow drainage (and [illegible])

[illegible] sometimes observed, in natural conditions, four hours after a rain

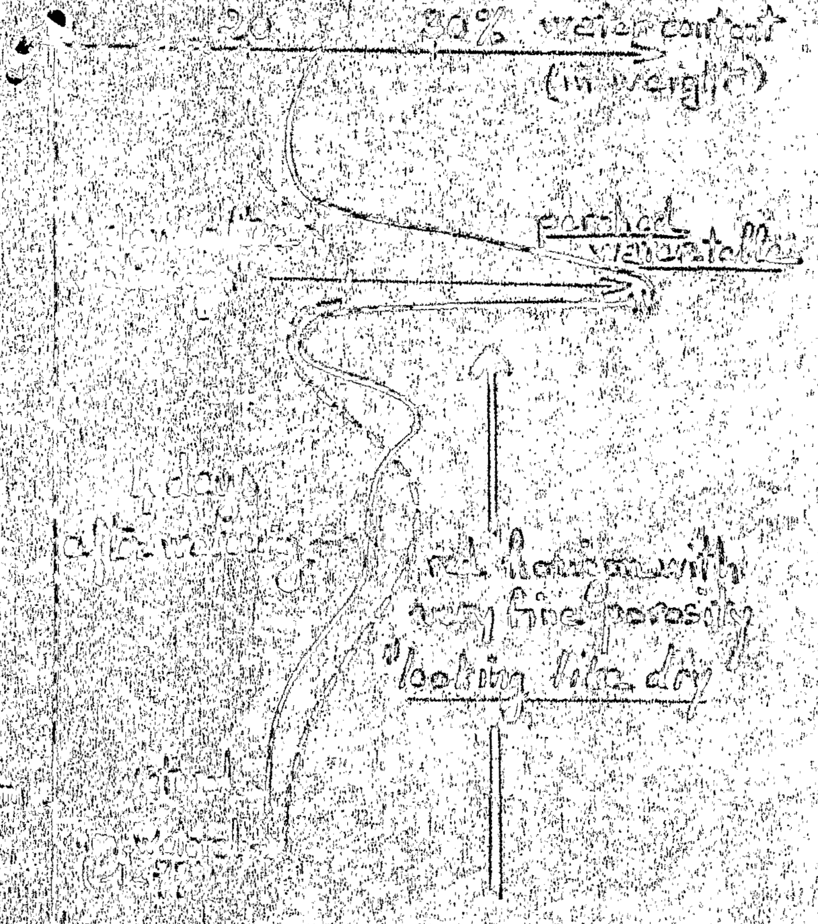
FIGURE n°12

Experimental study of the water-infiltration in the vertical drained soil SS4

(deep yellow homogeneous soil under forest, on Zanderij formation)

[illegible] sheet of 250 mm equal to the macroporosity of the two upper meters

was made under shelter ([illegible]) in points at intervals [illegible] — [illegible] Reference soil without shelter, at time SS4



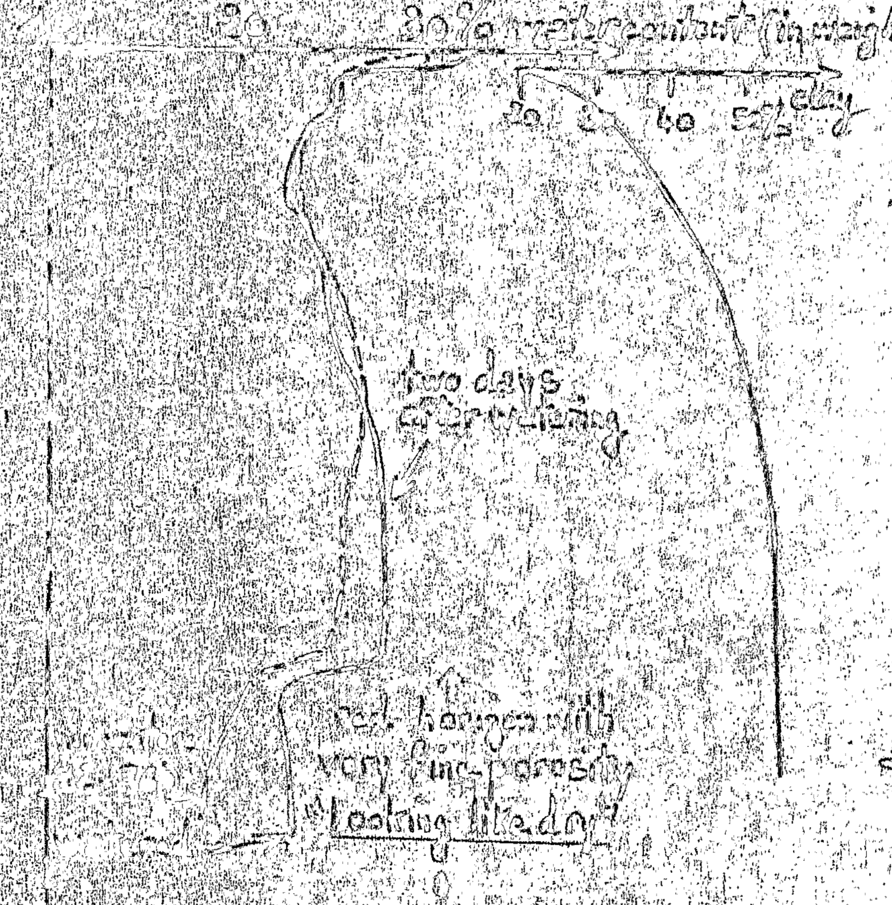
SS18 Profile

(see others datas on figures 2, 5 and 9)

[four days after watering the perched water table disappeared]

[Field Capacity measure is not possible by a vertical watering]

[the watering was done with a water slice of 250mm exceeding the macroporosity of the upper meters]

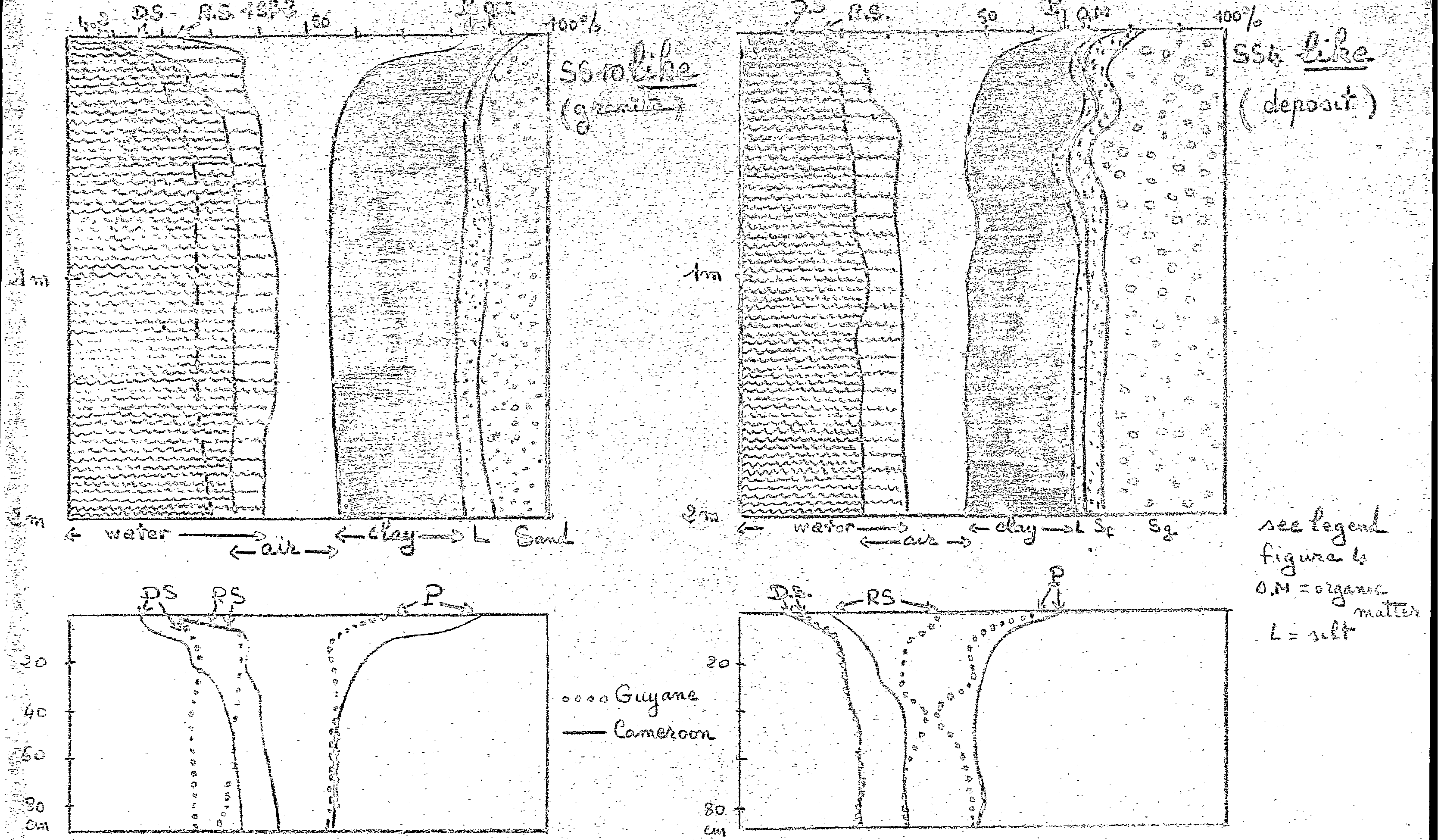


SS20 profile.

- the red, impermeable horizon is deeper (1.6 m) than in SS18 (0.8 m)
- the upper horizons are different (cf SS18) and no perched water table is observed.

[during the rainy season field water content is adjacent to F.C.]

[illegible] Comparison between field water content and [illegible] comportment to an experimental watering (with a mea- [illegible] Field Capacity)



see legend figure 6
O.M = organic matter
L = silt

FIGURE n°14 above: VOLUMETRIC DIAGRAMS OF TWO CAMEROONIAN FERRALITIC SOILS
below: COMPARISON WITH F. GUYANENSE SS10 (left) and SS4 (right) PROFILES, to show the differences appearing in the upper horizons

COMMENT OF THE NUMERICAL DATA
Included in figures 4 to 14.

The data included in these figures relate to soils shown during the second day of the fieldtrip, and which belong to units 1, 2, 4, 5 and 6 described in the note intitled : the pedological environment of French Guyane. Only units 1 and 2 may be compared to African Ferralitic soils, as done in figures 14 and 13.

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These measures give the volumetric composition and superficial permeability of 8 profiles, roots-distribution in 5 profiles, and modalities of the seapage of a water-slice in 3 profiles.

--

1 - <u>Volumetric composition</u> (figures 4,5,6,7 and 14).
From SS10 (unit 1) to SS18 (unit 6), the differencies are the biggest :

<u>In SS10</u>-(figure 5 above), macroporosity (P.F.C.) is very important, untill 2 m and deeper, and air-content remains considerable, even during the rainy season (P-R.S.). Vertical drainage is not counteract (under untouched forest) as neither hydromorphic spots, neither strong yellow horizon, or perched water table are observed.

<u>In SS18</u> (figure 5 below), on the contrary, air-content is small during the rainy season. Even, a sub-superficial perched water-table is observed in a lot of places and during several days after a rain. As a set off, during the dry season, air-content becomes important (seasonal opposition, consequently), but only untill 80 cm in depth. Underneath, begins a red and compacted horizon, which looks like dry. In fact, the volumetric diagram indicates this horizon is nearly water-saturated, and its water-content does not change during the year. This result does not mean water don't move down. But porosity is so fine than drainage is probably very slow in comparison with pluvial compulsion : this horizon is qualified "impermeable". High water-content during the dry season, in this declivity soil, may signify the porosity is very fine, so that pF 4.2, Field Capacity and Porosity are quite close to one another (F.C. measure, in the classic way, is evidently not possible).

SS20 profile (figure 13), also shows a red compacted horizon, but this one is deeper (1.6 m). At the time of a F.C. measure attempt, 48 h after infiltration, no perched water-table was observed, but only a sligh water-content maximum, above 1.6 m. In natural conditions, an oblique internal drainage is probable, in such a declivity soil (the pit, protected from rain and running water, is filled by water after the rain).

SS4 profile (figure 6) represents unit 2 (Zanderij deposit), because reduction and oxydation spots are observed in the A horizons and a fugacious perched water-table after an important rain. This slackening of the vertical drainage is in relationships with the presence of a thin compacted horizon about 50 cm in depth.

SS18, SS16 and SS8 profiles (figure 7) also represents unit 2 soils, but derived from migmatite. The same compacted horizon is observed, but more superficial and less accentuated than in SS4 profile, as well as a global diminution of the one upper water porosity (in regard to SS10).

SL4 profile (figure 4) is not quite homologous-under plantation-of forestry profile SS4, although the parent material is similar (Zanderij). Here, in fact, the compacted horizon is thiner and quite superficial (10 cm) so that the permeability at the soil-surface notably decreases (figure 11). Having collapsing sandy volumes in depth, and very important macroporosity, this unit 1 soil presents measured characteristics a bit near those of podzol SSP (unit 4).

SSP profile (figure 6) represents podzols, where they are not flooded after the pluvious periodes. Its macroporosity becomes enormous (37%) and such a soil, if there is an impermeable layer in depth, may contain an important water slice.

2 - Roots distribution (table, figures 8, 9 and 10).
By observing the profiles, differencies in roots distribution or roots quantity are stated. Measures were done for specifing and ratifiing those qualitative appreciations : for instance(), there is, in weight,

five to ten time less roots,, between 1 and 2 meters, in the SS18 profile than in the well vertically drained soils like SS10 and SS4.

Do those differences influence the global roots-weight ? it appears that, the most sandy is the profile, the most important and deeply distributed is the roots global weight : SSP > SS4 >> SS10 and SS18. So, the roots are bigger and deeper in the soils with poor supply in water and cations. But other factors interfere in this complex problem of roots comportment.

In the different roots-profiles, three forms are observed (figure 10) : "exponential" decreasing, as in SS18.

Regular decreasing (stairs in SSP, below 1 m)

Steps, (may even increasing), as SS4 between 1 and 1.6 m.

Interpretation of these differences will depend on roots-size measures,

Under the monospecific vegetation (carribean pines) at SLM profile, roots weight and distribution are quite inferior to those of plurispecific vegetation as in SS4. Moreover, litter/roots ratio, is very high, even more than in podzol SSP.

4 - <u>Permeability test, at the surface of the soils</u> (figure 11). Results, and especially their statistical distribution, give new or complementary informations, concerning pore-space organization and comportment. Peculiarly, comparison with ferralitic soils of South-Cameroon are interesting :

- Permeability is, in surface, on an average, higher in F. Guyane than in South-Cameroon. Relationships with two other differences may be suggested.

1 the peds of the A_1 horizon show, in a way, an hydrophobic behavior, in contrast with "hydrophile" behavior in South-Cameroon.

2 there often is an eluvial sandy horizon below the A horizon and soil-texture is more sandy.

- Dispersion of the results is shorter, from 1 to 10 instead of 1 to 100, and the ratio Average/median is usually positive but smaller. This distribution may be in relationships with a less important and less diversified faunic activity (in works of perforation or aeration).

- Vertical decreasing of the permeability is rapid, as in South-Cameroon. See it in SS8 profile (fig. 11), where reduction quotient, between surface and 30 cm, reaches 500.

- Sandy soils, as SSP, have sligh difference in permeability in relations with moistening at the beginning of the measure. It is the contrary in clayish soils, as SS10 (measures in dry and in rainy seasons).

- Soil, which badly reacts to the IFAC reclamation, initially was less permeable than the others forestry soils, but as permeable as South-Cameroon soils. After clearing, the permeability became as low as at 30 cm depth in SS8. Morphologic comparison with the initial forestry soil indicates a slice of about 30 cm of soil disappeared, by bulldozer and erosion.

5 - Experimental study of the infiltration of a water-slice (figures 12 and 13).

Experiment of the figure 12 aims to determine the water-seapage in a vertically drained soil, as SS4 : 250 mm of water were brought in surface and 1 h later 93 mm remains underneath (so, rest was obliquely drained).

Among those 93 mm, 60 mm were drained during the first 48 h, 33 mm during the following 48 h. So, is an inflexion in the water-seapage curv) ~~cure~~).

In details, a surcharge is observed utill time 6 h in the 8 first-decimeters. Then, this surcharge is vertically distributed, untill time 48 h (position taken as Field Capacity), but the initial water-content profile is reached(partially) 96 h later (sligh surcharge between 40 and 140 cm).

- Perched Water-table, observed in SS4 after the rain, was not produced during this experiment, however done with a bigger water-slice.

This contradiction may be explained : the site chosen for experiment is several meters farer than SS4 profile, along the transition to podzol, in a place where the compacted horizon is deeper and less accentuated.

Experiments made on deficient vertical drainage soils, SS18 and SS20, indicates : According to the depth of the red impermeable horizon, either a subsuperficial perched water-table, or a sligh surcharge in depth is created. Initial water-content profile is reached more than two days later : it don't mean the Field Capacity measure is possible, by this way, concerning the red horizon, even if the seepage time is prolonged 4 days or more : in fact, water brought in surface, escapes obliquely without penetrate the impermeable and moistened horizon.

Do the Field Capacity notion conserve its interest, in such a case ?

6 - *Remark, as a conclusion*.

Hydrodynamic units 1 to 6 have been distinguished after some *observations* of the profiles and their seasonal moisture variations. Here, this distinction has been corroborated, and specified, by some *measures*.

Observations orientated choice of measure (sites, profiles, horizons, domains). Reciprocally, measures led to search, and find, morphological features which failed to the former observations.

But observations are delicate, because the differences often are tenuous, even for a clever soil scientist. The same, measures are long and tedious, consequently expensive and limitated to a few profiles.

However, hydrodynamic differences have to be cartographied, since they determine soil cultural aptitudes in this country. --Consequently, maping criteriums, found upon easy observations or measures, have to be selected. Some of these criteriums are secure in use, others are facultative, others random.

It is the actual purpose of our service.

ORSTOM Pédologie