STICHTING VOOR BODEMKARTERING

WAGENINGEN

DIRECTEUR: Dr. Ir. F. W. G. PIJLS

SHORT REPORT ON A SOIL MAP OF A PART OF A FARMSTEAD IN ROEKEL (THE NETHERLANDS)

Soil Survey Institute
WAGENINGEN

SHORT REPORT ON A SOIL MAP OF A PART OF A FARMSTEAD IN ROEKEL (THE NETHERLANDS)

By: M. Bordbar and
M. Farman-ara
of Iran.

August 1961.

C O N T E N T S

+++++++
+++++
+++
+

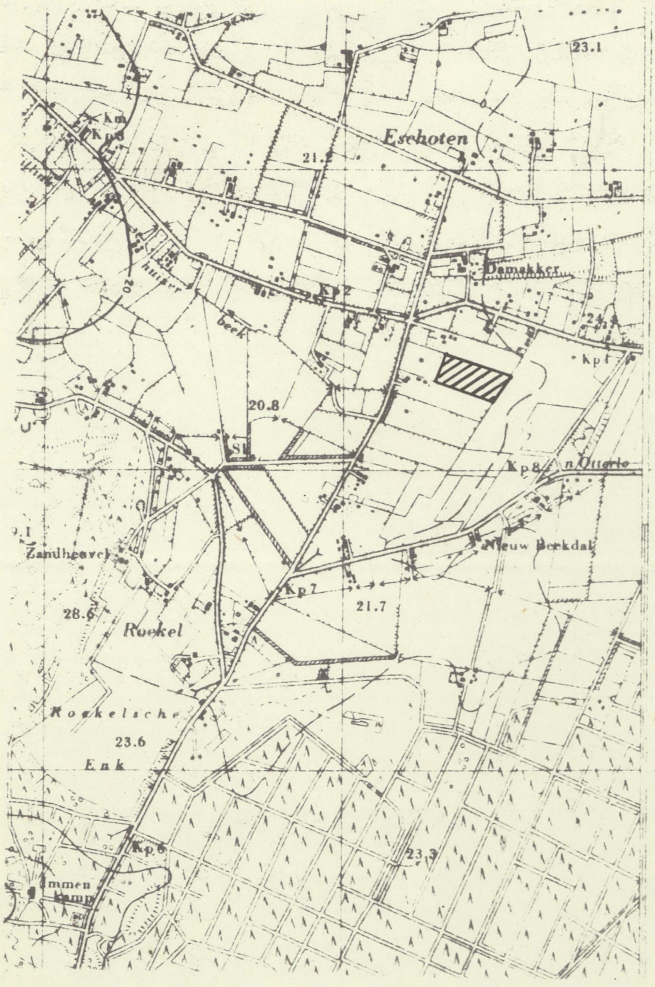
DESCRIPTION OF THE SYMBOLOS

PROFILE NO
•

DEPTH OF HORIZONS (Dec.m)
A1 / A2 / B2 / B3

WATER TABLE CLASS / Fe CONTENT
AND ITS DEPTH (Dec.m) / IRON CONCRETION (Dec.m)

LOCATION MAP



N° 32 H EDE

1. PREFACE

In the period of our study in Holland we had the opportunity to see different kinds of soils in the Netherlands and to visit many farms.

A part of our soil study in Holland was carried out in Wageningen under the direction of Mr. Pape en Mr. Kraanen of the Soil Survey Institute. During that period we had to map one small part of the land ourselves.

The place which was chosen, was located in a farmstead near "Roekel" village about 20 km far from Wageningen and in the north of it.

This area in soil survey mapping in 1951 was printed out as an association of gley-and humuspodzol soils. The difference of soils in a very short distance was so sharp and so wide that they hardly could be separated from each other on the map.

The land was used as a grassland at the moment and had slight differences in the elevation of the land surface. The low places were slightly too wet and consisted mostly of gley soils, on the higher places humuspodzol soils were found.

2. GEOLOGY OF THE AREA

The mapped area lies in the Gelderse Vallei, a glacial valley, formed during Riss time, and afterwards filled up with solifluction- and aeolian material.

To the east lies a pushed glacial ridge, consisting of coarse sand and gravel beds, alternating with some clay- and loam deposits. These beds were deposited in a horizontal position by the rivers Meuse and Rhine, but they were pushed up by the ice, so that they are now standing sometimes upright.

Under the ice, there was a depression from about 30 m. At the base was formed boulder clay, that functions now as an impervious layer. Because of the boulder clay, in some places artesian wells can be found.

Specially during the last glacial time, Würm time, artic winds swept masses of fine, sorted sand, into the valley.

This sand is called cover sand. It contains few coarse particles and few very fine particles. The medium size of the grains is ca. 100 - 200 micron.

The sand was deposited as parabola dunes, which are still visible in the landscape, thought they are more or less eroded. The mapped area lies in a fairly flat part, between the arms of some dunes. Deposition of the material ended about 10,000 years ago.

3. SOIL FORMING FACTORS

a. Climate

As the mapped area is very small, it is improbable that differences in climate in the area are of any importance for the differences in soil formation. Some typical data are given below.

Table: Temperature, precipitation and sunshine.
Observations in De Bilt, means over the period 1921-1950.

	Jan.	Febr.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Temperature °C													
Mean per 24 hours	1.9	2.3	4.9	8.4	12.4	15.2	17.2	16.2	14.2	9.8	5.5	2.4	9.2
Mean in day time	2.2	2.8	5.9	9.7	14.2	17.1	18.9	18.3	15.4	10.6	5.0	2.7	10.3
Number of summer days (max.temp. > 25°C.)	-	-	-	0	3	5	8	6	2	0	-	-	24
Number of frost days (min.temp. < 0°C.)	14	14	12	3	1	-	-	-	0	2	7	14	67
Number of ice days (max.temp. < 0°C.)	5	3	0	-	-	-	-	-	-	-	0	4	12
Precipitation													
Amount in mm	62	49	41	50	55	58	74	82	75	74	76	65	760
Number of days with at least 1.0 mm	13	10	9	10	9	9	11	12	11	12	13	12	131
Rain hours	44	35	28	30	32	28	30	30	29	45	52	41	425
Sunshine	54	74	133	155	211	218	206	192	143	105	53	44	1592
Sunshine in % of longest time possible	21	27	36	37	43	43	41	42	39	32	20	18	36
Number of sunless days	13	9	5	3	2	1	1	1	2	5	11	14	66

b. Vegetation

It is known, that since the time, 10,000 years ago, when soil formation started, different vegetations must have grown in the area. As it is well possible to have an alternation of different plants within short distance, it might be possible, that the differences in soils, must be attributed to differences in vegetation.

History of the vegetation since Pleniglacial time

	Subatlantic	Strong expansion of beech, later of Carpinus too Hazel recedes, increasing deforestation by man	Present time
	Subboreal	Elm and lime diminish, beech and Carpinus appear Beginning of deforestation by man	
Holocene	Atlanticum	Oak, alder, lime, ash and elm are important Hazel abundant, Pinus few	
	Boreal	Hazel and Pinus abundant. Expansion of oak and elm alder, ash and lime immigrate	
	Pre Boreal	Closed birch and pine forest. Pinus increases. Elm, oak and hazel immigrate	8300 bc
	Younger Dryas	Park landscape of birch and pine	
	Allerød time	Closed forest, birch first, later pine and birch	
Late Glacial	Early Dryas	Park landscape and park tundra	
	Bølling time	Park landscape of birch	11000 bc
Pleni Glacial		Tundra	

c. Parent material

The parent material consists of fine non calcareous slightly loamy sand. It is very uniform in composition. It consists mainly of quartz, mixed with some heavy minerals. The soils are originally very poor in nutrients.

Mineralogical composition of cover sands

The mean content of heavy minerals in the fraction 210-150 mu of cover sands is ca. 0.3 %. In contrast, the heavy mineral content of the richer preglacial soils is > 1.0 %. The rest is mainly quartz.

Example of the mineralogical composition of the heavy fraction of a cover sand soil

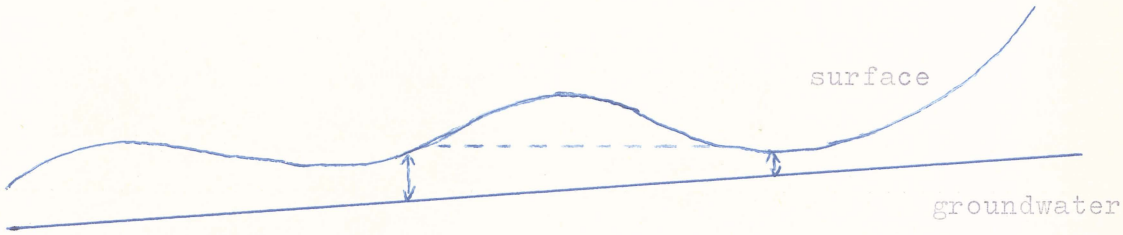
Turmaline	Garnet	Metamorfic minerals	Epidote	Saussurite	Hornblende	Augite
9%	10%	7%	15%	46%	9%	4%

As the parent material is very uniform, it is improbable that differences in soil formation are due to differences in parent material.

d. Relief

The relief is slightly undulating. Differences in height are about 10 - 30 cm. The general slope is in western direction. This slope is very small.

The topography is of importance for the groundwater situation. In general the groundwater is parallel to the surface. It does however not follow the slight undulations. This results in a situation where topographical high places are nearer the groundwater than some topographical low places.



There is a great possibility that this groundwater regime is responsible, at least in part, for the differences in soil formation.

e. Man

It is very probable that during a long time, farmers have cut off the sods of the area, to use them in the stable, to be mixed with manure, to be used on the arable land. The reclamation of the soil took place in the beginning of the 20th century. There is no reason to suppose that treatment of the area by man, has been different within short distances.

f. Time

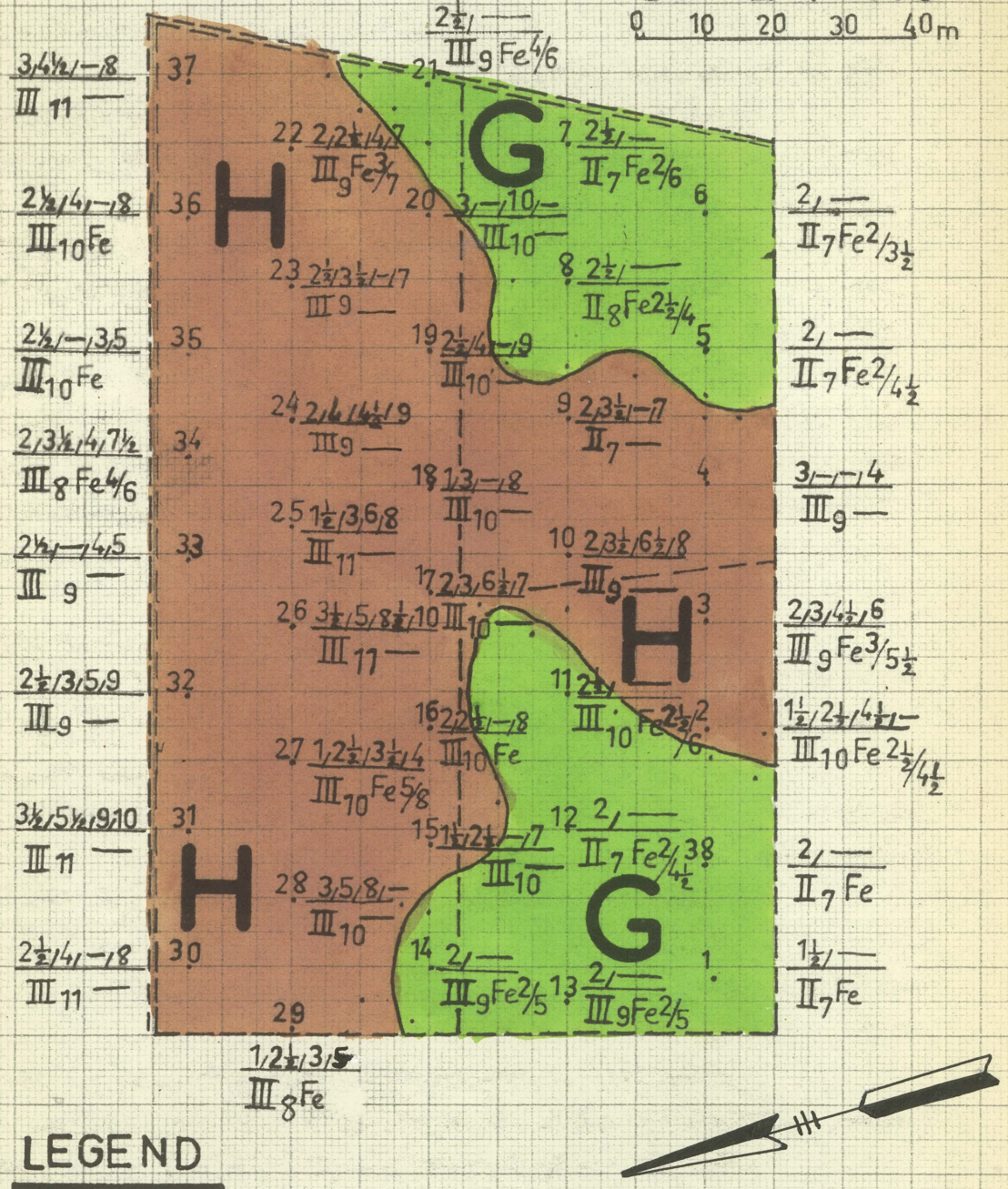
Soil formation started about 10,000 years ago. Factor time has been doubtless the same for the whole area mapped.

There are two factors that may be mainly responsible for the differences in soil vegetation and relief.

VERY DETAILED SOIL MAP OF A PART OF A FARM STEAD NEAR ROEKEL

SCALE 1:1000

0 10 20 30 40 m



LEGEND

G — GLEY SOILS

H — HUMUS PODZOL SOILS

AUGUST 1961 BY: M·FARMANARA — M·BORDBAR

4. THE SOIL MAP

To study the soil, the area was divided into 6 sections by 5 parallel lines. On these lines which were 20 metres far from each other, auger boring and soil study was done in every 20 metres distance.

In the case when different soils were found every 5 or 2 metres one or more borings were executed.

In this study the kinds of the layers of soils, their depth, presence of humus and iron, influence of water, vegetation, groundwater table etc. were studied.

The places of auger borings are shown on the joined map with their numbers and the depths of A1, A2, B2, B3 layers in decimeters over a short line.

The depths of layer of auger boring places are shown also as diagrams joined to this report (no. 1, 2) and one special line in H.P. soil was selected between profile nr. 22 and 29 to indicate the differences in depths of layers in detail. On this line every 5 metres one boring was done and the result of the study is given in diagram no. 3.

The depths of layers varied very much in many places of the area and some of the A, B layers were missing of mixed. In this case instead of its depth one short line was put in the symbol.

In the symbols marked on the map, the water table class, its depth and presence of iron or iron concretion, with its depth, are shown under the symbols lines.

The depth are in decimeter and presence of iron in the profile is shown by Fe, and iron concretion in the profile is as below Fe (2-5), which indicates iron concretion is found in the depth between 20 and 50 cm.

Estimation of groundwater table was based on the depth of lowest groundwater table or gley horizons of the profile.

When this gley horizon was at 80 cm depth of higher than that, it is shown as class II, and the depth of lowest groundwater table between 80-120 cm as class III.

On the map by the number of watertable class, and the depths on which the gley horizon is found, is put in decimeters.

5. KINDS OF SOILS

According to the soil classification guide, gley- and humus-podzol soils are found in the surveyed area.

In low laying parts of the land, there was mostly gley soil but on the small slopes or on the level parts, the humuspodzol soil was situated.

But differences of the layers and their depths were so variable that even in 20 cm distance we were expecting to find another soil.

I. Gley soils

In the lower parts of the area A/C profiles with a high iron content are found.

The depth of the "A" layer varied from 20-30 cm which had 5-6% humus.

Texture of soil was loamy sand. In the profiles no. 1, 8, 38 there was a heavy loam layer with bluish color.

In most of the gley profiles there was a layer from 20 to 60 cm full of iron concretions.

This soil usually is in class II groundwater table (lowest groundwater table is less than 80 cm deep) and is shown by green color in the map.

II. Podzol soils

Most of this kind of soil are found in the area usually located on a little higher places. More or less all the different layers are found, but in some case one of the layers is missing or mixed with the above layer or it is very thin.

Humus content of H.P. soils in "A1" is about 5-6% and in some of the profiles a thin layer or small patches of black humus was seen in B2-layer.

"A2" layer was very clear in most of the profiles and "B2" layer in some of the profiles was very strong with dark brown color and sometimes with humus bands.

The soil texture of all the profiles was weakly or not loamy sand and the percentage of loam was between 10-17,5 and the average of the diametres of sand particles was between 105-210 mu.

In some of the profiles there was some humus (< 1%) in all the layers which was continued into the groundwater layer, in this case the color of gley horizons was dark brown and some times the rest of previous plant roots were found into the gley layer.

BEDRIJFSLABORATORIUM VOOR GR

Onderzoek nummer	Merk en nadere aanduiding van het monster	Laag in cm	pH		Hoofdbestanddelen in % van de grond					
			H_2O	KCl	Humus Glv	Humus El	$CaCO_3$	Afslib-baar	Totaal zand	<
A264772	20323, 32H = N.O. 108a	5- 20	A1	5.7	7.1		0.0	4	89	1
A264773	20324, 32H = N.O. 108b	25- 30	A2	5.1	0.6		-	3	96	1
A264774	20325, 32H = N.O. 108c	30- 45	B2	4.6	2.2		-	3	95	1
A264775	20326, 32H = N.O. 108d	60-100	B3	4.6	1.2		-	2	97	0
A264776	20327, 32H = N.O. 109a	5- 20	A1	5.8	13.7		0.1	10	76	6
A264777	20328, 32H = N.O. 109b	20- 45	C1g	6.4	1.3		0.1	11	88	7
A264778	20329, 32H = N.O. 109c	45- 70	C2g	6.2	0.3		0.0	3	97	1
A264779	20330, 32H = N.O. 109d	70-100	G	6.3	0.4		0.0	3	97	1

HP
Gley

') in 10% HCl oplosbaar

ROND- EN GEWASONDERZOEK, MARIENDAAL, OOSTERBEEK

Tel. 08307-2981 en 2982

in % van minerale delen																					
Afslibbare delen				Zand												M	P-AL	Fe_2O_3 %	$\frac{Fe_2O_3}{Hum.}$ ')	$\frac{Al_2O_3}{Fe_2O_3}$
	2–4	4–8	8–16	16-25	25-35	35-50	50-75	75-105	105-150	150-210	210-300	300-420	420-600	600-850	850-1200	1200-1700					
5	1	0	2	1	1.5	2.5	7	8	31	28	17	4	1.5	0.4	0.2		150	48	0.20	0.03	1.15
	0.4	0	1.5	0.5	0.3	1	2	10	28	31	19	4	1.5	0.3			160		0.05	0.08	2.40
.5	0	1	0	0	0	0.5	1.5	8	33	29	18	4.5	1.5	0.5	0.3		155		0.18	0.08	3.22
.5	0.2	1	0	0.2	0.3	0.5	2	14	35	27	14	3	1	0.4	0.1		145		0.16	0.13	2.75
	1.5	2.5	1.5	1	2.5	2.5	3.5	8	26	23	15	3.5	2	0.5	0.3		140	67	2.49	0.18	0.29
	1	2	0.5	1	1	1	1.5	8	27	28	14	3	2	1.5	0.5	0.3	150		8.46	6.50	0.06
.5	0	1	0.2	0.4	0.3	1.5	4.5	15	35	24	13	3	1	0.3	0.1	0.1	135		0.46	1.53	0.56
	1	0.4	0.4	0.1	0.3	1	3	14	34	28	13	3	1	0.5			145		0.33	0.82	0.85

BEDRIJFSLABORATORIUM VOOR GROND-

Tel. 0

Onderzoek nummer	Merk en nadere aanduiding van het monster		Laag in cm	pH		Hoofdbestanddelen in % van de grond					Afslibbare
				H_2O	KCl	Humus		$CaCO_3$	Afslibbaar	Totaal zand	Al_2O_3 humus
						Glv	El				
											Al_2O_3 %') BS Base saturation
A264772	Humuspodzol soil	A1	5- 20							9.03	0.23 66%
A264773		A2	25- 30							0.20	0.12
A264774		B2	30- 45							0.26	0.58
A264775		B3	60-100							0.36	0.44
A264776	Gley soil	A1g	5- 20							0.05	0.72 73%
A264777		C1g	20- 45							0.42	0.54
A264778		C2g	45- 70							0.87	0.26
A264779		G	70-100							0.70	0.28

') in 10% HCl oplosbaar

") in m.aeq./100 gram grond

EN GEWASONDERZOEK, MARIENDAAL, OOSTERBEEK

3307-2981 en 2982

in % van minerale delen															M	U			
elen		Zand																	
8	8-16	16-25	25-35	35-50	50-75	75-105	105-150	150-210	210-300	300-420	420-600	600-850	850-1200	1200-1700					
	Kat-") waarde		H-") bezetting			P-tot.		N-tot.		C/N									
	Base exchange capacity		H on complex																
	11.9		4.1			122		0.20		19									
								0.03											
								0.03		40									
	23.7		6.4			364		0.529		14									

6. SOIL ANALYSES

In order to be able, to check the fieldwork, some soil samples were collected, of a gley soil and a humuspodzol soil.

Besides, the laboratory data give useful information on some aspects of the soil, which are difficult to judge in the field.

The mechanical composition

The analyses show that the sand is well sorted, with the greater part of the grains between 105 and 210 micron.

This confirms the aeolian origin.

The content of particles < 50 micron is small in all samples.

In the top part of the gley soil there is clearly more of the fraction < 2 micron. This may be due to the presence of iron concretions.

Chemical data

pH in the humuspodzol soil decreases with depth, in the gley soil there is an increase. This is typical for these soils.

The humus content in the humuspodzol soil, shows the different soil horizons. In the A2 layer the amount of humus is very small, in the B2 layer there is prominent increase.

Even at 60-100 cm depth there is still humus in the subsoil of the humuspodzol soil.

The humus in the gley soil stops at about 45 cm depth. The topsoil in the gley soil is of better quality than that of the humuspodzol soil. C/N ratios are 14 and 19 respectivsly, showing a higher N content of the humus in the gley soil.

C/N in the B2 layer of the humuspodzol is as high as 40, with is normal for these soils.

Fosfor is high in the topsoil of the gley soil, lower in the humuspodzol soil. Comparison of the P-al data shows that part of the P-tot. in the gley soil is fixed.

This clearly shows the influence of the iron.
The fact, observed in the field, that in the gley soils there is more iron than in the humuspodzol soil, is confirmed by the analytical data. In the A2 of the humuspodzol soil, iron is almost absent.

7. CONCLUSIONS

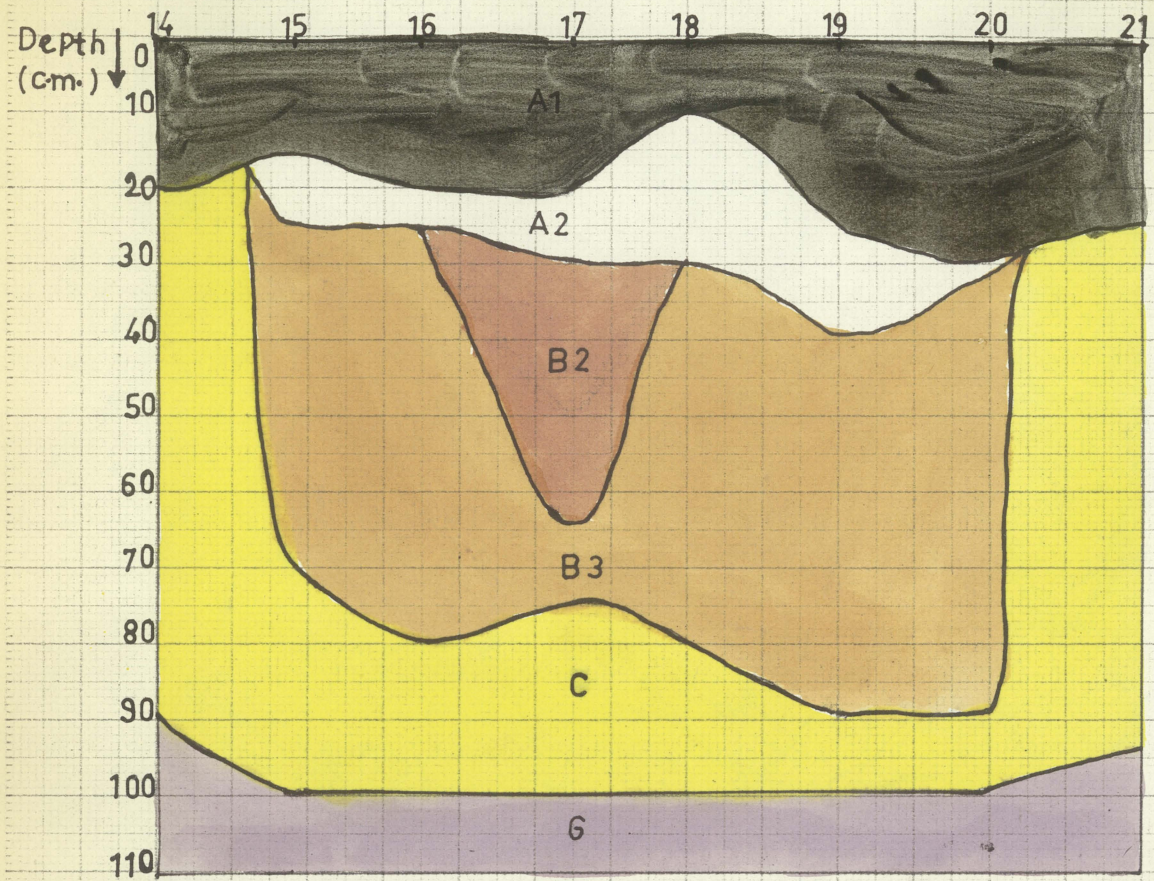
In the mapped area, soil formation has led to different results within short distances.

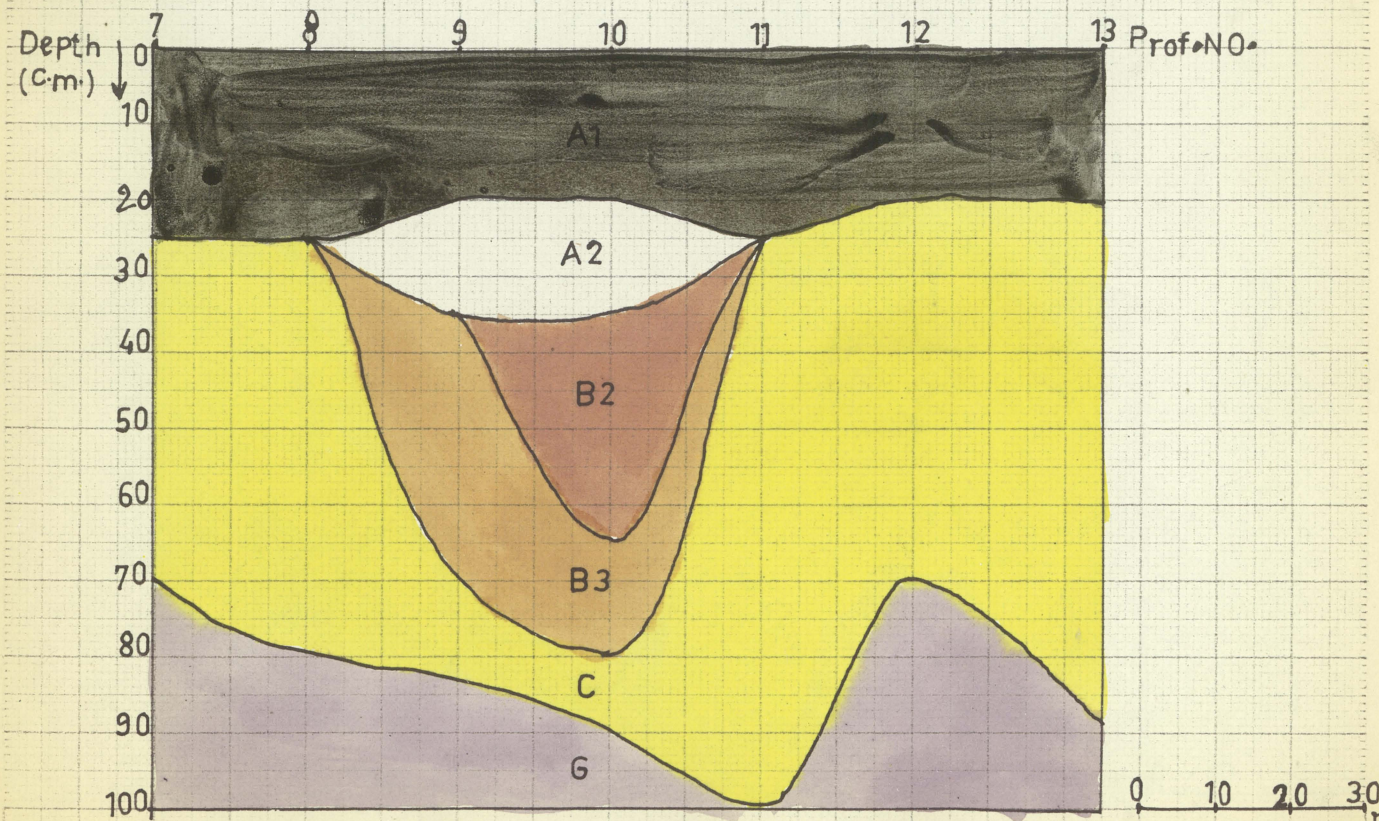
These differences may be due, mainly to differences in vegetation and differences in relief.

To get a better insight in the activity of these two factors it will be necessary to have a detailed map showing the differences in relief, to collect groundwater data in the area and to investigate the history of the vegetation by means of pollen-analytical research.

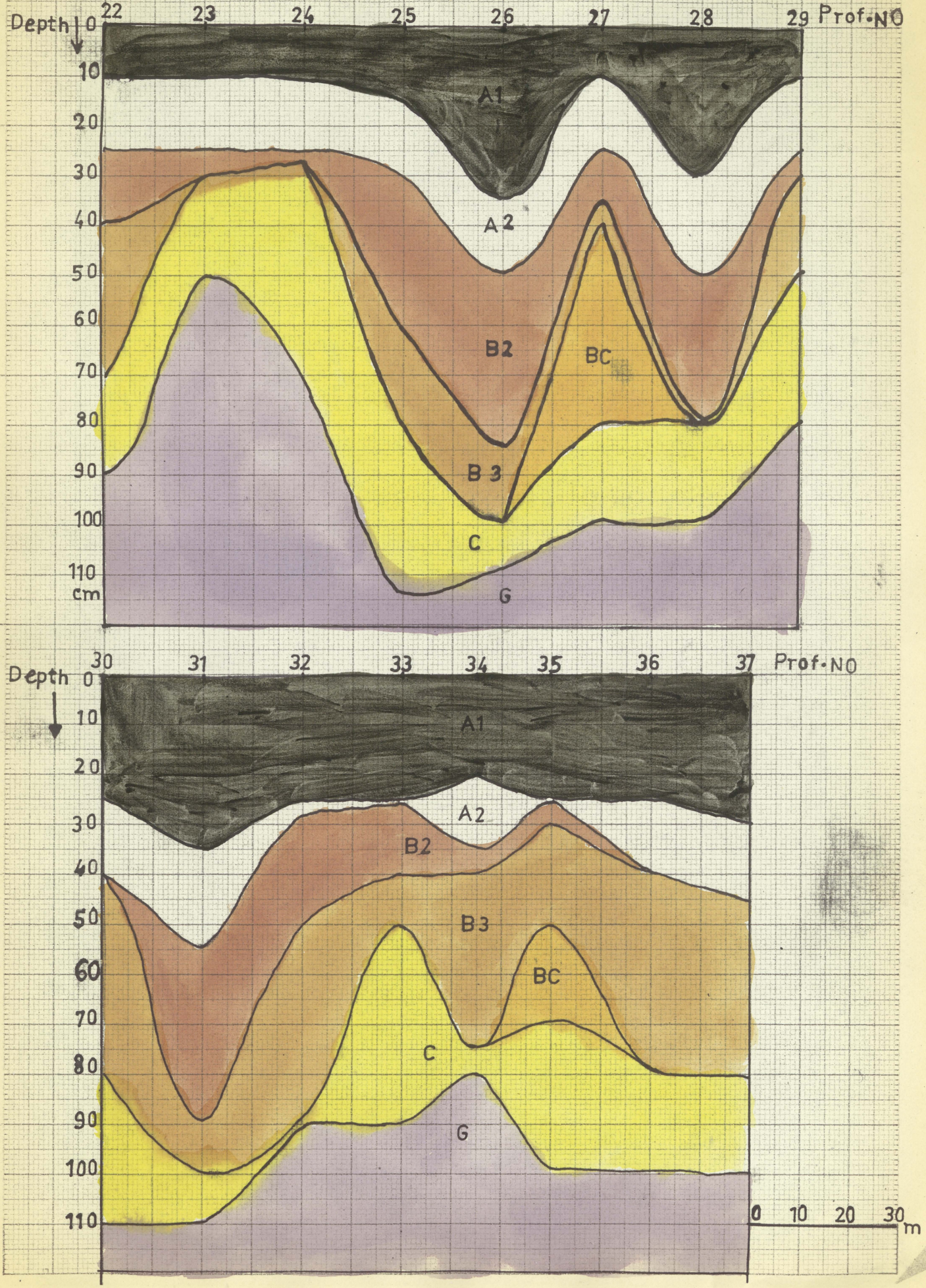
+++++
+++
+

CROSS SECTION THROUGH BORINGS: 7–13, 14–21





CROSS SECTION THROUGH BORINGS 22–29 AND 30–37



CROSSSECTION THROUGH BORINGS NO. 22–29