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ATTEMPT TO STUDY THE MICROMORPHOLOGICAL FEATURES OF POLLUTED SOILS AND RELATED TO SOIL PRODUCTIVITY

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ABSTRACT

Attempt was carried out on an area located between Helwan City South of Cairo, along a distance of 20 km to define soil polluted as a result of industrial. Conphrna samples collected from Ten soil profiles were taken according the different morphological features. Physical, chemical, micromorphology and heavy metals, i.e. Fe, Mn, Zn, Cu, Pb & Cd were determined in soils.

Results reveal the extent of inorganic and organic pollution of the tested media. Concentration of contaminants varied according to several factors, major of which are distance from polluting source increases in the vicinity of either industrial complex or dwelling zones as well as carried by aqueous water current in the first instance and wind direction in the second. Seven soil sites out of the ten investigated were polluted as they contained above permissible limits of heavy metals. Three of those sites were seriously injured so that the growth of cultivated maize was very poor to the extent that such weak plants were burned and some areas laid bare.

The results also indicate that the inorganic and organic pollution are the main factor for land degradation through their effect on productivity. Soil pollution affects soil morphology, physical, chemical, heavy metals and micromorphology of soil. The productivity of soils around the industrial activities are reduced referred to the surface and subsurface layers which are compacted and cemented by heavy metals which clear from morphology and micromorphology, high concentrations of heavy metals which caused in toxicity of plant, and other waste products have toxicity for plant.

Key words: Land degradation, pollution, productivity, industrial activities, contamination.

INTRODUCTION

Land degradation means, a decline in land quality caused by activities then has been a major or global issue during the 20th century and will remain high on the international agendas in the 21th century. Land degradation will remain are important global issue during the new century due to the adverse impact an agronomic productivity, the environment and its effect on food security and quality life. Pollution, this single word which means much for life on our planet, has been arisen as important issue and come out to world almost interest through industrialization. Pollution is caused when a change in physical and / or chemical conditions in the environment harmants.

The present work aims at studying soil degradation of the area of (20 km long and 4 km wide) locating at the Tebeen area of Helwan City south Cairo, where various industries had been established over decades. The industry's pollution of the area affected soil productivity and reduce it which could be called degradation of morphological, chemical, and, micromorphological properties.

Land degradation:

Land degradation can be considered in terms of the loss of actual or potential productivity or utility as a result of natural or anthropic factors; it is a decline in land quality or reduction of productivity. In the context of productivity, land degradation results in from a miss relation between land quality and land use (Beinroth *et al.*, 1994). Mechanisms of initial land degradation include physical, chemical, and biological processes (Lal, (1994). Important among physical processes are the decline in soil structure leading to crusting, compaction, erosion, desertification, an aerobism, environmental pollution, and unsustainable use of natural resources. Significant chemical processes include acidification, leaching, salinization, decrease cation retention capacity, and fertility depletion. Factors of land degradation are the biophysical processes, processes and attributes that determine the kind of degradative processes e.g. erosion, salinization etc. These include land quality (Eswaran *et al.*, 2000) as affected by its intrinsic properties of climate, terrain and landscape position, climax, vegetation, and biodiversity, especially soil biodiversity. Causes of land degradation are the agants that determine the rate of degradation.

Soils and pollution:

Soils, as a part of the environment, receives pollutants from all types of human activities. Production potential of soil may be reduced or eliminated. Plants grown may absorb toxic materials that cause problems at some points in the good chain (Lund, 1971, and Thompson and Trach, 1978). Berrow and Reaves (1984) reported that soils has become polluted if the contents of a metal exceed the upper end of an accepted normal range. They also added that the continuous accumulation of harmful metals and their persistence in soil makes soil pollution a farmer serious matter than either air or water pollution.

Pollution of the area under investigation:

South of Cairo particularly at Tebeen of Helwan City many factories forming an industrial complex are located around the agricultural lands. Soil productivity at this area has been dramatically reduced (Abdel Tawab 1985). Abdel Salam and Sawelem (1967) found that total deposited dust in Helwan area ranged between 70.9 ton per square mile a month during June and 384.7 ton per square mile a month during December, the figure for April was 117.6 during the natural dusty weather. El-Sheikh *et al.*, (1979) reported that the average concentration of Fe, Mn, Zn, Cu, and Pb in dust collected from Helwan area were 9.00 1.00, 16.00, 0.67, 0.03, and 0.64 mg/g respectively. Abdel Tawab (1985) denoted that dust-fall is enriched with Pb around the industrial complex at Helwan and at a 200 m distance from the factories as a result of fuel combustion. He also found that the concentration of Mn, Zn, and Pb in soils of Helwan area beside the industrial complex were 9.7, and 16 times of their concentrations in a good fertile soil.

Discharging liquid wastes of various industries neighbourlig fresh water streams lowers their quality for irrigation purposes, such case depends on source and location (El-Wakeel and El-Sawaby, 1988). El-Faleky (1981) revealed that the main source of Pb and Zn, pollution in Helwan area was the Iron & Steel Factory's out let containing 300 mg/L, Pb and 229 mg/L Zn, whereas the only source of Mn was the cake industry containing 680 mg/L he concluded that zinc represents the most serious hazard in water pollution, where the amount discharged into the Nile and canals reached about 27 ton/year followed by lead 3.4 ton/year.

Micromorphology studies:

According to El-Husseiny, and El-Saadany 1992 who found in their studies on alluvial soils classified as torrifluvents the apedal S. matrix, dense argillic plasma with sepic fabric, few fine skeleton grains of quartz while voids varied from channels, vughs, chambers to planes. Pedological features formed from cutanic organs and ferromangans; gluebules of ferromanaganic; concretions and hard nodules of ferromanganese and carbonate. This could be due to cultivation and flooding of Nile water. Sandy soils are classified as torripsmments had a pedal S. matrix few argillic to siltic plasma with a sepic fabrics channels and vughs are dominant, very coarse spherical rounded quartz grains which could be referred to transportation and physical weathering. The microstructure of the alluvial clay soils was highly developed than the sandy soils. According to Abd Rheim 1999 the micromorphological investigation showed that the Typic Torrifluvent profile has pellicular grain structure whereas Typic Torripsamments and Typic Torriorthents have compact grain structure and bridged grain structure, respectively. Sample and compound packing voids were dominated over other types of voids. Data also revealed the presence of opaque minerals such as hematite, magnetite, limonite, biotite, pyrolusite as iron and manganese bearing minerals which were inherited from parent material. The main types of distribution patterns in the Torrifluvents, Torripsamments and Torriorthents were porphyric, gefuric and chitonic, respectively. The most important pedofeatures were loose discontineous infillings, irregular mucleic, ferruginous and manganiferrous nodules and coatings of amorphous Fe and Mn compounds were found in the studied soils, respectively.

MATERIALS AND METHODS

The present work was conducted on an area located between El-Tebeen – Helwan in the north and El-Saf (Giza Governorate), in the south along a distance of 20 km long and 4 km wids. Such area is exposed to a serious chemical pollution derived from several industries established there, i.e. iron. Steel, weaving and spining, coal and others. Such pollution is carried by air and waste water.

Soil Sampling:

Ten soil profiles were chosen to represent the area under investigation (Fig. 1). Soil profiles were dug and a brief descripted in field according to FAO guide (1990). Soil samples were air dried, crushed, passed through a 2.0 mm sieve and kept dry for subsequent analyses.

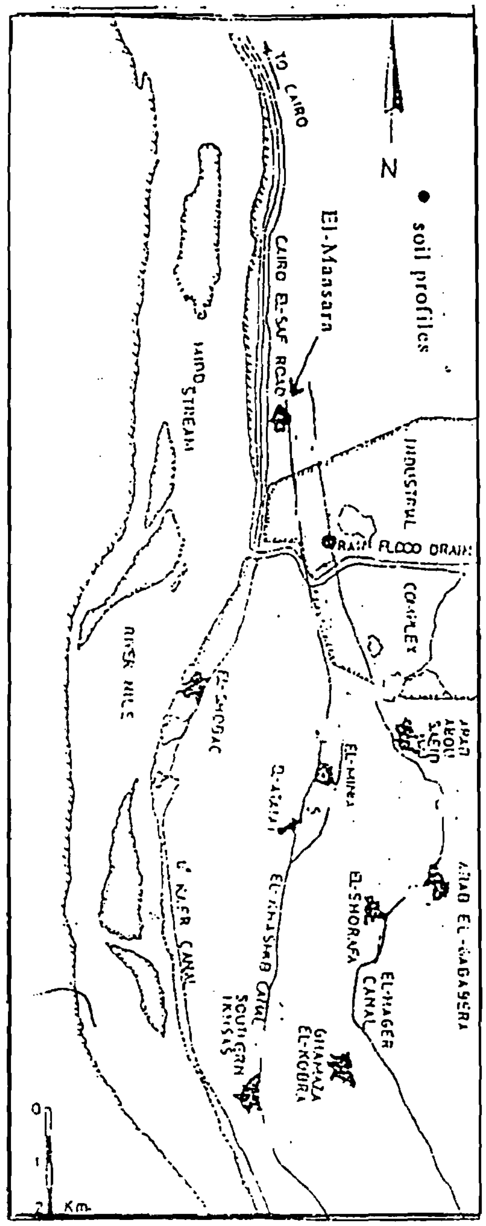

Fig. 1. Location of soil profiles.

Soil Analysis:

The particle size distribution of the samples was conducted using the international pipette method (Piper, 1950). Organic matter content was determined by the Walkly Black procedure are given by Klute (1986), and page *et al.* (1982). Calcium carbonate was determined by using Collins Calcimeter (Wright 1939). The pH values and electrical conductivity of the saturated extract were determined according to Klute (1986) and Page *et al.* (1982). Soluble cations and anions of the saturated extract were determined according to Klute (1986) and Page *et al.* (1982). Cations exchange Capacity (CEC) of the soil were determined by sodium acetate method Klute (1986) and Page *et al.* (1982).

Heavy Metals Analyses:

The total heavy metals as Fe, Mn, Zn, Cu, Pb, and Cd were determined after fusion with mixture of concentrated HNO_3, $HClO_4$, and H_2SO_4 as given by Hesse (1971). The available content of these micronutrients was extracted using 5×10^{-3} N DTPA (diethylene triamine penta acetic acid) in 10^{-2} M $CaCl_2$ and 10^{-1} M triethanolamine (TEA) at pH 7.3, according to Lindsay and Norvell (1978). In all cases, the elements were determined using an atomic absorption spectrometer.

Micromorphological Analyses:

Undisturbed soil samples were taken in Kubiena boxes and used for the preparation of the soil thin section. The samples were air dried at room temperature and impregnation of these samples was performed using Epifoxresin in vacuum unit. Then the impregnated soil samples were subjected to prepare the thin section through sectiong, grinding, polishing and finishing, according to Murphy (1986). The thin section obtained were examined using a petrographic microscope. The terminology proposed Bullock *et al.* (1985) was used for the micromorphological description of thin section.

RESULTS AND DISCUSSION

Morphological description:

Table 1 reveals that the soils beside the source of pollution are covered by a crust of heavy metals, dust of the factory, undecomposed organo material and salts from the waste products. Surface crust ranged between continuous and discontineous and hard and moderately hard. Soil colour varied widely between the surface and subsurface layers according to the distance of pollution source and heavy metals content. Soil structure changed from hard platy and compacted near the pollution source to blocky far from the pollution source, this variation could be due to the industrial and human activities. The variation in morphological features could be due to the highly effect of industrial activities in different forms such as solid, dust, soluble as heavy metals and salts which reduce soil productivity.

Table 1. Morphological description of soil profiles of investigated area.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Symbol of horizon	Colour		Texture class	Structure	Consistance	Boundary	Morphological features
				Dry	Moist					
1	200	0-25	Ap	10YR5/3	10YR3/3	CL	S-mmssb	hd	Gd	Layer cover with flafy layer of industry wastes, residual of plant without decomposed and few rounded and subrounded of limestone and sandstone gravels.
		25-70	C1	10YR5/2	10YR4/2	CL	m-lsa-sb	vhd	Ci	Very few small rounded and subrounded limestone and sandstone gravels, common small hardnodules of calcium carbonate and gypsum and few black patches of industrial wastes.
		70-120	C2	10YR5/3	10YR3/3	C	m-lvsa-sb	Exhd		Very few small rounded and subrounded limestone and sandstone gravels, common small hardnodules of calcium carbonate and gypsum and few black patches of industrial wastes.

Structure:

s-mmssb : Small to medium moderately strong subangular blocky structure
m-lsasb : Medium to large strong angular and subangular blocky structure
m-lvsa-sb : Medium to large strong angular and subangular blocky structure
Mssb : Medium strong subangular blocky structure
m-lssb : Medium to large strong subangular blocky structure
m-lvssb : Medium to very strong subangular blocky structure
s-mssp : Small to medium strong platy structure
s-mssb : Small to medium strong subangular blocky structure
s-lsasb : Medium to large very strong angular and subangular structure
s-lsasb : Medium to large very strong massive structure
Lvsasb : Large very strong angular and subangular blocky structure
Smasb : Small to medium to strong angular and subangular blocky structure
Mlsasb : Medium to large strong angular and subangular blocky structure
Smsasb : Small to medium strong angular and subangular blocky structure
m-lvsasb : Medium to large strong angular and subangular blocky structure
Mlvsab : Medium to large very strong angular and subangular blocky structure
m-lmsb : Medium to large moderate strong angular and subangular blocky structure
Mssb : Medium strong angular and subangular blocky structure
Mlvssb : Medium to large very strong subangular blocky structure
m-lmsb : Medium to large moderately strong subangular blocky structure
Mssb : Medium strong angular and subangular blocky structure
Mlvssb : Medium to large strong subangular blocky structure
Lvsasb : Large very strong subangular blocky structure
Mmsb : Medium moderately strong subangular blocky structure
Mlvsasb : Medium to large very strong angular and subangular blocky structure
Mlsasb : Medium to large very strong subangular blocky structure
Mlvsasb : Medium to large very strong angular and subangular blocky structure

Constance:

hd : Hard in dry case
vhd : Very hard in dry case
Exhd : Extremely hard in dry case

Texture class:

Cl : Clay loam
C : Clay
SCL : Sandy clay loam

Boundaray:

Gd : Gradually diffuse boundary
Ci : Clear irregular boundary
Cs : Clear smooth boundary
Cd Clear diffuse boundary
Cw Clear wavy boundary

Table 1. Cont.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Symbol of horizon	Colour		Texture class	Structure	Consist-ance	Bound-ary	Morphological features
				Dry	Moist					
		0-20	Ap	10YR5/2	10YR3/2	SCL	Mssb	hd	Cs	Layer cover with layer of industrial wastes, residual of fresh organic matter and very few subrounded limestone and sandstone gravels.
2	400	20-50	C1	10YR6/3	10YR4/3	CL	m-lssb	hd	Cs	Common small hard nodules of CaCO3 and gypsum common small black patches of industrial wastes and very few subrounded lime stome and sandstone gravels.
		50-80	C2	2.5YR6/4	2.5YR5/4	C	m-lvssb	vhd	Gd	Very few small rounded and subrounded limestone and sandstone gravels, common small hardnodules of calcium carbonate and gypsum and few black patches of industrial wastes.
		80-120	C3	2.5YR7/4	2.5YR5/6	C	m-lvssb	vhd		Common small hardnodules and concretion of $CaCO_3$ and gypsum and few rounded and subrounded limestone and sandstone gravels.
3	900	0-30	Ap	2.5YR3/4	2.5YR3/2	CL	mssb	hd	Cs	Surface cover with thin layer of dust and industrial wastes, residual of natural plant without decomposed few subrounded sandstone and limestone gravels.
		30-100	C1	2.5YR4/2	2.5YR3/2	CL	m-lvssb	hd		Common black patches of industrial wastes, common concretion and hardnodules of $CaCO_3$ and gypsum and very few subrounded limestone and sandstone gravels.
		0-10	Ap	10YR4/1	10YR3/1	SCL	s-msp	hd	Cs	Surface cover with industrial wastes as a dust and residual of natural plants die
		10-30	C1	10YR5/3	10YR4/2	CL	s-mssb	hd	Gi	Common concretion and hard nodules of $CaCO_3$ and gypsum, common small patches of industrial wastes and few subrounded limestone and sandstone gravels.
4	1500	30-60	C2	10YR6/2	10YR4/2	CL	s-mssb	hd	Cr	Common concretion and hard nodules of $CaCO_3$ and gypsum, very few black patches of industrial wastes and few subrounded limestone and sandstone gravels.
		60-90	C3	10YR5/1	10YR4/2	C	m-lssbs	hd	Cw	Few subrounded limestone and sandstone gravels, very few black paches of industrial wastes and hard nodules of $CaCO_3$ and gypsum
		90-120	C4	10YR5/2	10YR4/2	C	m-lvsm	vhd		Very few subrounded hard nodules of $CaCO_3$ and gypsum and very few subrounded limestone and sand stone gravels.

Table 1. Cont.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Symbol of horizon	Colour		Texture class	Structure	Consistance	Boundary	Morphological features
				Dry	Moist					
5	2000	0-30	Ap	10YR4/2	10YR3/2	CL	s-mmssb	mhd	Gi	Common small hardnodules wastes and dust and few subrounded and rounded limestone and stone gravels and common fresh residual of natural plants.
		30-70	C1	10YR6/2	10YR3/2	C	s-mmssb	mhd	Cw	Few black patches of industrial wastes, common concretion and hardnodules of $CaCO_3$ and gypsum, and few subrounded limestone and sandstone gravels.
		70-120	C2	10YR6/2	10YR3/2	C	Lvsa-sb	Vhd		Common small concretion and hard nodules of $CaCO_3$ and gypsum and very few subrounded limestone and sandstone gravels.
6	2500	0-15	Ap	10YR5/1	10YR3/1	CL	Smsp	mhd	Cs	Common small to medium hardnodules of industrial wastes and dust, common fresh residual of natural plants without decomposed and few subrounded limestone and sandstone gravels.
		15-40	C1	10YR4/2	10YR3/2	C	s-masb	vhd	Ci	Few small hardnodules and black patches of industrial wastes, common concretion and hardnodules of $CaCO_3$ and gypsum, few subrounded limestone and sandstone gravels.
		40-80	C2	10YR5/2	10YR4/2	C	m-lsasb	vhd	Gd	Very few small nodules and black patches of industrial wastes, common concretion and hardnodules of $CaCO_3$ and gypsum, and very few subrounded limestone and sandstone gravels.
		80-120	C3	10YR5/2	10YR4/2	C	s-msasb	Exd		Common small concretion and hard nodules of $CaCO_3$ and gypsum and very few subrounded limestone and sandstone gravels.
7	3000	0-20	Ap	10YR4/2	10YR3/2	CL	m-lssb	hd	Ci	Few small rounded and subrounded limestone and sandstone gravels.
		20-70	C1	10YR4/2	10YR3/2	C	m-lvsasb	vhd	Gd	Common small hardnodules and concretion of $CaCO_3$ and gypsum, few small patches of iron oxides and manganese oxides and very few small subrounded limestone and sandstone gravels.
		70-120	C2	10YR4/2	10YR3/2	C	m-lvsa-ab	Exhd		Few small hardnodules of $CaCO_3$ and gypsum and few small subrounded limestone and sandstone gravels.

Table (1) Cont.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Symbol of horizon	Colour		Texture class	Structure	Consist-ance	Bound-ary	Morphological features
				Dry	Moist					
8	6000	0-20	Ap	10YR5/2	10YR3/2	CL	m-lmsb	mhd	Cw	Common small hardnodules and subrounded limestone and sandstone gravels.
		20-50	C1	10YR5/2	10YR3/2	CL	Mssb	hd	Gd	Few small hardnodules of $CaCO_3$ and common small rounded and subrounded limestone and sandstone gravels.
		50-90	C2	10YR5/2	10YR3/2	C	m-lvssb	hd	Gr	Common small hardnodules of $CaCO_3$ and common small rounded and subrounded limestone and sandstone gravels.
		90-120	C3	10YR4/2	10YR3/2	C	Lvsasb	Exhd		Few small hardnodules and concretion of $CaCO_3$ and common small rounded and subrounded limestone and sandstone gravels.
9	9000	0-30	Ap	10YR4/2	10YR3/2	CL	m-msb	mhd	Gd	Common and small subrounded limestone and sandstone gravels, very residual vegetation.
		30-70	C1	10YR4/2	10YR3/2	CL	m-lsasb	Vhd	Ci	Common small hardnodules of $CaCO_3$ and few small subrounded limestone and sandstone gravels.
		70-120	C2	10YR4/2	10YR3/2	C	m-lvsasb	Vhd		Few small hardnodules of $CaCO_3$ and gypsum and very few small subrounded limestone and sandstone gravels.
10	12000	0-20	Ap	10YR4/2	10YR3/2	C	m-lssb	Vhd	Ci	Common and small rounded and subrounded limestone and sandstone gravels.
		20-70	C1	10YR4/2	10YR3/2	C	m-lvsasb	Vhd	Gd	Common small hardnodules and concretion of $CaCO_3$ and gypsum and few small subrounded limestone and sandstone gravels.
		70-120	C2	10YR4/2	10YR3/2	C	m-lvsasb	Exhd		Very few small hardnodules and concretion of $CaCO_3$ and gypsum and few small subrounded limestone and sandstone gravels.

Physical and Chemical characterization:

The texture ranged between sandy clay loam and clay. Table 2 showed that calcium carbonate ranged between 5.00 and 13.79%. Organic matter content reach to 6.09% in the surface and decrease with depth to 0.98%. Table 2 showed that the pH values above neutrality and ranged between 7.5 and 7.91. Electrical conductivity values generally deminish with depth of soil profiles layers and ranged between 120.12 and 2.79 dS/m and decrease with depth. The total soluble salts is high near the source of pollution and decrease with distance which is due to the effect of industrial activity. Cation exchange capacity ranged between 22.38 and 45.83 mq/100 g soil.

Heavy Metals and Soil Pollution:

Content, of six elements representing the most dominant heavy metals that polluted the soils surrounding the industrial establishments, are listed in Table 3. Data show high differences in the amounts detected for each element from place to another horizontally and vertically, confirming the effect of latitude and depth in all cases. Dominance of such heavy metals content reveal that the total and available forms were high in the surface and decrease with depth as well as high beside the source of pollution and decrease with distance.

Soil Micromorphological Studies:

Data of Micromorphological studies in Table 4 and Figs. (2-19) shows that the skeleton grains dominated by quartz, orthoclase, plagecolclase, however some layers had microcline calcite as the light minerals while heavy minerals are hornblende, augite, zircon, rutile, strolite, epidot, biotite, zircon and opaque minerals iron and manganese minerals.

The related distribution and plasma fabrics are porphyroskelic, agglomero, argillasepic, skelsepsic and vosepic plasmic fabrics are the dominant and some parts have calusterd.

Microstructure is varied from profile to another and from layer to other in profiles (1and 5) the surface layers have compacted structure and quartz grains impreginated completely in the fine material i.e. heavy metal, organo compound material and clay, while the subsurface layers have bridged grains structure and quartz grains surrounded completely by fine materials (heavy metals, organo compound material and clay) and the deep layers have bridged structure and quartz grains surrounded by clay. However, profile (10) shows bridged grains structure and quartz surrounded packing is the dominant. Voids which varied from compound packing, simple packing, vughs, channels, mamulated vughs, prolated vughs, chambers, and fissures.

Pedological features reveal differented with the distance from source of pollution such as globular, hardnodules, conceration, skeltans and voidans of heavy metals. Organs of humified organic material, and concretion of $CaCO_3$ and gypsum and salts crystals are the dominant in the surface layers while few hardnoduls and cutanic of ferromangano and hardnodules and cutanic $CaCO_3$ and gypsum are dominant in the lower layers in profiles (1 and 2).

Table 2. Some chemical properties, particle size distribution, cation exchangeable capacity and exchangeable cations (meq/100 g soil) of soil profiles of investigated area.

Prof.. No	Distance (m)*	Depth (cm)	pH	$CaCO_3$ (%)	O.M (%)	EC (dS/m)	Coarse Sand %	Fine Sand %	Silt %	Clay %	Texture class	CEC meq/100 g soil	Exchangeable cations (meq/100g soil) Ca^{++}	Mg^{++}	Na^{+}	K^{+}
1	200	0-25	7.88	5.07	6.09	126.12	5.11	34.43	25.31	35.16	Clay loam	33.980	19.253	9.154	4.253	1.320
		25-70	7.65	4.07	5.87	100.45	11.47	30.56	23.75	34.23	Clay loam	32.021	18.988	7.152	4.524	1.450
		70-120	7.76	3.66	2.32	30.25	4.94	24.99	29.10	40.58	Clay	38.895	20.561	11.702	5.267	1.510
2	400	0-20	7.53	6.46	5.12	90.45	6.36	41.44	23.87	28.32	Sandy clay loam	29.763	19.783	4.483	4.263	1.230
		20-50	7.78	3.98	4.95	50.76	6.85	32.52	25.82	34.82	Clay loam	32.860	16.992	9.993	4.725	1.150
		50-80	7.69	4.02	3.11	20.21	3.13	22.37	34.04	40.55	Clay	38.533	19.897	12.084	5.532	1.020
		80-120	7.88	1.72	1.79	10.35	4.70	25.52	24.42	45.37	Clay	42.871	19.768	15.370	5.723	1.980
3	900	0-30	7.75	4.77	5.05	50.25	8.69	35.41	25.70	30.23	Clay loam	28.262	15.763	7.346	4.053	1.100
		30-100	7.63	5.58	4.02	40.45	6.07	30.64	29.61	33.69	Clay loam	30.671	14.891	10.217	4.253	1.350
4	1500	0-10	7.87	5.21	4.89	35.66	2.98	45.22	25.26	26.55	Sandy clay loam	22.381	9.657	8.283	3.241	1.200
		10-30	7.76	6.86	3.78	30.23	5.81	31.43	27.18	35.82	Clay loam	32.761	18.756	8.020	4.665	1.320
		30-60	7.53	7.01	2.05	15.79	6.43	27.40	28.72	37.50	Clay loam	33.998	17.988	9.939	4.731	1.340
		60-90	7.68	3.98	1.65	7.88	4.04	23.92	27.08	44.97	Clay	40.987	22.110	11.544	5.653	1.680
		90-120	7.76	2.11	1.06	8.98	1.67	23.92	27.32	47.04	Clay	45.832	24.891	12.670	6.531	1.760
5	2000	0-30	7.89	5.11	4.56	20.35	5.38	33.46	29.24	31.92	Clay loam	28.891	14.250	9.452	3.989	1.200
		30-70	7.68	3.79	2.71	20.56	3.08	30.53	28.53	40.92	Clay	38.623	19.379	11.683	5.681	1.380
		70-120	7.73	3.02	1.56	15.11	1.30	28.77	26.43	43.55	Clay	40.524	20.735	12.408	5.711	1.670

* Distance from source of pollution (m)

Table 2. Cont.

Prof. No.	Distance (m)	Depth (cm)	pH	$CaCO_3$ (%)	O.M (%)	EC (dS/m)	Coarse Sand %	Fine Sand %	Silt %	Clay %	Texture class	CEC meq/100 g soil	Exchangeable cations (meq/100g soil) Ca^{++}	Mg^{++}	Na^{+}	K^{+}
6	2500	0-15	7.85	13.79	3.11	12.61	6.274	35.629	28.577	29.555	Clay loam	26.221	15.231	6.303	3.567	1.120
		15-40	7.75	7.99	2.20	8.23	4.302	19.637	35.501	40.651	Clay	38.736	20.875	10.730	5.771	1.360
		40-80	7.67	8.78	1.89	6.11	3.819	12.833	39.794	43.554	Clay	40.637	22.751	10.555	5.721	1.610
		80-120	7.57	5.56	1.21	5.81	4.624	17.556	32.705	45.115	Clay	41.989	21.876	12.662	5.891	1.560
7	3000	0-20	7.65	9.99	2.71	11.32	7.493	32.159	28.964	31.646	Clay loam	28.879	16.231	7.507	3.991	1.150
		20-70	7.71	6.87	1.81	9.76	3.802	31.996	23.961	40.340	Clay	37.983	18.101	13.020	5.562	1.300
		70-120	7.76	3.01	1.09	5.12	4.170	23.836	29.270	42.800	Clay	39.876	19.872	12.951	5.673	1.380
8	6000	0-20	7.83	11.88	2.50	9.86	10.339	29.133	25.420	35.120	Clay loam	32.768	19.735	6.991	4.532	1.510
		20-50	7.68	6.36	1.81	6.65	7.775	27.842	27.630	38.180	Clay	35.989	19.556	9.631	5.242	1.560
		50-90	7.75	7.77	1.21	5.07	5.703	24.059	29.375	40.863	Clay	38.753	18.871	12.476	5.776	1.630
		90-120	7.83	5.89	2.35	5.12	2.086	25.567	29.603	42.743	Clay	40.112	20.310	12.410	5.672	1.720
9	9000	0-30	7.76	4.01	2.09	4.96	14.810	25.287	25.625	34.378	Clay loam	33.210	18.787	8.100	4.873	1.450
		30-70	7.62	5.95	1.73	3.78	14.339	25.454	23.060	37.170	Clay loam	35.987	19.651	9.704	5.022	1.610
		70-120	7.60	2.11	1.11	3.11	7.670	23.482	22.460	46.400	Clay	44.021	20.873	15.167	6.251	1.730
10	12000	0-20	7.91	6.75	2.10	2.79	4.245	20.913	34.190	40.880	Clay	39.762	20.982	11.288	5.875	1.620
		20-70	7.63	5.21	1.35	1.75	9.214	20.017	25.530	45.710	Clay	43.798	24.912	11.399	5.682	1.810
		70-120	7.50	4.97	0.98	1.55	1.832	27.017	24.280	47.040	Clay	45.657	23.831	13.635	6.341	1.850

Table 3. Total and available heavy metals (Fe, Mn, Zn, Cu, Pb and Cd, ppm) of soil profiles of investigated area.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Fe		Mn		Zn		Cu		Pb		Cd	
			Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.
1	200	0-25	32647	478	2262	152.9	928	40.2	270	39.3	326	56 7	8.5	0.51
		25-70	26376	285	1298	87.6	599	22.9	164	21.2	209	31.6	7.2	0.40
		70-120	20926	156	1001	42.8	501	13.1	100	9.9	101	19.9	5.9	0.33
2	400	0-20	27978	105.2	1619	140.4	782	35.2	220	20.1	246	48.4	7.5	0.44
		20-50	23867	87.3	1422	76.3	643	27.3	149	15.2	102	36.5	6.4	0.32
		50-80	21919	40.2	1269	39.9	399	24.8	89	9.8	69	20.6	5 1	0.12
		80-120	21072	37.8	684	28.1	358	9.8	75	9.1	58	9.8	4.0	0.16
3	900	0-30	25874	101.9	1489	78.2	678	29.3	199	24.4	243	41.2	6.8	0.41
		30-100	20275	40.4	1098	44.0	502	20.8	112	10.2	97	15.8	5.2	0.34
4	1500	0-10	24981	86.0	1236	75.8	474	23.3	160	19.8	172	38.4	6.3	0.48
		10-30	19126	69.3	889	40.3	310	20.8	112	10.2	126	21.6	5.2	0.36
		30-60	17232	56.2	790	31.6	264	14.1	82	7.5	89	17.4	3.9	0.21
		60-90	15166	41.2	684	28.1	239	10.3	59	3.1	63	9.1	2.8	0.17
		90-120	15011	40.8	516	7.8	201	8.7	47	2.4	41	4.2	1.9	0.07
5	2000	0-30	23545	79.8	1061	51.8	358	24.8	132	12.1	136	20.4	6.3	0.19
		30-70	20111	47.9	939	38.9	273	12.7	107	10.2	69	7.6	5.1	0.21
		70-120	19618	31.7	869	29.2	219	10.8	94	8.9	47	3.0	4.3	0.18

Table 3. Cont.

Prof. No.	Distance from source pollution (m)	Depth (cm)	Fe		Mn		Zn		Cu		Pb		Cd	
			Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.	Total	Avail.
6	2500	0-15	17462	45.8	1001	20.2	353	19.8	130	10.7	136	19.8	3.8	0.33
		15-40	16791	24.2	942	19.4	266	14.3	102	6.9	101	8.4	2.9	0.21
		40-80	14982	20.1	691	18.4	237	12.8	94	4.8	50	2.0	2.3	0.09
		80-120	12012	17.9	516	7.8	206	9.9	47	2.2	28	1.4	1.9	0.07
7	3000	0-20	15313	36.2	916	69.8	239	13.1	111	10.1	86	14.3	3.7	0.34
		20-70	12120	19.8	882	61.2	291	10.4	96	9.1	63	2.2	3.6	0.29
		70-120	9594	10.9	702	26.2	264	8.2	59	3.1	37	1.1	2.5	0.16
8	6000	0-20	13960	35.9	882	61.2	336	4.4	66	1.7	85	13.2	2.5	0.10
		20-50	11876	23.7	761	20.3	242	1.9	51	1.2	74	10.8	1.9	0.07
		50-90	11009	21.8	699	18.1	210	1.1	22	0.5	63	4.9	1.2	0.14
		90-120	976	18.2	672	16.9	189	10.6	19	0.3	59	3.0	1.1	0.10
9	9000	0-30	13876	24.8	802	26.1	318	21.8	60	1.2	77	23.2	1.2	0.14
		30-70	11009	18.2	761	20.3	266	14.3	51	1.0	52	9.8	1.1	0.10
		70-120	10432	9.1	672	16.9	206	9.9	22	0.5	28	1.4	0.9	0.06
10	12000	0-20	11918	14.2	780	16.2	276	3.5	59	0.8	66	2.4	1.1	0.20
		20-70	10826	10.3	639	12.1	198	2.3	49	0.7	51	2.1	0.9	0.07
		70-120	998	9.9	518	7.6	124	2.0	36	0.4	42	1.8	0.5	0.01

Table 4. Micromorphological description of some profiles of the investigated area

Prof No	Distance (m)	Horizon symbols	Depth (cm)	Skeleton grains and basic distribution	Related distribution and plasma fabric	Microstructure	Voids	Pedological features	Organization level
		Ap	0-25	Many small to medium rounded and subrounded normal quartz, frequent of feldspar especially orthoclase and plagioclase in small subangular sharp, few heavy minerals augite, hornblende, zircon, rutile and common opaque minerals (iron and manganese oxides) in random distribution	Most of parts haveculusterd. Porphoroskelic and argillasepic vosepic and skelisepic are the dominant plasmic fabric	Combacted structure, quartz grains impregnated completely fine material (heavy metals, humidified Organo material, and clay) whilst some parts have massive structure.	Compound packing voids are dominant and some parts have prolated vughs and channels. .	Globular, hard nodules, concretion and cutanic of heavy metals in voids and around of grains are dominant, and interculcong salts crystals and cutanic organic compound.	Secondary and tertiary structure are the dominant.
1	200	C_1	25-70	Common medium rounded and subrounded normal quartz, frequent orthoclase and plagioclase and few calcite. Few heavy minerals zircon, strolite niotite, epidotes, and hornblende. Common opaque minerals (iron and manganes) in random distribution.	Some parts have culstred. Porphroskelic, agglomiro and argillasepic. Vosepic and skelispic plasmic fabricare the daminant plasmic fabric.	Bridget grain structure, and quartz grains surrounded completely by fine material (heavy metals, humidified Organo compound material and clay), whilst other parts have massive structure.	simple packing voids are dominant and some parts have prolated and mamulated vughs and channels	hard nodules, concretion and cutanic of heavy metals coted grains and voids are common, few cutanic of arganic compound and interculcong salts and gypsum crystals..	Tertiary and secondary structure with medium to small pedal material are the dominant.
		C_2	70-120	Common small to medium subrounded normal quartz few feldspars or thoclase; heavy minerals as hornblend, biotite, epidotes, straulite, and zircon and few opaque minerals.	Prophyroskelic, agglomero plasmic fabric, vospeic and skelispic are the dominant plasmic fabric.	Bridged grain structure, quartz grains surrounded by fine material (clay).	simple packing voids are dominant some parts have prolated, vughs and fissurs.. .	Few concretion, and cationic of ferro mangano and, Concentration, hard nodules and cutanic of $CaCO_3$ and gypsum.	Secondary structure with medium to small pedal are the dominant.

Table 4.

Prof. No	Distance (m)	Horizon symbols	Depth (cm)	Skeleton grains and basic distribution	Related distribution and plasma fabric	Microstructure	Voids	Pedological features	Organization level
		Ap	0-20	Dominant of small to medium rounded to subrounded normal and undulose quartz. Frequent of orthoclase and plogioclase in small subangular shape. Few heavy minerals zircon, augite, hornblende, rutile and common opaque minerals (iron and manganese oxides) in random distribution.	Porphyroskelic,argillasepic, vosepic and skelisepic are the dominant plasmic fabric and some parts have clustered.	Compacted structure, quartz grains impregnated complete in fine material (heavy metals, humified organo material and clay) whist some parts have massiue structure.	Compound packing voids are dominant and some parts have vughs and channels.	Hard nodules and cutanic of heavy metals in voids and arround of grains are dominant, few glopular and concretion of heavy metals , and interculong salts, crystal and organo compound cutanic.	Tertiary and secondary structure with small pedal material are the dominant
5	2000	C_1	30-70	Common small rounded normal quartz, frequent orthoclase and plagioclase and few calcite. Few heavy minerals such as biotil, zircon, epidotes homlende and common apague minerals (heavy metals) in random distribution.	Some parts have clustered. Prophyroskelic, argillasepic, agglomcro, vosepic and skelisepic are the dominant plasmic fabrics.	Bridged gain structure, quartz grains surounded completely by fine material (heavy metals and clay), whist some parts have massive structure.	Simple packing voids are dominant and some parts have channels, vughs and chambers.	Many hard nodules and cutanic heavy metals in voids and arround of grains and few hard nodlues and concretion of $CaCO_3$ and gypsum.	Secondary structure and pedal soil material are the dominant.
		C_2	70-120	Common small to medium subongular normal and undulose quartz, frequent orthoclase and few calcite. Few heavy minerals such as biotit, homlende, straulite, and zircon. Few opague minerals (iron, and manganese oxides).	Porphyrosekelic, agglomero vosepic and skelisepic are the dominant plasmic fabrics.	Bridged gain structure, quartz grains surounded by fine material (clay).	Simple packing voids is the dominant. Some parts have mamulted vughs, and fissurs.	Few hard nodules, concretion and cutanic of ferromangano and hard nodules and cutanic of $CaCO_3$	Tertiary structure and pedal soil material are the dominant.

Table 4.

Prof. No.	Distance (m)	Horizon symbols	Depth (cm)	Skeleton grains and basic distribution	Related distribution and plasma fabric	Microstructure	Voids	Pedological features	Organization level
10	12000		0-20	Common small to medium rounded and subrounded normal quartz, frequent of orthoclase and plagioclase in subangular shope, few heavy minerals such as zircon, augite, hornblend and biotite, and few opague minerals (iron, and manganese oxides) in random distribution.	Some parts have clusterd. Porphyroskelic, agglomero, vosepic, and skelisepic are the dominant plasmic fabrics.	Bridged gain structure, quartz grains surounded by fine material i.e. (humefied organic material, and clay) whilst some parties have massive structure.	Simple packing voids are dominant and some parts have mamulted vughs, and channels..	Few hard nodules, concretion of heavy metals and $CaCO_3$ and gypsum precipitated in voids.	Secondary and Tertiary structure, with medium pedal material are the dominant
		C_1	20-70	Common medium rounded and subrounded normal and undulase quartz. Frequent of orthoclase and plagioclase and few calcite. Few heavy minerals such as biotate, epicdase, zircon and hornblende. Few opaque minerals (iron, and manganese oxides) in random distribution.	Porphyrosekelic, agglomero vosepic and skelisepic plasmic fabrics are the dominant.	Bridged gain structure, quartz grains surounded by fine material (clay) whilst some parties have massive structure.	Simple packing voids are dominant and some parts have mamulted vughs, channels and fissurs.	Very few hard nodules and concretions of ferromangano and gypsum and $CaCO_3$ precipitated in voids are common.	Tertiary structure with small to medium pedal material are the dominant.
		C_2	70-120	Common medium rounded subangular normal quartz frequent of plagioclase, microcline, few heavy minerals such as hornblende, zircon, augite, and biotite, few opague minerals (iron, oxides) in random distribution.	Porphyrosekelic, agglomero vosepic and skelisepic plasmic fabrics are common.	Bridged gain structure, quartz grains surounded by fine material (clay) whilst some parties have massive structure.	Simple packing voids are dominant and some parts have mamulted vughs, and chambers.	Hardnodules and concertinos of $CaCO_3$ and gypsum are common.	Secondary structure with medium pedal material are the dominant.

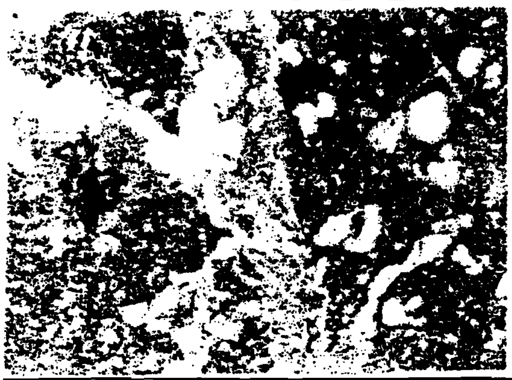

Fig (2): Voidans, hardnodules, and plasma of fine material of heavy metals, organic material and clay. Profile (1) PLX25.

Fig (5): Voidans and plasma of fine material of organo material, heavy metals and clay. Profile (1) PLX25.

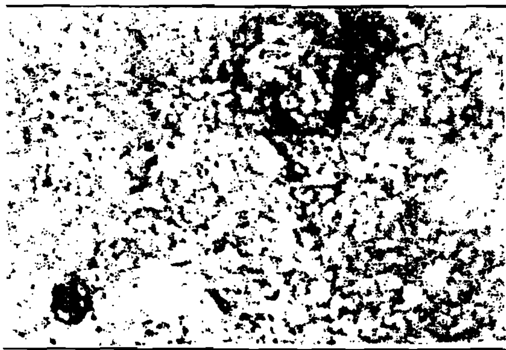

Fig (3): Voidans of heavy metals and concentration of $CaCO_3$ and gypsum. Profile (1) PLX25.

Fig (6): Globular, voidans and plasma of fine material, heavy materials and clay. Profile (1) PLX25.

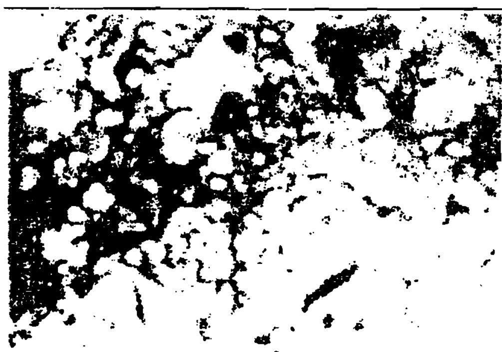

Fig (4): Skillans and voidans of heavy metals. Profile (1) PLX25.

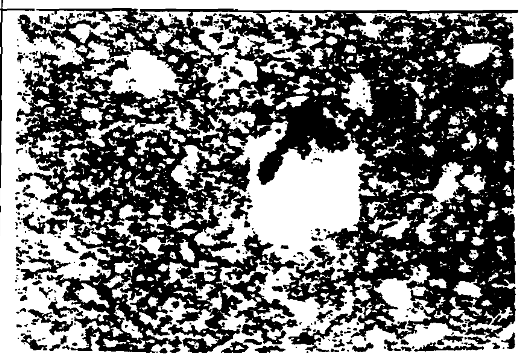

Fig (7): Compacted structure, quartz grains impregnated completely by fine material of heavy metals and clay. Profile (1) PLX25.

Fig (8): Skillans, Globular and plasma of fine material of heavy metals and clay. Profile (10) PLX25.

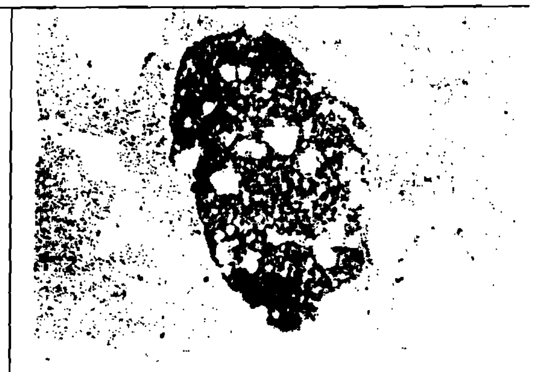

Fig (11): Skillans and concretion of heavy metals. Profile (10) PLX25.

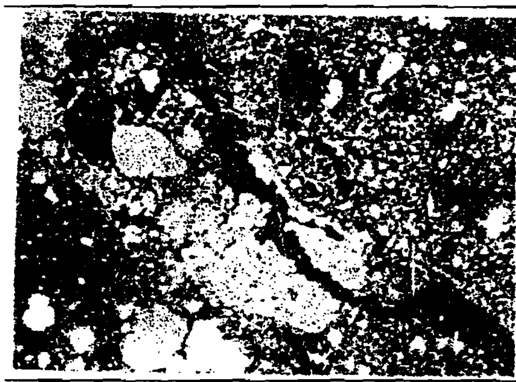

Fig (9): concretion, hardnodules of $CaCO_3$ and gypsum and voidans and plasma of fine material of heavy metals and clay. Profile (5) PLX25.

Fig (12): Voidans, hardnodules and plasma of fine material of organo material, heavy metals and clay. Profile (5) PLX25.

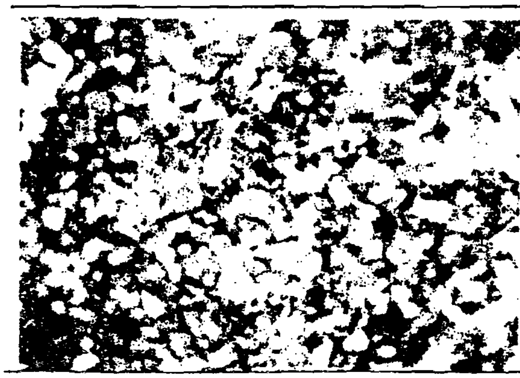

Fig (10): Bridged grains structuere, quartz grains surrounded by fine material of humified organs material and clay. Profile (10) PLX25.

Fig (13): Voidansplan voids and plasma of fine material of heavy metals and clay. Profile (5) PLX25.

Fig (14): Compound and vughs voids of profile (10) PLX25.

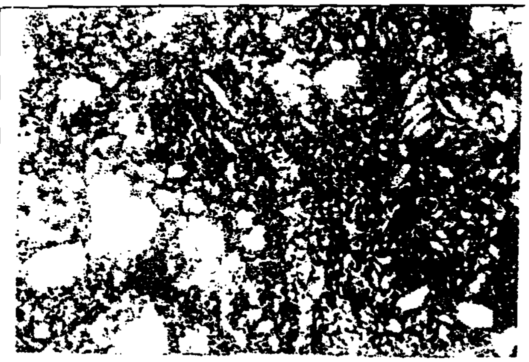

Fig (17): Humified and parts of organic matter, concretion and hardnodules of, $CaCO_3$ and gypsum. Profile (1) PLX25.

Fig (15): Plane and skew voids of profile (10) PLX25.

Fig (18): Voidans, skillans and plasma of fine materials of heavy metals and clay. Profile (5) PLX25.

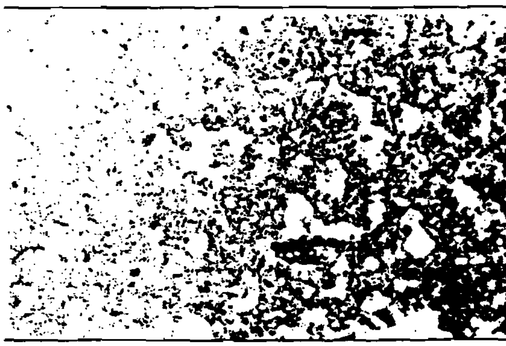

Fig (16): Very few hard nodules and concretion of heavy metals, $CaCO_3$ and gypsum. Profile (10) PLX25.

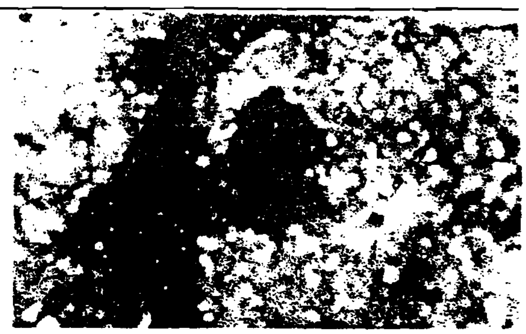

Fig (19): Voidans, and plasma of fine materials of heavy metals and clay. Profile (5) PLX25.

While in profile (10) very few hardnodules and concretion of ferromanmgano and hardnodules and concretion of $CaCO_3$ and gypsum are dominant.

Organization level are tertiary, secondary, and pedal soil material are dominant. From the previous observation it could be concluded that the heavy metal cemented the surface layer to become hard and closed the pores this causes sinderneb growing of plant near the source of pollution and decreased the productivity.

CONCLUSION

From the previous discussion it is clear that pollution are of the important factors which lead to degradation of soil productivity. Productivity of soils at sites No. 1, 2, 3, 4 and 5 there is no growth, while 6, 7, 8, 9 and 10 are seriously impeted, as indicated from the very poorly growth of maize cultivated, being affected by a thin layer of heavy metals covered the surface of the soil, the surface soils have compacted microstructure of heavy metals, strong salinity and toxicity of high concentration of heavy metals. The high content of organic matter on such soils are referred to their slow rate of decomposition, due to the inhibited chemioganotropic microbial population. Jones (1972) noted that the safe levels (in ppm) of heavy metals in plants are 300-400 Fe, 20-50 Mn, 5-20 Cu, 25-50 Zn levels above these assigned could be injurious as such, land degradation and soil pollution.

Soil pollution of the area under investigation resulted from industrial activities. The wastes of industrial activities a injucor soil surface layers thin layer of heavy metals.

Accumulation of certain heavy metals, namely Pb, Co, Ar. In plant tissues might be toxic to humans and animals (El-Sokkary 1980) Kipling 1980, Eid 1984, Abdel. Mottaleb *et al.*, 1993, and Badawi 1993).

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محاولة لدراسة المظاهر الميكرومورفولوجية للأراضى الملوثة وعلاقتها بالانتاجية

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محاولة لدراسة منطقة التبين الواقعة فى نطاق مدينة حلوان جنوب القاهرة على طول مسافة ٢٠ كم من المنطقة الصناعية لتحديد الخواص الدقيقة للأراضى كنتيجة للأنشطة الصناعية المقامة هناك على الخواص الميكروفورلوجية والمحتوى من العناصر الثقيلة للأرض. تم إختيار عشره قطاعات ممثله لمناطق التلوث وتم وصفها بدقه كما تم تجميع العينات الحقلية المثارة وغير المثارة من القطاعات الأرضية للدراسة المعملية تبعا للخواص الموفولوجية الخواص الطبيعية والكيماوية والميكروفولوجية والمحتوى من العناصر الثقيلة Fe, Mn, Zn, Cu, Pb & Cd لدراستها وتحديدها.

أظهرت النتائج المتحصل عليها أن التلوث سواء العضوى أو غير العضوى يتوقف إمتداده على العديد من العوامل الأساسية منها المسافة من مصدرالتلوث (حيث يزداد التلوث بالقرب من المجمع الصناعى والمناطق السكنية كمصدر تلوث) والموقع الجغرافى (حيث يتناقص كلما إتجهنا جنوب المجارى المائية بالنسبة للملوثات المنقولة مع النفايات السائلة وعلى العكس بالنسبة للملوثات المحمولة بالهواء. وكانت تحتوى سبعه من المواقع العشرة المختبرة الملوثة على معدلات من العناصر الثقيلة أعلى من المسموح بها ومن بين هذه المواقع السبع ثلاثة مواقع قد إضطر المزارعين لحرق النموات النباتية الضعيفة فى معظمها منعا من ازدياد الخسائر.

دلت النتائج المتحصل عليها أيضا على أن التلوث العضوى وغير العضوى عامل أساسي فى تدهور الأرض من خلال تأثيره على الإنتاجية. تلوث الأرض يؤثر على الخواص الموفولوجية والطبيعية والكيماوية والميكروفولوجية والمحتوى من العناصر الثقيلة.

أنخفضت الإنتاجية حول الأنشطة الصناعية بدرجة كبيرة ويرجع هذا إلى عديد من العوامل منها إندماج والتحام الطبقات السطحية للأرض وذلك تحت تأثير ترسيبات العناصر الثقيلة والذى إتضح من الدراسات المورفولوجية والميكروفولوجية والعامل الثانى هو التركيز العالى من الأملاح والعامل الثالث التركيز العالى من العناصر الثقيلة.