J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 8 (9): 401 - 409, 2017

# Effect of some Soil Properties on Heavy Metal Contents in Soil Qena Governorate.

**Ibrahim, M. S. ; A. A. Abd El-Galil ; O. Negim ; M. A. Nazir**
**Soils & Water Department, Faculty of Agriculture, Sohag University, Egypt**

## ABSTRACT

This study aims to assess heavy metal in the soils of Qena governorate. To fulfill this objective, surface soil samples were collected from industrial site and agricultural soils in Qena governorate. Cd. Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn in the samples were estimate. During sampling we focused on the residential communities located downwind from the industrial zone to investigate the effect of industrial plants on the surrounding. The average An concentration of these elements in all soil samples were in the following order Fe> Mn> Cr> Cu> Ni> Co> Zn> Pb> Cd. In addition, positive correlations were found between organic matter, clay content and concentration of total heavy metal. In comparison to level heavy metal (industrial zone & cultivated soil) of Qena , the mean contents of Cu, Cr, Mn, Ni and Fe are high in industrial zone samples. The obtained values were higher than the background levels measured in control soil sample . The findings of this study revealed that there need for monitoring of heavy metal contents in soils from the vicinity of industrial sites in Qena governorate in order to assess the possible potential hazard to life and environment.

**Keywords:** heavy metal, Pollution assessment, industrial areas.

## INTRODUCTION

The pace and scale of environmental contamination by industrial activities have steadily increased in the last two centuries due to the pronounced industrial revolution, (Stigliani *et al* ., 1991).Soil environment in industrial areas where the metallurgical plants are site, as well as in the agricultural site surrounding these facilities is often heavily polluted with trace element **(**Sofilič *et al.* 2008).

More than one source is responsible for the environmental pollution in the study area, including industrial, urban and agricultural sources.

Many different industries are located on the banks of the Qena. These industries pour their effluents directly in to the water bodies, with partial treatment and/or without any treatment. Most problematic are the chemical factories of Qus, Dishna and Nga Hmadi that dump their waste liquids directly into Nile river branches without any treatment. The amount flow of industrial waste water discharge to the Rosetta branch is about 0.05 million m three /day( Abu el - ela & El-bahrawy 1993) In general, sources of the trace element in soils mainly include natural occurrence derived from origin materials and human activities. humanity inputs are associated with industrialization and agricultural activates deposition, such as waste incineration, waste disposal, atmospheric deposition, , urban effluent, fertilizer application and long-term application of incineration, urban effluent, traffic emissions and long-term application of wastewater in agricultural land, (Bilos, *et al* 2001 and Koch and Rotard , 2001).

The objective of this study is to determine the content of some heavy metals for cultivated soil and industrial sites in Qena governorate, Egypt

## MATERIALS AND METHODS

**Soil sampling:** Surface soil samples of were collected from 13 locations within the industrial sites in four major cities of Abu Tisht, Ngi Hmmadi, Dishna and quos, respectively in Qena Governorate, Egypt. Control soil samples were collected from locations within the four cities that were far from any major pollution sources. Corresponding sample cultivated soil were collected from 13 locations within the agriculture soil sites in four major location of Abu Tisht, Ngi Hmmadi, Dishna and quos. (Table1) and (Map1.). All samples were put in airtight polyethylene bags and taken back to the laboratory.

The collected soil samples were air-dried and sieved through a 2 mm sieve, then stored in air-tight polyethylene bottles. Determination of some physical and chemical properties and total heavy metal Cd, Cr, Co, Cu, Mn, Ni, Pb and Zn concentration were estimated in the soils and water Department ,Faculty of Agriculture, Sohag University.

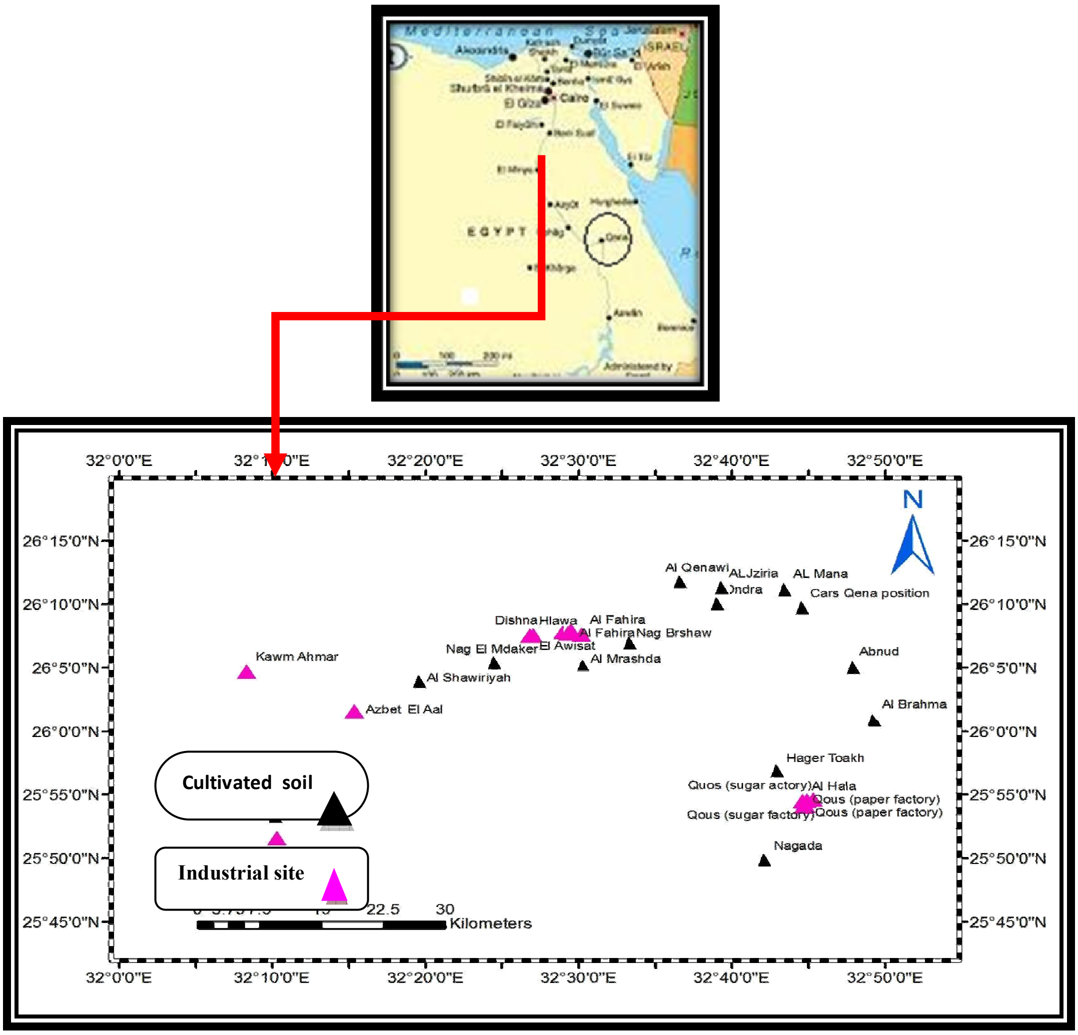
**Soil Analysis** : Soil reaction (pH) was measured by means of a digital pH meter_ (Cole Parmer) in water suspension (1:1) , Page et .al. (1982). Particle size distribution of the soil samples was carried out using Pipette method, Page et. al. (1982). Organic matter was determined by the rapid titration method of Klute and Dirksen (1986) Total soil salinity (ECe) was determined by electrical conductivity meter, Page *et al.* (1982)**.** Cationic and anionic compositions of the soil saturation extract were determined following the methods described by Page *et al.*(1982) and determining trace element concentrations in soil samples by The aqua regia (3:1, v/v, HCl to HNO3 using ICP Absorption Spectrometry (Nieuwenhuize *et al.*, 1991).

## RESULTS AND DISCUSSION

**Soil characteristics:**

**Industrial site**

Table (2) shows the pH values ranged from 6.51-8.22 The highest pH value 8.2 in the soil samples has been found at site ( 2&7) while the least pH value was associated with industrial site. This is due to the factory waste and out the aids (Environmental Protection Agency, 1996) studied soils are non saline to extremely saline, as evidenced from the ECe values which range from 0.79 to 7.01 dSm $^{-1}$. Generally, most soils are non saline to slightly saline except those of the sampling site the industrial sites from Qus .the data revealed that carbonate content in the studied soils ranges from 0.16 to 4.92%. Exceptional cases are found in site (12) where calcium carbonate18.53%. The clay content in surface soils varies between 3 to 35% . the major part of the clay fine are loam in nature where the loam fraction is prevailed over the other fractions followed by sand then clay (Table 1) . The soil organic matter contents ranged from 0.28 to 2.88 % for industrial site. the cationic composition of the soluble salts is mostly dominated by calcium sodium and /or sodium followed by magnesium, while potassium is the least. In general, the soluble cations follow the order Ca > Na > Mg> K. for most of soil samples. Meanwhile, the anionic distribution has variable trends with tend highest of bicarbonate and chloride.




**Map 1. location of soil samples map**

**Table 1. Location of soil samples (industrial zone and cultivated soil )**

| provence | NO | Location | Latitude | Longitude | Sand% | Silt% | Clay% | Texture |
|---|---|---|---|---|---|---|---|---|
| | | | **(industrial zone)** | | | | | |
| Farshot | 1 | Kawm Ahmar | 26°04'40.9" | 32°08'19.4" | 69.8 | 15.5 | 14.7 | sandy loam |
| Nag Hmmadi | 2 | Azbet Abd El Aal | 26°01'32.0" | 32°15'21.2" | 65.5 | 31.5 | 3.0 | sandy loam |
| Dishna | 3 | Dishn (faiber bord) | 26°07'39.9" | 32°29'16.8" | 49.6 | 25.1 | 25.3 | clay loam sand |
| | 4 | El Awisat | 26°07'31.3" | 32°26'94.6" | 15.3 | 65.5 | 19.2 | Silt loam |
| | 5 | Dishna | 26°07'32.9" | 32°27'02.5" | 36.0 | 55.5 | 8.5 | loam Silt |
| | 6 | Al Fahira | 26°07'55.8" | 32°29'92.3" | 51.7 | 33.7 | 14.6 | loam |
| | 7 | Hlawa | 26°07'31.3" | 32°26'94.6" | 9.3 | 71.5 | 19.2 | Silt loam |
| | 8 | Al Fahira | 26°07'95.8" | 32°30'11.3" | 54.1 | 29.4 | 16.5 | sandy loam |
| Quos | 9 | Quos (sugar actory) | 25°54'34.4" | 32°45'21.0" | 37.6 | 36.6 | 25.8 | loam |
| | 10 | Qous (sugar factory) | 25°54'31.4" | 32°44'55.3" | 63.7 | 13.5 | 22.8 | sand clay loam |
| | 11 | Qous (paper factory) | 25°54'07.1" | 32°44'49.7" | 41.2 | 23.8 | 35.0 | clay loam |
| | 12 | Qous (paper factory) | 25°54'01.2" | 32°44'40.8" | 9.0 | 55.0 | 36.0 | Silt clay loam |
| | 13 | Al Hala | 25°54'28.3" | 32°44'38.7" | 53.0 | 21.0 | 26.0 | sand clay loam |
| | | | (Cultivated soil) | | | | | |
| Qena | 14 | Al Qenawi | 26°11'42.7" | 32°36'65.3" | 81.3 | 13.4 | 5.3 | loam sand |
| | 15 | ALJziria | 26°11'15.2" | 32°39'16.3" | 44.0 | 27.0 | 29 | clay loam |
| | 16 | AL Mana | 26°11'13.5" | 32°43'26.2" | 79.8 | 17.4 | 2.8 | loam sand |
| | 17 | Cars Qena position | 26°09'42.0" | 32°44'32.0" | 59.2 | 31.5 | 9.3 | sandy loam |
| Dndra | 18 | Dndra | 26°10'00.7" | 32°38'75.6" | 68.2 | 23.9 | 7.9 | sandy loam |
| Qena | 19 | Abnud | 26°10'00.7" | 32°38'75.6" | 53.0 | 16.0 | 31 | sand clay loam |
| Qeft | 20 | Al Brahma | 26°00'57.9" | 32°49'14.3" | 81.0 | 15.4 | 3.6 | loam sand |
| Al Wakf | 21 | Al Shawiriyah | 26°03'03.5" | 32°19'30.1" | 54.7 | 28.8 | 16.5 | sandy loam |
| | 22 | Nag El Mdaker | 26°05'19.2" | 32°24'92.3" | 73.3 | 18.3 | 8.4 | sandy loam |
| | 23 | Al Mrashda | 26°05'99.8" | 32°28'94.4" | 63.4 | 32.2 | 4.4 | sandy loam |
| | 24 | Nag Brshaw | 26°06'54.5" | 32°33'99.9" | 84.2 | 10.6 | 5.2 | loam sand |
| Nagada | 25 | Nagada | 25°49'47.0" | 32°42'09.0" | 28.9 | 52.7 | 18.4 | silt loam |
| | 26 | Hager Toakh | 25°56'43.0" | 32°42'59.0" | 47.9 | 30.0 | 22.1 | loam |

**Soil cultivated**

The geographical distribution of soil pH, ECe values, CaCO3 and clay contents within the top 30 cm of soils are presented in table 3. of the cultivated soils had pH values between 7.6 and 8.27. According to ECe values of soils were considered non saline to slightly saline, as evidenced from the ECe values which range from 0.79 to 7.01 $dSm^{-1}$. Exceptional cases are found in site 12 where ECe 7.01 dS/m. The organic matter contents of soils ranged between 0.28 and 1.73%. The data revealed that carbonate content in the studied soils ranges from 0.16 to 7.54 %. Exceptional cases are found in site 6 where calcium carbonate was 11.15%. The major part of the clay fine are silt in nature where the silt fraction is prevailed over the other fractions followed by sand then clay. the soluble cations for most of soil samples follow the order Ca > Na > Mg> K. Meanwhile, the anionic distribution has variable trends.

**Table 2. Some soil chemical and physico-chemical properties of the representative soil samples**.

| $CaCo_3$% | OM% | Soluble cations and anions me/l | | | | | | | PH | Ece dS/m | S.P | NO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $SO_4^{--}$ | $Cl^-$ | $HCO^{-3}$ | $K^+$ | $Na^+$ | $Mg^{++}$ | $Ca^{++}$ | | | | |
| 0.41 | 1.15 | 2.2 | 17.6 | 18.8 | 1.42 | 10.32 | 11.6 | 14.4 | 7.70 | 3.86 | 110 | 1 |
| 1.64 | 0.57 | 0.1 | 6.6 | 3.8 | 0.43 | 3.45 | 2.2 | 4.2 | 8.22 | 1.05 | 33 | 2 |
| 0.16 | 2.08 | 0.1 | 4.4 | 8.4 | 1.06 | 5.13 | 2.4 | 4.2 | 7.70 | 1.29 | 57 | 3 |
| 1.80 | 2.82 | -- | 3.6 | 5.2 | 0.40 | 3.42 | 2.2 | 2.4 | 7.80 | 0.88 | 119 | 4 |
| 2.38 | 2.31 | 0.1 | 3.0 | 4.8 | 0.08 | 2.35 | 2.2 | 3.0 | 7.40 | 0.79 | 65 | 5 |
| 1.31 | 2.60 | 0.3 | 14.4 | 6.4 | 3.23 | 9.43 | 2.2 | 5.6 | 7.60 | 2.11 | 54 | 6 |
| 18.53 | 0.86 | 0.4 | 2.0 | 7.2 | 0.27 | 1.92 | 1.4 | 5.8 | 8.22 | 0.96 | 60 | 7 |
| 1.31 | 0.86 | 0.2 | 7.8 | 9.6 | 1.33 | 4.45 | 3.6 | 8.2 | 7.90 | 1.76 | 52 | 8 |
| 0.57 | 2.16 | 0.2 | 26.0 | 12.2 | 0.93 | 25.08 | 2.8 | 8.6 | 8.16 | 3.84 | 67 | 9 |
| 1.72 | 2.88 | 0.4 | 14.8 | 22.8 | 1.01 | 9.61 | 8.8 | 17.8 | 7.87 | 3.80 | 53 | 10 |
| 4.92 | 2.60 | 0.3 | 14.6 | 45.2 | 8.76 | 10.02 | 16.2 | 24.6 | 7.20 | 6.01 | 70 | 11 |
| 1.23 | 0.28 | 0.3 | 22.2 | 47.6 | 5.31 | 18.40 | 13.2 | 32.8 | 6.51 | 7.01 | 47 | 12 |
| 0.49 | 0.28 | 0.2 | 46.0 | 11.6 | 2.65 | 18.64 | 7.4 | 28.4 | 8.12 | 5.78 | 36 | 13 |
| Cultivated soil | | | | | | | | | | | | |
| 6.15 | 0.28 | 0.1 | 8.6 | 6.2 | 0.65 | 3.32 | 2.0 | 8.6 | 7.8 | 1.49 | 41 | 14 |
| 0.16 | 2.60 | 0.5 | 7.0 | 11.8 | 0.40 | 0.91 | 4.2 | 13.2 | 7.95 | 1.93 | 63 | 15 |
| 7.54 | 0.89 | 0.1 | 19.8 | 17.0 | 1.98 | 3.15 | 7.2 | 24.3 | 8.07 | 3.71 | 32 | 16 |
| 0.16 | 0.28 | 1.3 | 5.4 | 3.4 | 1.02 | 4.24 | 2.4 | 2.2 | 8.11 | 1.01 | 57 | 17 |
| 1.23 | 0.86 | 0.3 | 12.4 | 18.1 | 1.19 | 7.52 | 7.2 | 14.6 | 7.95 | 3.08 | 50 | 18 |
| 11.15 | 0.28 | 0.3 | 19.8 | 17.4 | 1.63 | 8.31 | 3.2 | 23.8 | 7.81 | 3.75 | 67 | 19 |
| 1.80 | 0.28 | 0.2 | 7.0 | 8.4 | 1.58 | 7.43 | 1.6 | 4.8 | 7.60 | 1.56 | 42 | 20 |
| 0.41 | 0.57 | 0.2 | 3.4 | 9.8 | 0.76 | 3.41 | 2.8 | 6.4 | 8.23 | 1.34 | 57 | 21 |
| 1.64 | 1.73 | 0.2 | 4.0 | 4.6 | 2.16 | 2.72 | 1.6 | 2.2 | 8.27 | 0.88 | 57 | 22 |
| 0.20 | 0.28 | 0.3 | 12.6 | 10.4 | 1.48 | 6.61 | 3.2 | 11.6 | 7.93 | 2.33 | 50 | 23 |
| 6.56 | 0.28 | 0.3 | 18.4 | 17.8 | 2.14 | 11.41 | 5.2 | 17.4 | 8.04 | 3.65 | 21 | 24 |
| 4.13 | 1.73 | 1.2 | 29.7 | 12.3 | 1.90 | 31.20 | 3.0 | 6.8 | 8.31 | 4.32 | 62 | 25 |
| 3.65 | 1.44 | 1.1 | 23.4 | 14.5 | 0.34 | 26.00 | 4.0 | 8.6 | 8.25 | 3.90 | 66 | 26 |

**Trace element contents in soils:**

**Evaluation of Nickel** : Table (3) and map (2) Nickel concentration in the surface layers of soil (0 -30 cm) ranged from 5.90 to135.36 with a mean value of 41.75 mg $kg^{-1}$ soil. The highest nickel concentration (135.36 mg $kg^{-1}$) in industrial soils samples has been found at location 4 (quos , paper Factory). These results indicated that paper Factory waste of Qena governorate contain greater amounts of Ni . Corresponding values for sample cultivated soil ( 0- 20) cm were from 7.07 to 80.40 with an average value of 34.23mg kg-1 soil. The highest nickel concentration (80.40 mg kg-1) in the top soil samples has been found at location 5 ( AlWakf ).The major sources of nickel pollution in the soil are metal plating industries, combustion of fossil fuels, and nickel mining and electroplating. It is released in to the air by power plants and trash incinerators and settles to the ground after undergoing precipitation reactions (Raymond and Okieimen, 2011)

**Evaluation Of Chromium (Cr)** Table (3) and map (3) The concentrations of Cr in the industrial soils ranged from 25.64 to.272.86 with a mean value of 200.18mg $kg^{-1}$ soil. The highest Chromium concentration (311.9 mg $kg^{-1}$) in industrial soils samples has been found at location 4(quos, paper Factory). While values for sample Cultivated soil (0- 20) cm were from 4.28 192.96 mg $kg^{-1}$ with an average value of 122.11mg $kg^{-1}$ soil. The highest Chromium concentration (192.96 mg $kg^{-1}$) in the top soil samples has been found at location 3 (Abnoud ).The high Cr levels are generally associated with ultramafic and mafic rocks. The average concentration of Cr in basalt is 90 mg/kg, in granite 4 mg/kg and in world soil 70 mg/kg. (Bowen 1979). that the burning of fossil fuels to generate energy needed industrial activities account for more than 80% of contaminate Ni. (Nriagu 1990) These observations indicate that Cr pollution in Qena soils.

**Evaluation Of Cobalt (Co)** Table (3) and map (4) show The concentrations of Co in the industrial soils ranged from 4.27 to 35.21 mg $kg^{-1}$ with a mean value of 23.09 mg $kg^{-1}$ soil. The highest Cobalt concentration (35.21 mg $kg^{-1}$) in industrial soils samples has been found at location 3 (Dishna, Hlawa) ). While values for sample Cultivated soil ( 0- 20) cm were from 0.38 to 26.41 mg $kg^{-1}$ with an average value of 12.51 mg $kg^{-1}$ soil. The highest Cobalt concentration (26.41mg $kg^{-1}$) in the top soil samples has been found at location 5 (Alwkf, Nag Brshaw ). sources of cobalt coal combustion, electroplating, stainless steel, paints, glass, plastic hardeners, fertilizers and lead as well as iron and silver mining and processing (Reimann & De caritat 1998)

**Evaluation Of Copper (Cu)** Table (3) and map (5) show The concentrations of Cu in the industrial soils ranged from 7.65 to 128.37 with a mean value of 67.99 mg $kg^{-1}$ soil. Exceptional cases are found in site 12 where the highest copper concentration (211.59 mg $kg^{-1}$) in industrial site samples (quos, EL Hela, paper Factory) .Corresponding values for sample cultivated soil ( 0- 20) cm were from 2.04 to 56.16 with an average value of 34.91 mg kg-1 soil. The highest copper concentration (72.3 mg $kg^{-1}$) in the top soil samples has been found at location 24 (Nag Brshaw) Copper is found in relatively high levels in mafic rocks (60-120 mg $kg^{-1}$) and argillaceous sediments(40 -60 mg $kg^{-1}$ ) and in much lower levels in limestones (2-10 mg $kg^{-1}$) Mean copper contents for uncontaminated soils world wide range from (13- 24) ppm, but the overall range for world soils is higher (1-140 mg $kg^{-1}$) depending on the nature of the soil parent materials( Kabata-Pendias and Pendias, 1992) Values for soil contents vary but generally range from 1-40 mg $kg^{-1}$ with an average of 9 mg $kg^{-1}$ in the United States(Tisdale *et al.*, 1985)

**Evaluation Of Lead (Pb) :**Table (3) and map (6) show The concentrations of Pb in the industrial site ranged from 0.10 to.42.89 mg $kg^{-1}$ with a mean value of 16.80 mg $kg^{-1}$ soil. The highest Lead concentration (42.89 mg $kg^{-1}$) in industrial site samples has been found at location 4 (quos , paper Factory) .Corresponding values for sample cultivated soil ( 0- 20) cm were from 1.19 to 11.87 mg $kg^{-1}$ with an average value of 6.95 mg $kg^{-1}$ soil. The highest Lead concentration (11.87 mg $kg^{-1}$) in the top soil samples has been found at location 4 (Al Brahma ) greatest presence of lead occurs in argillaceous sediments from (20-40 mg $kg^{-1}$) while shales from (18-25 mg $kg^{-1}$) and amounts are also high in felsic rocks (15-24 mg $kg^{-1}$). The general range of lead in world soils is 3-189 mg $kg^{-1}$ with means value of 10-67 mg $kg^{-1}$ and an overall average level of 32 mg $kg^{-1}$. A threshold of contamination of 20 mg $kg^{-1}$ has been suggested based on the low lead levels found in Alaskan soils range of means 22-28 mg $kg^{-1}$ . (Kabata -Pendias and Pendias, 1992) The range in amounts of lead in remote areas tends to be from 10-30 ppm but levels in other soils are higher,30-100 ppm (Davies, 1990).

**Evaluation Of Cadmium Cd** Table (3) and map (7) show The concentrations of Cd in the industrial site ranged from 0.04 to. 2.97 mg $kg^{-1}$ with a mean value of 0.81mg $kg^{-1}$ soil. The highest cadmium concentration (2.97 mg $kg^{-1}$) in industrial site samples has been found at sample 3 location 3 (Deshna , fiber board Factory) While values for sample Cultivated soil ( 0- 20) cm were from 0.04 to 1.23 with an average value of 0.54 mg $kg^{-1}$ soil. The highest Cadmium concentration (1.23 mg $kg^{-1}$) in the top soil samples has been found at location 3(Abnud ). Human activity can contribute to increased Cd levels as a result of industrial activity or agricultural practices (Adriano, 2001) Different international authors fix a normal Cd range of 0.07 and 1.1 mg $kg^{-1}$ (Alloway, 1990) Cadmium is present mainly in organic-rich shales (0.22-0.30) mg $kg^{-1}$, while in igneous rocks it is where highest in mafic units from (0.13-0.22 mg $kg^{-1}$) It is found in soils at levels ranging from 0.06-1.1 mg $kg^{-1}$ and the worldwide average is 0.53 mg $kg^{-1}$, which is also considered to be the threshold of contamination (Kabata- Pendias and Pendias, 1992). Actual phytotoxicity can occur on polluted soils, but it is rare (Alloway, 1990)

**Table 3. Total h eavy metal contents in soil samples .**

| NO | Ni | Cr | Co | Cu | Pb | Cd | Zn | Fe | Mn |
|---|---|---|---|---|---|---|---|---|---|
| **Normal soils Median*** | **50** | **70** | **8** | **30** | **35** | **0.35** | **90** | **---** | **1000** |
| 1 | 5.90 | 25.64 | 4.27 | 26.57 | 19.91 | 1.00 | 16.10 | 717.3 | 117.00 |
| 2 | 72.79 | 167.8 | 29.30 | 20.36 | 37.30 | 2.42 | 15.32 | 1067.2 | 189.43 |
| 3 | 48.24 | 154.68 | 24.46 | 19.82 | 17.86 | 2.97 | 34.31 | 3056.4 | 348.57 |
| 4 | 21.13 | 133.8 | 26.03 | 14.37 | 0.37 | 0.62 | 18.54 | 1681.5 | 356.50 |
| 5 | 12.02 | 262.05 | 19.80 | 7.65 | 5.29 | 0.16 | 17.34 | 1956.5 | 333.80 |
| 6 | 46.23 | 248.72 | 23.65 | 71.73 | 12.88 | 0.13 | 19.93 | 2342.7 | 315.00 |
| 7 | 31.80 | 244.00 | 35.21 | 70.98 | 7.78 | 0.04 | 23.37 | 2832.9 | 350.28 |
| 8 | 13.73 | 280.90 | 30.43 | 25.35 | 10.19 | 0.67 | 15.69 | 3430.0 | 482.02 |
| 9 | 13.66 | 224.70 | 26.91 | 60.21 | 0.22 | 0.25 | 23.20 | 1966.8 | 344.08 |
| 10 | 14.60 | 272.86 | 31.75 | 123.97 | 0.10 | 0.62 | 21.91 | 2080.1 | 274.12 |
| 11 | 101.43 | 94.09 | 5.43 | 103.02 | 39.92 | 0.02 | 20.48 | 719.95 | 447.15 |
| 12 | 135.36 | 311.60 | 28.05 | 211.59 | 42.89 | 1.54 | 15.89 | 692.4 | 733.80 |
| 13 | 25.91 | 181.56 | 14.91 | 128.37 | 23.73 | 0.12 | 13.66 | 1386.0 | 172.04 |
| Cultivated soil | | | | | | | | | |
| 14 | 33.58 | 165.68 | 25.13 | 24.55 | 6.83 | 0.41 | 20.50 | 2248.51 | 467.85 |
| 15 | 21.23 | 4.28 | 5.78 | 26.12 | 4.01 | 0.75 | 16.43 | 274.10 | 271.49 |
| 16 | 26.21 | 84.24 | 0.38 | 45.72 | 1.94 | 0.26 | 8.46 | 433.25 | 122.96 |
| 17 | 22.82 | 172.20 | 24.17 | 25.49 | 9.97 | 0.27 | 17.85 | 1915.58 | 307.43 |
| 18 | 7.07 | 144.12 | 12.03 | 24.68 | 10.08 | 0.26 | 13.22 | 1340.00 | 269.15 |
| 19 | 54.70 | 192.96 | 10.92 | 51.95 | 2.36 | 1.23 | 11.51 | 925.31 | 160.52 |
| 20 | 19.41 | 130.05 | 6.73 | 14.21 | 11.87 | 0.86 | 8.54 | 380.05 | 6.10 |
| 21 | 26.36 | 138.42 | 19.12 | 48.43 | 6.53 | 0.04 | 16.21 | 1624.00 | 150.31 |
| 22 | 55.90 | 152.64 | 14.19 | 17.86 | 11.32 | 0.34 | 13.40 | 1840.81 | 347.76 |
| 23 | 66.72 | 133.11 | 7.08 | 2.04 | 1.19 | 0.08 | 8.47 | 998.41 | 67.44 |
| 24 | 80.40 | 131.61 | 26.41 | 72.30 | 8.37 | 1.01 | 9.64 | 519.52 | 592.00 |
| 25 | 12.34 | 63.92 | 4.40 | 56.16 | 6.65 | 0.83 | 8.86 | 552.40 | 128.36 |
| 26 | 18.25 | 74.27 | 6.32 | 44.42 | 9.23 | 0.76 | 7.43 | 532.65 | 179.42 |

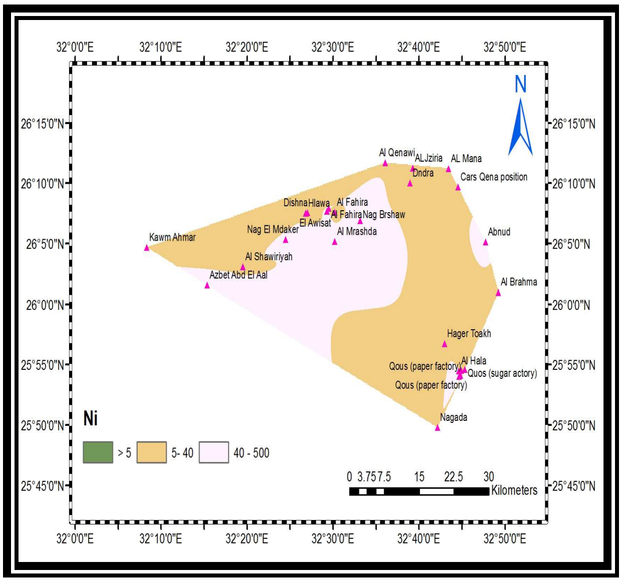
***Bowen – 1979.**

**Evaluation Of Zinc (Zn)** Table (3) and map (8) show The concentrations of Zn in the industrial site samples ranged from 13.66 to 23.37 mg $kg^{-1}$ with a mean value of 19.67mg $kg^{-1}$ soil. Exceptional cases are found in site 3 where the highest Zinc concentration (34.30 mg $kg^{-1}$) The highest Zinc concentration (34.30 mg $kg^{-1}$) in industrial sites samples has been found at location 3 (Deshna , fiber board Factory). While values for sample Cultivated soil ( 0- 20) cm were from 7.43 to 20.50 with an average value of 12.34 mg $kg^{-1}$ soil. The highest Zinc concentration (20.50 mg $kg^{-}$

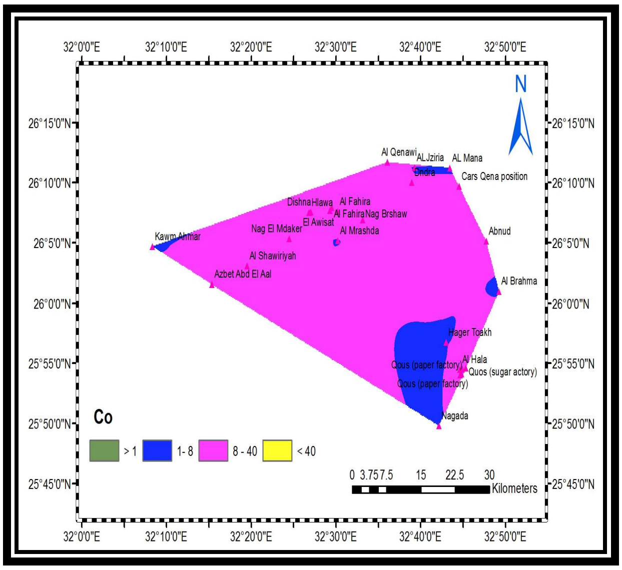
$^{1}$) in the top soil samples has been found at location 1 (Al Qenawi ).Zinc is important essential for plants to lipid and carbohydrate metabolism and is required at levels range from 10-20 mg $kg^{-1}$ (Kabata-Pendias and Pendias, 1992).in this study value Zinc associated with soil texture. Zinc is adsorbed by clay and organic matter and may accumulate in the surface horizons of soil (Nazir. M.A 2009).

**Evaluation Of Iron (Fe)** Table (3) and map(9 ) present the (Fe) values of the studied soil samples. The values are widely different, as they range from 692.4 to 3430.0 mg $kg^{-1}$ with a mean value of 1840.75mg $kg^{-1}$ soil. The highest Iron concentration (3430.0mg $kg^{-1}$) in industrial soils samples has been found at location 3 (Deshna , fiber board Factory) While values for sample cultivated soil ( 0- 20) cm were from 274.0 to 2248.5 mg $kg^{-1}$ with an average value of 1044.96 mg $kg^{-1}$ soil. The highest iron concentration (2248.51 mg kg-1) in the top soil samples has been found at location 1 (Al Qenawi ). The highest deposition of Fe in soil might be due to its use in the production of machine tools, pigments, paints and alloying in various industries that may result in pollution of the soil and a change to the soil structure thus making it risky for use in cultivation Rahman *et al.*, 2012.

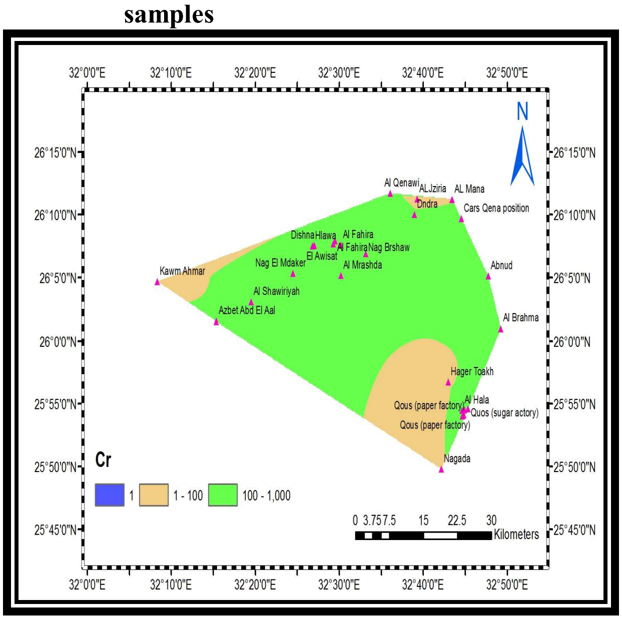
**Evaluation Of Manganese (Mn)**:-Table (3) and map (10) The concentrations of Mn in the industrial site ranged from 117.0 to 483.8 mg $kg^{-1}$. The highest manganese concentration ( 482.86 mg $kg^{-1}$) in industrial zone samples has been found at location 3 (Al Fahira- (Deshna). While values for cultivated soil sample ( 0- 20) cm were from 6.10 to 347.76 mg $kg^{-1}$. The highest manganese concentration (592.00 mg $kg^{-1}$) in the top soil samples has been found at location 5 (Nag Brshaw ). Total Mn in some soils of the south valley region of Egypt varies was from 110 to 753 mg $kg^{-1}$. with low content of Mn in the soils of the lower Nuba Plain relative to those of Dakhla Oasis, El- Demerdashe *et al.* (1991).



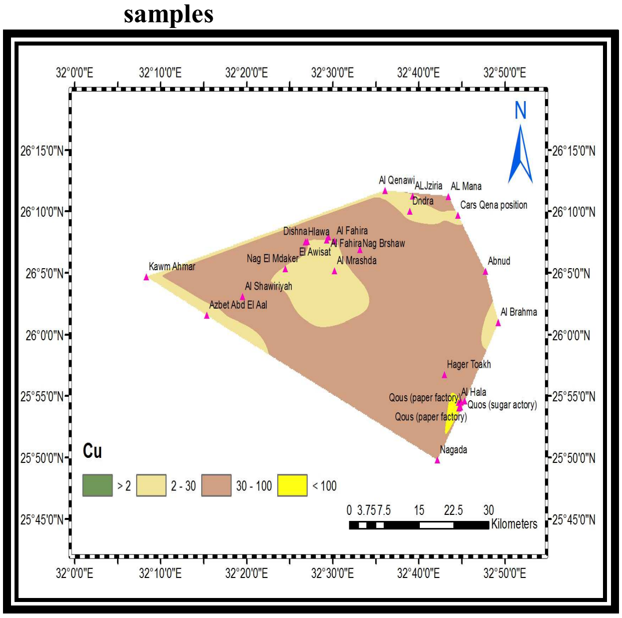

**Map 2. Nickel concentration of the surface soil samples**



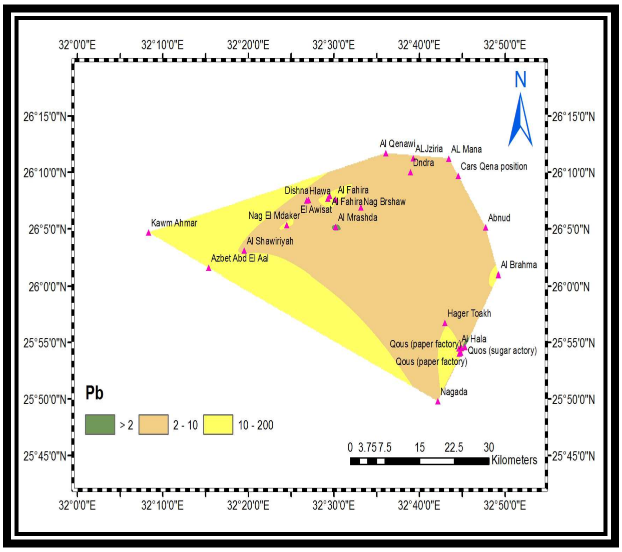

**Map 4. Cobalt concentration of the surface soil samples**



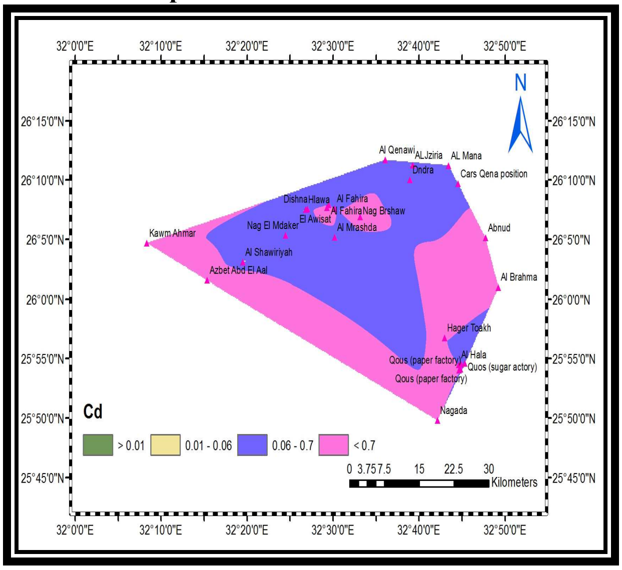

**Map 3. Chromium concentration of the surface soil samples**



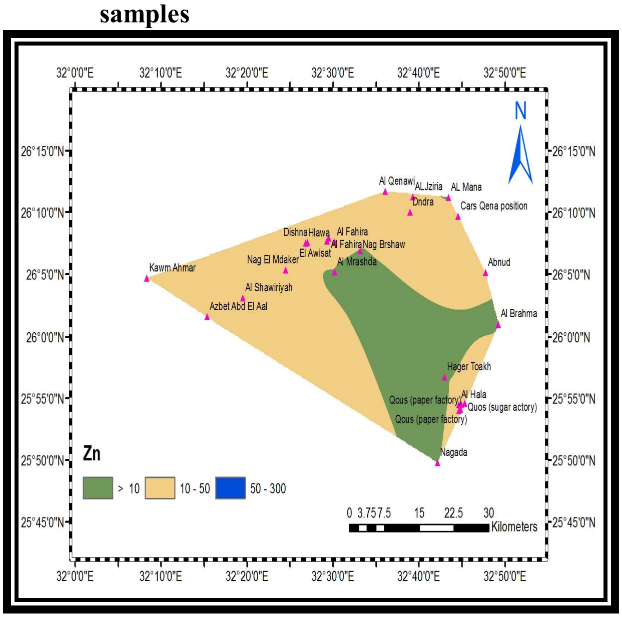

**Map 5. Copper concentration of the surface soil samples**



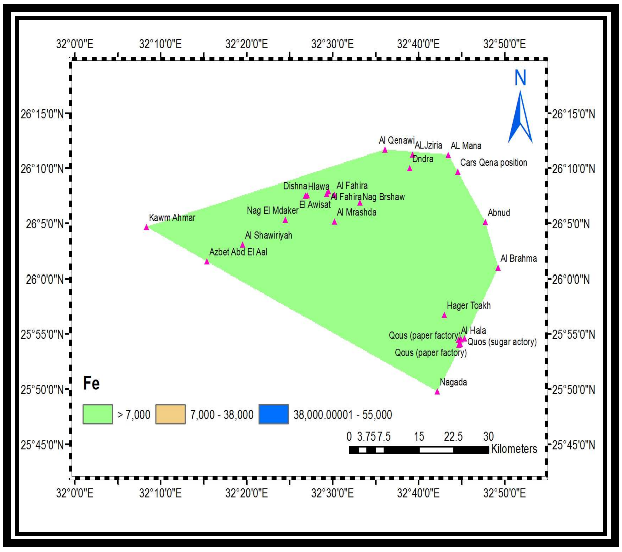

**Map 6. Lead concentration of the surface soil samples**



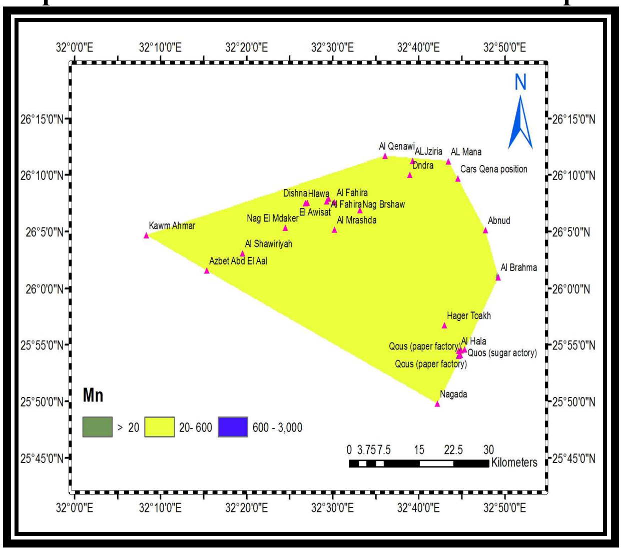

**Map 7. Cadmium concentration of the surface soil samples**




**Map 8. Zinc concentration of the surface soil samples**




**Map 9. Iron concentration of the surface soil samples**




**Map 10. Manganese concentration of the surface soil samples.**

**Relationship between heavy metal concentrations and soil properties**

Soil texture, clay and organic matter contents are the most important soil properties, affecting the total amounts of heavy metal in soils . The data found that Cr, Pb, and Cu were correlated with clay content. high correlations between concentrations of Cr, Cu, Mn, and Ni and the amounts of particles<0.02 mm in surface soils by Dudka (1993). clay content is highly correlated with concentrations of all trace elements. In this respect, The data showed that the positive correlation between concentration cd, co, Cr, Cu, Fe, Mn, Ni, Pb, Zn industrial zone samples and soil clay content are shown in respectively (r=0.244) (r=0.269) (r=0.491) (r=0.575[*]) (r=0.62) (r=0.732[**]) (r=0.28) (r=0.73) (r=0.98). This is consistent with previously published data by Ma.l.*et al.* ((1997) They indicate that concentrations of Cr, Cu, Fe, , Ni, Pb, and Zn were strongly correlated with clay content in surface soils sample. In addition, it was found only soil clay content was high significant positive correlation between total concentration Cu and Mn (r=0.732[**]) &(r=0.575[**]) . These results agree with those obtained by Aydinalp C, et.al (2003). From our study, relationship between heavy metals in Cultivated soil and Clay content showed moderate positive correlation with values Cd. Cu, Fe, Mn, Ni, Pb, Zn are shown in respectively (r=0.497) (r=0.316) (r=0.115) (r=0.089) (r=0.013) (r=0.054) (r=0.075). Moreover, a not positive correlation was found between values Co, Cr and Clay content. In addition, a significant positive correlation was found between the concentration Cd, Co, Cu, Fe, Mn, Ni, Pb, Zn in the studied soil samples and organic matter with correlation coefficients of( r=0.096) (r=0.240) (r=0.118) ( r=0.023) (r=0.763**) ( r=0.104) (r=0.287) (r=0.190), respectively. Relationship between heavy metal concentrations and soil properties is presented in figure (11 and 12).

The amounts and types of organic matter vary with the type of soils. Organic matter influences the mobility of heavy metal in soils either by changing the soil pH or by accumulating the free metal cations on the large negative charge of the organic matter (Rieuwerts, 2007). Soil organic matter also reduces the toxicity of $Cr^{6+}$ by reducing it into less toxic $Cr^{3+}$ (Magdoff. et, al Weil, 2004).


**Fig. 11. Relationship between heavy metal concentrations and clay, silt, sand and organic matter content (industrial site).**

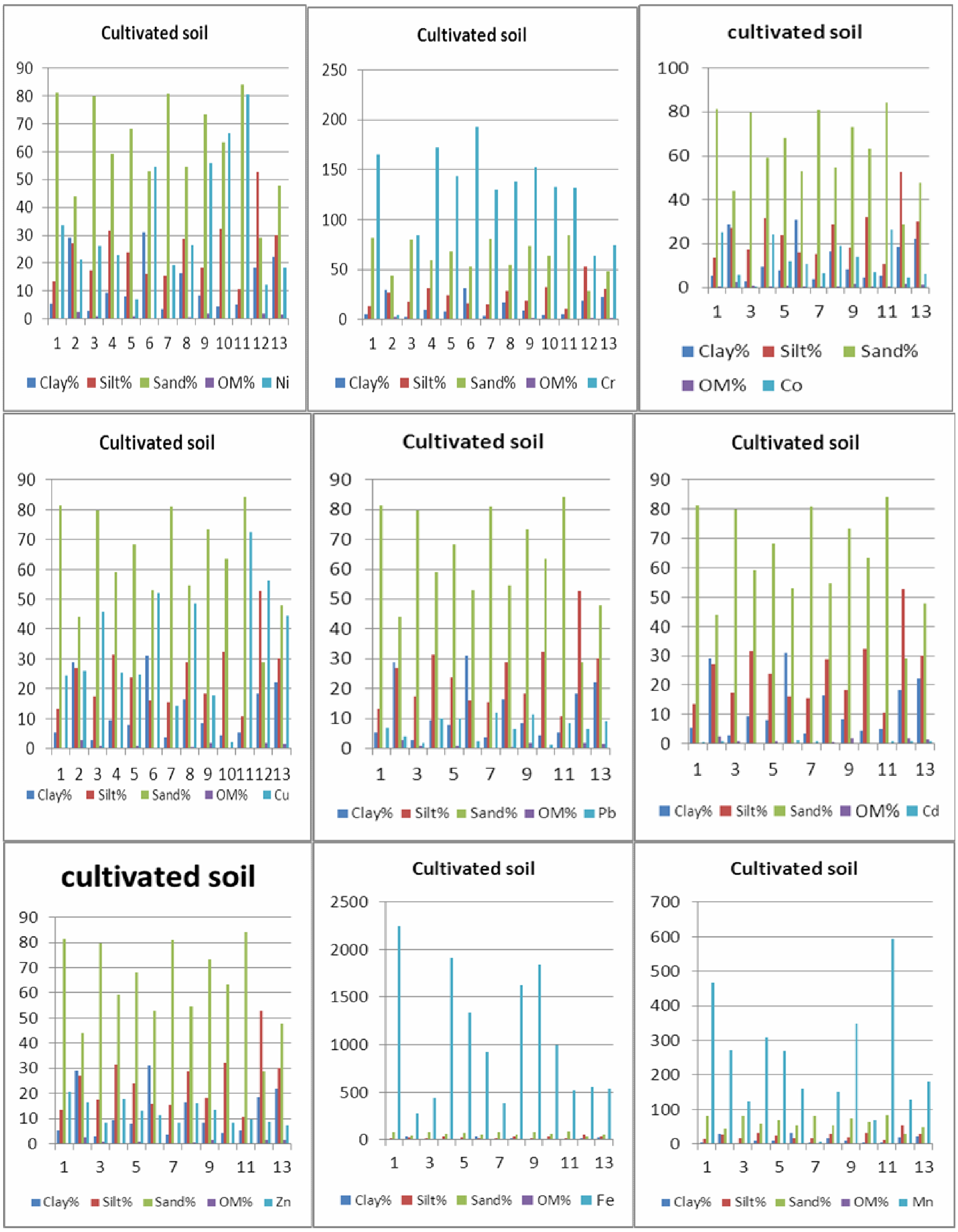



**Fig. 11. Relationship between heavy metal concentrations and clay, silt, sand and organic matter content (cultivated soil).**

## CONCLUSION

Physiochemical properties and levels of heavy metal Cd. Co. Cr, Cu, Fe, Mn, Ni, Pb, and Zn in soil samples selected locations in industrial area and cultivated soil for Qena governorate. Heavy metal concentrations in industrial zone soil samples are mostly higher than those in the soil for control due to metals emitted from factories and other sources. This study indicated to most heavy metal were above the natural heavy metal concentration of soil surface in industrial area. The data shows that iron had the highest concentration in the soil and can be represented in the following order : Fe> Mn> Cr> Cu> Ni> Co> Zn> Pb> Cd .

Positive correlations were observed between clay content,organic matter and total heavy metal .Correlations between the concentrations of the studied elements and some soil properties, primarily organic matter and clay contents, may indicate the prevailing way of retention of these elements in soil.

Environmental efforts must be done to keep the trace element concentration under permissible levels where the geochemical results indicate rising trend with time permissible levels where the geochemical results indicate rising trend with time.

## REFERENCES

Abu El-Ela, S., and El-Bahrawy, A. (1993): Pollution in the River Nile: Assessment and Control, A Case Study, Proceedings of the Nile 2002 conference held in Aswan, Egypt February 1-6, pp 1-15.

Adriano D.C., 2001. Trace elements in terrestrial environments: Biogeochemistry,bioavailability and risks of metals. Ed. Springer-Verlag, New York, 866 pp

Alloway, B. J. 1990. Cadmium. In Heavy Metals in Soils. B. J. Alloway (ed.). Blackie and Son, Ltd Bishopbriggs, Glasgow. pp 100-124.

Aydinalp C, Marinova S (2003) Distribution and forms of heavy metals in some agricultural soils. Pollut J Environ Stud 12(5):629–633 Dudka, S. 1993. Baseline concentrations of As, Co, Cr,Cu, Ga, Mn, Ni, and Se in surface soils, Poland. Appl. Geochem. 2:23-28.

Bilos C., Colombo J. C., Skorupka C. N., Rodriguez P. M. (2001). "Sources, distribution and variability of airborne trace metals in La Plata City area Argentina". Environmental Pollution. Vol. 111, pp 58-139.

Bowen, H.J.M. (1979): Environmental chemistry of the elements. London: Academic Press, pp.333.

Davies, B. E. 1990. Lead. In Heavy Metals in Soils, B. J. Alloway (ed.). Blackie and Son Ltd., Bishopbriggs, Glasgow. pp 177-196.

Dudka,S. 1993. Baseline concentrations of As, Co, Cr, Cu, Ga, Mn, Ni, and Se in surface soils, Poland. Appl. Geochem. 2:23-28

El-Demerdashe, S., Abdel- Hamid, E.A., Abed, F.M.A and El-Kassas, H. L.(1991). Iron status and its relation to some soil variables in calcareous soils of Egypt. Egypt. J. Soil Sci.,31(3): 357-372.

Environmental Consultancy. 1996. Trace metal distributions in the soils of the Puchuncaví valley near the Ventanas copper smelter, region V, Chile. University of Sheffield, Sheffield. 76 p

Kabata-Pendias, A. and Pendias, H. (1992). Trace Elements in Soils and Plants, 2nd ed.,CRC Press Inc., Boca Raton, Florida. 365 pp

Koch M. and Rotard W. (2001). "On the contribution of background sources to the heavy metal content of municipal sewage sludge". Water Science and Technology. Vol. 43, pp. 67-74.

Klute, A., and Dirksen, C. (1986). Hydraulic conductivity and diffusivity: laboratory method. PP: 687 –734. In :A. klute of. Methods of soil Analysis part 1.2nd

Ma L.Q., Rao G.N. (1997): Chemical fractionation of cadmium, copper, nickel, and zinc in contaminated soils. Journal of Environmental Quality, 26: 259–264.

Magdoff, F., & Weil, R. R. (2004). Soil organic matter in sustainable agriculture. CRC Press. DOI: 10.1201/9780203496374.ch1

Nazir. M.A. (2009). Effect of soil properties on zinc and manganese adsorption by some soils of Egypt., M.Sc., Thesis, Fac., Agric, AL Azhar. Univ.,Egypt

Nieuwenhuize, J., C.H. Poley-Vos, A.H. van den Akker, and W. van Delft. (1991). Comparison of microwave and conventional extraction techniques for the determination of metals in soils, sediment and sludge samples by atomic spectrometry. Analyst 116:347–351.

Nriagu, J.O., 1990. Global metal Pollution poisoning the Biosphere? Environ., 32: 7-32.

Page, A.L., Miller, R.B. and keeney, D.R. (1982). Methods of Soil Analysis, part 2. Chemical and Microbiological properties. Second Edition. ASA-SSSA, Madison, Wisconsin, U.S.A..

Rahman, S.; Khanam, D.; Adyel T.; Islam, M. Sh.; Mohammad Ahsan, A and Akbor, M. A. (2012). Assessment of Heavy Metal Contamination of Agricultural Soil around Dhaka Export Processing Zone ((DEPZ) Bangladesh: Implication of Seasonal Variation And Indices, Appl. Sci 2(3)584-601.

Raymond A. W. and Okieimen, F. E. (2011). Heavy Metals in Contaminated Soils: A Review of Sources, Chemistry, Risks and Best. Available Strategies for Remediation; ISRN Ecology; 20p

Reimann, C. and de Caritat. P., (1998): Chemical Elements in the Environment , Springer-Verlag, Berlin, Heidelberg, New York, pp. 398

Rieuwerts, J.S. (2007). The mobility and bioavailability of trace metals in tropical soils: a review. Chemical Speciation and Bioavailability, 19(2), 75-85.

Sofilič T, Rastovčan-Mioč A, Šmit Z(2008). Polychlorinated dibenzo-p-dioxin and dibenzofuran emissions from Croatian metallurgical industry. Arch Metall Mater. 2008;53:1–12.

Stigliani, W.W., P. Doelman, W. Salomons, R. Schulin G.R. Smidt and E.A.T.M.V. Sjoerd, (1991). Chemical Time Bomb: Predicting the unpredictable. Environ 33- 5:30 ,.

Tisdale, S. L., Nelson, W. L. and Beaton, J. D. (1985). Soil Fertility and Fertilizers. 4th ed MacMillan Publishing Co. New York. pp 358-403

## تأثير بعض خواص التربة علي محتوى المعادن الثقيلة في اراضي محافظة فنا

**محمد سليمان ابراهيم ، على عبد الجليل الشهير ، اسامه ابراهيم نجيم و محمد نظير احمد**
**قسم الأراضى والمياه - كلية الزراعة – جامعة سوهاج**

اجري هذا البحث لتقييم العلاقة بين بعض خواص التربة وتركيز العناصر الثقيلة في التربة المنزرعة وتربة المناطق المحيطة بالمصانع في محافظة قنا ، وذلك لتقييم التلوث ببعض العناصر وخاصة العناصر الثقيلة ولتحقيق هذا الهدف تم جمع 13 عينة سطحية من التربة المنزرعة و 13 عينة سطحية من المناطق المحيطة بمصنع الورق بمركز قوص ومصنع الفيبر بورد بدشنا وتم تحديد مواقع اخذ العينات باستخدام جهاز نظام تحديد الموقع العالمي "GPS" وتم تحليل الصفات الطبيعية والكيميائية للتربة ومحتواها من العناصر الثقيلة وتم توقيع التوزيع الجغرافي لتركيز العناصر المدروسة في التربة على خرائط باستخدام انظمة المعلومات الجغرافية "GIS ".واوضحت النتائج ما يلى :- المحتوى الكلى للعناصر المدروسة كانت في الترتيب التالي :-.Fe> Mn> Cr> Cu> Ni> Co> Zn> Pb> Cd . اظهرت النتائج الى ارتفاع محتوي العناصر الثقيلة في تربة المناطق المحيطة للمصانع وخاصة المنطقة المحيطة بمصنع الورق بمركز قوص وذلك مقارنة بمحتواها في التربة المنزرعة حيث قد تتجاوز تركيزاتها في المنطقة الصناعية الحدود الطبيعة التي اوصي بها .1979 - Bowen. وظهرت زيادة واضحة في اكثر من موقع للمنطقة الصناعية لعناصرPb Cu Ni Cr مما يوضح ان التلوث في هذه المنطقة بالعناصر الثقيلة قد يرجع ذلك الي نفايات ومخلفات المصانع سواء السائلة او الصلبة او انبعاثات الابخرة. ولقد اوضح التحليل الاحصائي ان هناك ارتباط موجب بين التركيز الكلي لعناصر الدراسة محتوي المادة العضوية والنسبة المئوية للطين والسلت واوضحت الدراسة بان هناك ارتباط موجب عالى المعنوية بين التركيز الكلي للمنجنيز والنحاس مع النسبة المئوية للطين. على ضوء هذه الدراسة يلزم الحذر الشديد من تراكم هذه المعادن الثقيلة في البيئة وذلك من خلال الانشطة الصناعية بصفة خاصة او الانشطة البشرية بصفة عامة والتي تؤدى الي حد السمية.