Total And Available Forms Of Cobalt In Some Calcareous Soils

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ABSTRACT

Experiments were conducted to study the forms of *Co*, and its relations with some physical-chemical properties of some calcareous virgin soils of Kurdistan region. Soil samples were taken at(٠-٣٠)cm depth from ١٢ different sites .The some chemical and physical properties, and the amount of total and different forms of cobalt were determined.

Total *Co* in soils varied widely from (٣٢ to ٤٧) mg.kg$^{-١}$ soil .The statistical analyses has shown that each of total carbonate, active lime, CEC, Fe, Mn oxides , clay amount and organic matter has a significant role in determining of total *Co* .Water soluble *Co* varied between (٠,٠١ to ٠,٦٣) mg.kg$^{-١}$ and exchangeable *Co* extracted with NaOAc ranged (٠,٠٦ – ٠,٧ ٥) mg.kg$^{-١}$soil , whereas , exchangeable *Co* extracted with acetic acid ranged (٩,٣٣ to ٢٤,٩٦) mg.kg$^{-١}$ soil .There were a positive significant correlation between exchangeable *Co* and total *Co*, CEC, clay and organic matter content , and a negative significant correlation with pH ,total carbonate and active lime.

Chelating *Co* extracted with (TPA+$CaCl_٢$+ TEA) ranged (٠,١٧ to ٢,٣٦) mg.kg$^{-١}$ soil and it has a negative significant correlation with total carbonate, active lime, pH, and a positive significant correlation with organic matter, *Co* bound to organic substance and CEC.

Easily reducible Co which is bound to Fe and Mn ranged (٣,٩٧ to ١٣,٠٥) mg.kg$^{-١}$ soil and has a high positive significant correlation with clay, organic matter, CEC ,water soluble *Co*, and chelating Cobalt , and has a negative significant correlation with pH, total carbonate, active lime .

Oxidisable *Co* which bound to organic substance ranged (٤,٥٥ to ٨. ٥٣) mg.kg$^{-١}$ soil and has a high negative significant correlation with clay, organic matter, chelating *Co*, and positive significant correlation with pH, total carbonate and active lime.

Co bound to non-silicate metals ranged (٢,٧٥ to ١٠,١٦) mg.kg$^{-١}$ soil. These values have a high negative significant correlation with clay, organic matter, and positive significant correlation with pH, total carbonate and active lime.

Introduction

The earth's crust contains average *cobalt* concentration of (٢٠- ٢٥) mgkg$^{-١}$ as shown by (Abbasi et al , ١٩٨٩ ; Kabata, ٢٠٠٠) and ٤٠ mgkg$^{-١}$ as shown in (Tisdal et al , ١٩٨٥ and Halvin ,٢٠٠٥) .

Total *Cobalt* in soils typically ranges (١ to ٧٠) mgkg$^{-١}$soil with the average of (٨)mgkg$^{-١}$ soile (Halvin, ٢٠٠٥). Total cobalt is much higher in areas which are geologically rich in *Cobalt* (Pavely ,١٩٩٨).There are several forms for *cobalt* in soil, mainly it is exist in five forms such as ; soluble in soil solution, exchangeable

,chelating , nonexchangeable *cobalt,* and salts forms. (Kim et al, ٢٠٠٥).

In solutions of most soils, the *Cobal*t concentration is fairly low and ranges (٠,٣ to ٨٧) µ g. $L^{-١}$ (Kabata, ٢٠٠٠). Cobalt in soil Solution is often< ٠,٥ $mgL^{-١}$(Halvin, ٢٠٠٥).Under oxidizing and moderately reducing conditions,the *Cobalt* uncomplexed ion $Co^{+٢}$ is the dominant *cobalt* aqueous species at pH values less than ٩,٥ (Krupka, ٢٠٠٢)

Cobalt is easily absorbed by organic substances and creates organic chelates. These increase the mobility of *cobalt* and influence their mobility within the profile of the soils, and also increase its adaptability by plant, particularly in soils with an increase reactivity under oxidative conditions
(Baralkiewicz , ١٩٩٩). *Cobalt* organic chelates may also readily available to plants . (Bloomfield . ١٩٨١) .

The nonexchangeable micronutrients associated with secondary clay minerals and insoluble metal oxides are quite stable and are not important in estimating the availability of micronutrients (Mortvedt, ١٩٧٢) . Micronutrients cations interact with silicate clay; they may be tightly
bound or fixed to certain silicate clay, especially the ٢: ١ type. Zinc and manganese, *cobalt,* and iron ions some times occur in the crystal structure of these clays (Brady, ٢٠٠٠). The aim of this investigation is to find the total and available forms of cobalt and the effectiveness of some physical and chemical properties on its amount in some calcareous soils .

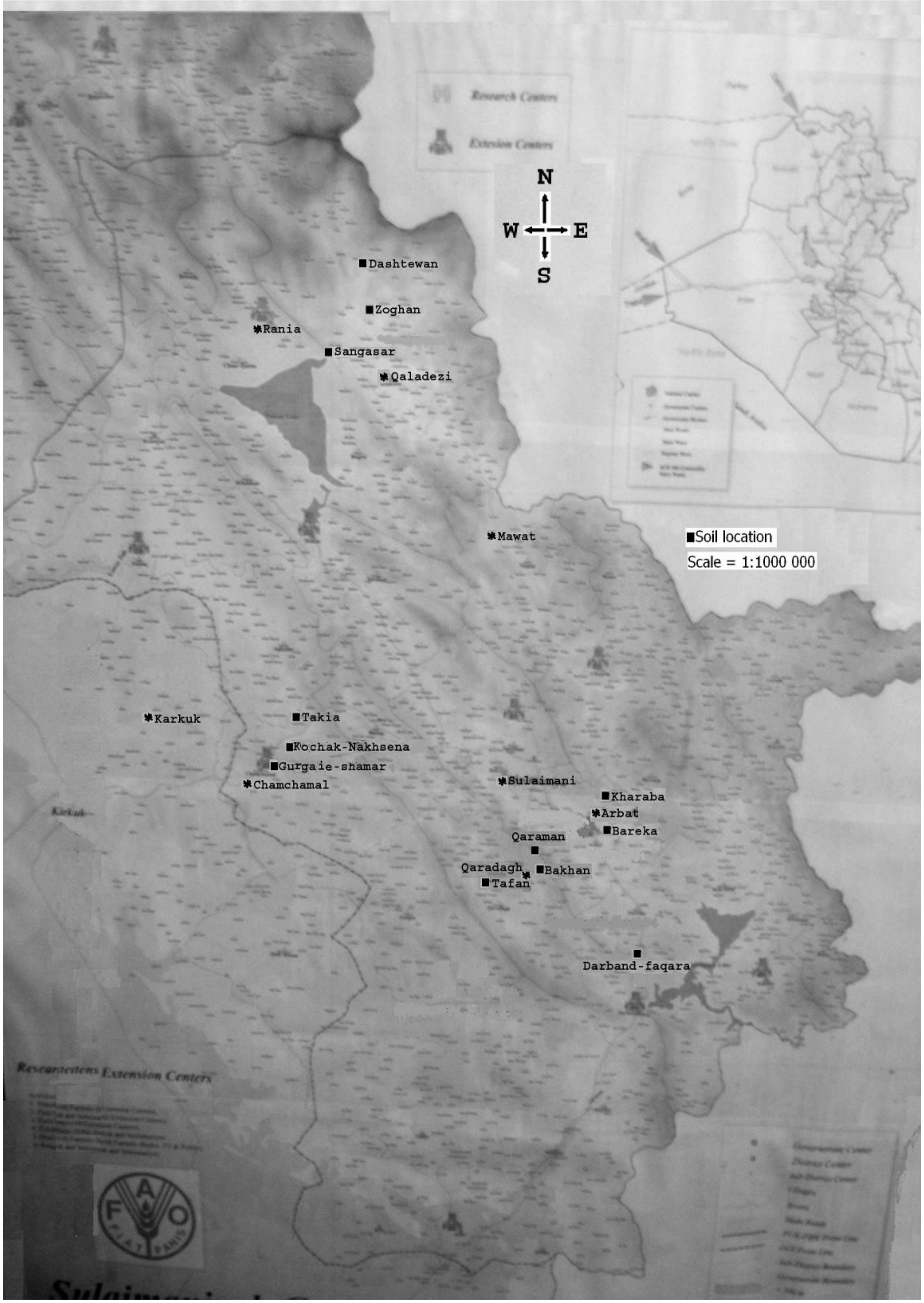
Materials And Methods

Soil samples were taken at (٠-٣٠) cm depth from ١٢ different soil sites in Kurdistan region (Fig.١) selections of these locations were based on virgin soils and as according to its differences in some physical properties. Representative soil samples were taken from each location. Soil samples were dried and passed through ٢ mm sieve and stored.

Particle size distribution determined according to the international pipette method as described by (Black , ١٩٦٥) .*Electrical conductivity* (EC) was measured for the saturation extract at (٢٥) C^{O}(Hesse,١٩٧١) . *pHs* and *pH*$_{٢:١}$*o.o ١M CaCl*$_{٢}$ of the soils were measured as described in (Jackson ,١٩٧٣)

Total carbonate minerals were determined titrimetrically as described in (Rowell ,١٩٩٦) and *active calcium carbonate* (active lime) was determined titremetrically according to (Kozhekov and Yakovleva, ١٩٧٧) . The soil was decomposed by wet digestion according to (Jackson,١٩٧٣), then cobalt was determined by Atomic Absorption spectrophotometer (FAAS) at wave length ٢٤٠ nm .
Water soluble cobalt was determined according to (Richard ,١٩٥٤) as described in (U.S.D.A , Handbook -٦٠ , ١٩٦٩) .

Chelating *Cobalt* was extracted by (٠,٠٠٥ M DTPA + ٠,٠١ M $CaCl_٢$ + ٠,١ M TEA) method according to (Lindsay and Norvell, ١٩٧٨) method . *Exchangeable Cobalt* was extracted according to (Jackson, ١٩٧٣) then cobalt determined by Atomic Absorption spectrophotometer.



Fig(١):The locations of soil samples

Sequential extraction procedure was performed according to the procedure recommended by the Standard Measurement, and testing programmed of the European Union (SM and T-formerly BCR), for the determination of *Cobalt* forms in soils. The chosen extraction scheme is an operationally and standardized procedure , in which the reagent used at each stage is intended to release metals associated with particular soil phase such as acid soluble , reducible , oxidisable , and residual . *Cobalt* determined in the extracts by atomic absorption spectrophotometer (FAAS) (Tokalioğlu ٢٠٠١).

Results and Discussions

The physical and chemical properties of studied soils shown in Table(١) Total *Cobalt* in the studied *soils* ranged from (٣٢ – ٤٧) mg.kg$^{-١}$, with the average (٣٩,١٦) mg.kg$^{-١}$.This indicates that studied soils are located in global scale (١-٧٠) mg.kg$^{-١}$. The highest value has been observed in the soil from Dashtewan (٤٧) mg.kg$^{-١}$ and the lowest value in the soil from Gurgaie-shamar (٣٢) mg.kg$^{-١}$(Table٢).

A high negative significant correlation coefficient was found between *total Cobalt* and total carbonate (r = - ٠,٩٨**) , active lime (r = - ٠,٩٨٠٥**). pHs (r= -٠,٨٢**) or pH: $_{١:٢}$ CaCl$_٢$ (r= -٠,٩٧**)and a high positive significant correlation coefficient with CEC (r = ٠,٩٨٤**), clay content (r = ٠,٩٧٦ **) and organic matter (r = ٠,٩٧١**)(Fig ٢).There was also a high positive significant correlation coefficient between total *Cobalt* and *Cobalt* bound to Fe and Mn_(r = ٠,٩٣٥ **) .This might be due to that total *Cobalt* sorbed by oxides (mainly Fe and Mn) precipitated onto the carbonate or other soil particles.

The results showed that the *water soluble Cobalt* which was extracted by ١:٥٠ (soil : distilled water) ranged between (٠,٠١ - ٠,٦٣) mg.kg$^{-١}$, with the average of (٠,٣٠) mg.kg$^{-١}$. This is in agreement with (Baralkiewicz ,١٩٩٩ ; Kabata ,٢٠٠٠) . The correlation coefficient between water soluble cobalt and total carbonat,active lime, clay ,O.M,pHs and pH١:٢CaCl٢ were (-٠,٩٧,-٠,٩٥،٠,٩٣،٠,٩١,-٠,٨٨ and-٠,٩٦) respectively (Fig.٢).

The results in Table (٢) and Fig.(٣) showed that the *exchangeable Cobalt* extracted with NaOAc ranged between(٠,٠٦ to ٠,٧٥) mg.kg$^{-١}$, with average of (٠,٣٨) mg.kg$^{-١}$.The *exchangeable Cobalt* extracted with CH$_٣$COOH ranged from (٩,٣٣ to ٢٤,٩٦) mg.kg$^{-١}$, with the average of (١٧,٠٦) mg.kg$^{-١}$. There was a high significant positive correlation coefficient between *total Cobalt* and both *exchangeable Cobal*t extracted with NaOAc and CH$_٣$COOH (r = ٠,٩٦٢ **, ٠,٩٨٢**) respectively.

It has been observed that there were several combined factors which is affecting *exchangeable Cobalt* in studied soils, such as clay contents and organic matter, CEC, total carbonate, active lime, and pH .

The *chelating Cobalt* ranged (٠,١٧ to ٢. ٣٦) mg.kg$^{-١}$, with the average of (٠,٨٩) mg.kg$^{-١}$. The highest *chelating Cobalt* was observed in the soil from Dashtewan, while the lowest was in the soil from Gurgaie-shamar .

The interaction between organic matter and clay minerals content is one of the most important soil properties governing the chelating *Cobalt* in the soils. (Brady and Ray, ٢٠٠٠). It has been found that there was a high positive significant correlation coefficient between *chelating Cobalt* with clay minerals and O.M (r = ٠,٨٥ **, ٠,٧٤**), and negative significant correlation coefficient between *chelating Cobalt* and pHs , pH : $_{١:٢}$ $CaCl_٢$, total carbonate and active lime content (r = - ٠,٨٢** , -٠,٧٦** , - ٠,٨٢** , -٠.٨٠ **) respectively (Fig.٣) . These interference factors might be due to forming of calcium complexed compounds with DTPA (Ca-DTPA) and Cobalt cations via occurrence the competition between $Ca^{+٢}$ and $Co^{+٢}$ on surface of solid ,.This is in agreement with (Hem ,١٩٨٥) .On the other hand , the humus has a high CEC and because some of the $Ca^{+٢}$ ions have acompetition with *Cobalt* and then chelated by organic compounds present in humus. This is in agreement with that reported by (Troeh and Thompson , ٢٠٠٥) .

The *reducible Cobalt* bound to Fe and Mn oxides ranged from (٣,٩٧ to ١٣,٠٥) mg.kg$^{-١}$, with the average of (٨,٢٨) mg.kg$^{-١}$.The highest value of *reducible Cobalt* was in the soil from Zoghan (١٣,٠٥) mg.kg$^{-١}$, while the lowest value was in the soil from Gurgaie-shamar (٣,٩٧) mg.kg$^{-١}$ Table٢ .

The negative significant correlation coefficient between *reducible Cobalt* and pHs (r = - ٠,٧٥**), pH : $_{١:٢}$ $CaCl_٢$ (r = -٠,٩٣**) , total calcium carbonate (r = -٠,٩٢**) , and active lime (r = - ٠. ٩٢**) was observed . The high positive significant correlation coefficient between *Cobalt bound to Fe and Mn oxides* and water soluble *Cobalt* (r= ٠,٨٦٢**) ,CEC (r = ٠,٩٠ **) was found (Fig.٤). This might be due to that the soils which have the highest *reducible Cobalt,* have the highest clay and O.M contents. So a high significant positive correlation coefficients between *reducible Cobalt* and organic matter and clay contents (r = ٠,٩٥ **, ٠,٩٤**) , respectively was observed and there was a high positive correlation significant coefficient between chelating *Cobalt* and *Cobalt* bound to Fe and Mn oxides (r = ٠,٨٤٢**). This might be due to that humic substances easily adsorbed *Cobalt* onto clay and Fe oxides .This is in agreement with (Kabata,٢٠٠٠; Brooks, ١٩٩٨) .

The value of oxidisable *Cobalt* ranged from (٤. ٥٥ to ٨,٥٣) mg.kg$^{-١}$, and the average was (٦,٩٠) mg.kg$^{-١}$. The highest value was observed in the soil from Gurgaie-shamar, while the lowest in the soil from (Dashtewan) . This might be due to that several factors combined such as pH, amount and type of organic matter, soil texture, interactions of *Cobalt* with other metals and microorganisms activities.

The positive significant correlation coefficients between oxidisable *Cobalt* and pHs (r = ٠,٨٢٣**) , or pH: $_{١:٢}$ ٠،٠١M$CaCl_٢$ (r = ٠,٨٩٠ **). This might be due to that the soil from Gurgaie-shamar has the highest total carbonate and active lime(٤٠٤,٣ ,١٧٥,٥) gm.kg$^{-١}$, respectively. While the soil from Dashtewan has the lowest total carbonate and active lime(١٤٤,٦ , ٥٣,٤)gm.kg$^{-١}$, respectively , and has a high a positive significant correlation coefficient with total carbonate (r=٠,٩٣٤**), and active lime (r =٠,٩٢٧**). This might be due to that total carbonate and active lime accelerate to raising of pH, consequently , conversion $Co^{+٢}$ to $Co^{+٣}$ and formation of the complex anion $Co\ (OH)_٣^{\ -}$, then precipitation of *Cobalt* occurs . This is in agreement with (Baralkiewicz, ١٩٩٩). Or might be due to that total carbonate competes the $Co^{+٢}$ on organic ligands and sulfide surfaces and its converting to oxidation forms $Co^{+٣}$or precipitation status at high pH . It has been found that there was a high negative significant correlation among oxidisable *Cobalt* and organic matter and clay content (r = - ٠,٨٦٨ ** , -٠,٨٩٩**).This might be due to releasing organic and inorganic *Cobalt* by mineralization. This is in agreement with what is reported by (Brady and Ray, ٢٠٠٠; Kassim and Ali ١٩٨٩). It could be concluded that under high $O_{٢}$ of aerobic condition,decomposition takes place much more highly than when $O_{٢}$ is low, and with increase of oxidation conditions, will decrease an accumulation of clay and O.M contents . Therefore, the soil from Gurgaie-shamar which has the highest oxidisable *Cobalt* , has lowest amount of clay and organic matter contents,while the soil from Dashtewan which has the lowest oxidisable *Cobalt*, has the highest organic matter and clay contents. A negative significant correlation coefficient between oxidisable *Cobalt* and chelating *Cobalt*(r=-٠. ٨٣٨**) was found.

The values of residual *Cobalt* which are bound to non-silicate metals ranged between (٢,٧٥ to ١٠,١٦) $mg.kg^{-١}$, with the average of (٦,١٩) $mg.kg^{-١}$ .The highest value was observed in the soil from Bareka while the lowest value was in the soil from Zoghan. There was a high positive significant correlation coefficient between *Cobalt* bound to non-silicate and; pHs (r = ٠,٨٨ *) , or $pH:_{١:٢}CaCl_{٢}$ (r = ٠,٨٨١**) , total carbonate (r = ٠,٨٣٦**) , and active lime (r = ٠,٨٠٨**).This might be due to increasing of soil pH dependent on negative charge and accelerate the adsorption of *Cobalt* by non-silicate metals or increasing pH leads to precipitation of *Cobalt* with non silicate minerals above pH ٧, this is in agreement with that reported by (Kabata,٢٠٠٠). Consequently , might be due to either *Cobalt* fixed by minerals or precipitation on non-silicate minerals. So, it was observed that the soil from Bareka which has the highest amount of non-silicate *Cobalt* (١٠,١٦) $mg .kg^{- ١}$,has the highest pHs (٧,٦٩), or $pH:_{١:٢}$ $CaCl_{٢}$ (٨,٣٢) , and relatively high total carbonate (٣٨٣,٨) $gm.kg^{-١}$, active lime (١٦٠,٧) $gmkg^{-١}$, while , the soil from Zoghan which has the lowest amount of non-silicate *Cobalt* (٢,٧٥) $mg.kg^{-١}$, has the lowest pHs (٧,٠٣) , or pH : $_{١:٢}$ $CaCl_{٢}$ (٧,٣٢) , and relatively the lowest total carbonate (٢٦,٠٣) $gm.kg^{-١}$, active lime (١٥٧. ٧) $gm.kg^{-١}$.

It has been found that there was a high negative significant correlation coefficient between *Cobalt* bound to non-silicate and clay and O.M. (r = -٠,٨٦**, -٠,٨٣**) respectively. This might be due to that under oxidation conditions, most of O.M and clay will be decomposed and the *Cobalt* bound to non-silicate precipitated under same conditions.

The results in Tables (٢)showed that the pseudo total *Cobalt* ranged between (٣٠,٧٦to ٤٦,٣٤))$mg.kg^{-١}$, with average about (٣٨,٤٤) $mg.kg^{-١}$.The results indicate that pseudototal *Cobalt* has similar pattern of total *Cobalt* extracted by conventional method in all its correlations with same physical and chemical properties of studied soil.

Table(١) some selected chemical and physical properties of the studies soils;

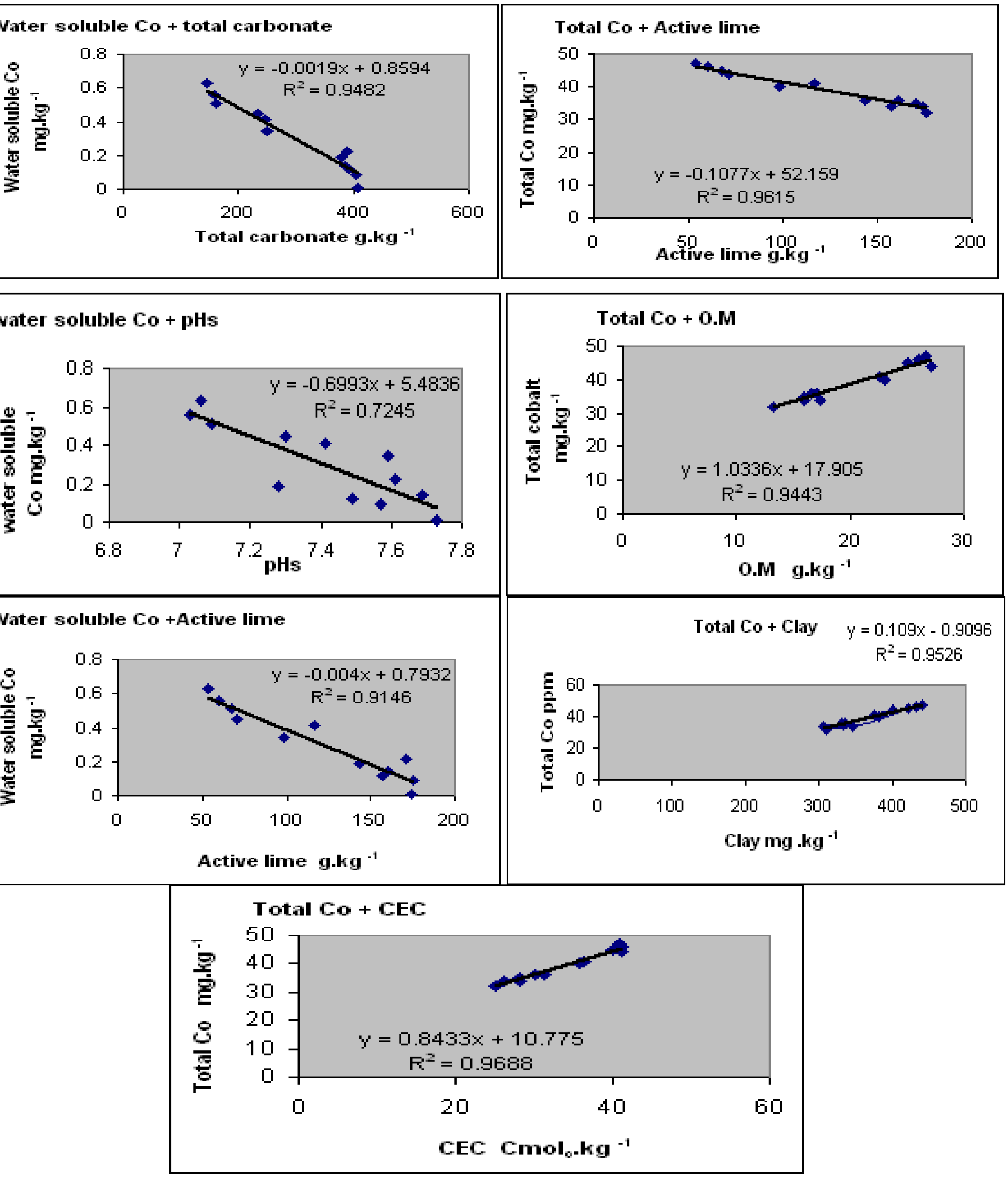
Soil No	Soil location	gm . kg $^{-١}$			Texture	CEC Cmol.kg$^{-١}$ soil	Ph		dS . m $^{-١}$		gm. kg $^{-١}$			Active/ Total CO$_٣$
		Clay	Silt	sand			pHs	pH$_{١:٢}$ ٠,٠٠١M CaCl$_٢$	ECs	EC$_{١:٢}$ ٠,٠٠١M CaCl$_٢$	O.M	Total carbonate	Active lime	
١	Gurgaie-shamar	٣١٠,١	٤٩٤,٢	١٩٥,٧	SCL	٢٥,١١	٧,٥٧	٨,٣٨	٠,٤٣	٠,١٧	١٣,٢٢	٤٠٤,٣	١٧٥,٥	٤٣,٤٠
٢	Kochak-nakhshena	٣٣٣,٣	٥٣٤,٥	١٣٢,٢	SCL	٢٦,٠٣	٧,٦١	٨,١٦	٠,٤٥	٠,١٩	١٥,٩٩	٣٨٧,٢	١٧٠,٨	٤٤,١١
٣	Takia	٣٣٤,٥	٥٤٠,١	١٢٥,٤	SCL	٣١,٢١	٧,٢٨	٨,١٢	٠,٤٤	٠,١٨	١٧,٠٤	٣٧٧,٩	١٤٣,٣	٣٧,٩٢
٤	Bakhan	٤٠٠,٢	٥٣٤	٦٥,٨	SC	٤١,١٢	٧,٣٠	٧,٤١	٠,٤١	٠,٢٠	٢٧,١٢	٢٣٢,٧	٧٠,٩	٣٠,٤٦
٥	Qaraman	٣٧٥,٥	٥٦٥,٨	٥٨,٧	SCL	٣٦,٤٤	٧,٤١	٧,٧٢	٠,٣٧	٠,١٦	٢٢,٥٢	٢٤٥,١	١١٦,٥	٤٧,٥٣
٦	Tafan	٣٨٢,٣	٥٢٨,٣	٨٩,٤	SCL	٣٥,٦٦	٧,٥٩	٧,٧٠	٠,٤٤	٠,٢٢	٢٣,١٢	٢٥٠,٩	٩٨,١	٣٩,٠٩
٧	Bareka	٣٣٢,٢	٤٩٧,٤	١٧٠,٤	SCL	٣٠,٢١	٧,٦٩	٨,٣٢	٠,٦٥	٠,٤٠	١٦,٦٤	٣٨٣,٨	١٦٠,٧	٤١,٨٧
٨	Kharba	٣٠٥,٥	٥٢١,٧	١٧٢,٨	SCL	٢٨,٠٤	٧,٤٩	٨,٢٢	٠,٥٤	٠,٢٩	١٥,٩٣	٣٩٢,٨	١٥٧,١	٣٩,٩٩
٩	Darban faqara	٣٤٥,٠	٤٩٤,٧	١٦٠,٣	SCL	٢٦,٢٢	٧,٧٣	٨,٣١	٠,٣٤	٠,١٤	١٧,٤٣	٤٠٦,٢	١٧٣,٨	٤٢,٧٨
١٠	Zoghan	٤٣٢,٢	٥٠٢,٧	٦٥,١	SC	٤١,١٠	٧,٠٣	٧,٣٢	٠,٥٤	٠,١٦	٢٦,٠٣	١٥٧,٧	٥٩,٩	٣٧,٩٨
١١	Sangasar	٤٢١,١	٤٩٣,٥	٨٥,٤	SC	٣٩,٩٨	٧,٠٩	٧,٣٩	٠,٦١	٠,٢٨	٢٥,١١	١٦٢,٢	٦٧,٥	٤١,٦١
١٢	Dashtewan	٤٤١,	٤٧٨,٢	٨٠,٥	SC	٤٠,٨٩	٧,٠	٧,٤٠	٠,٦٩	٠,٣٤	٢٦,٧٠	١٤٤,٦	٥٣,٤	٣٦,٩٣

		٣					٦							

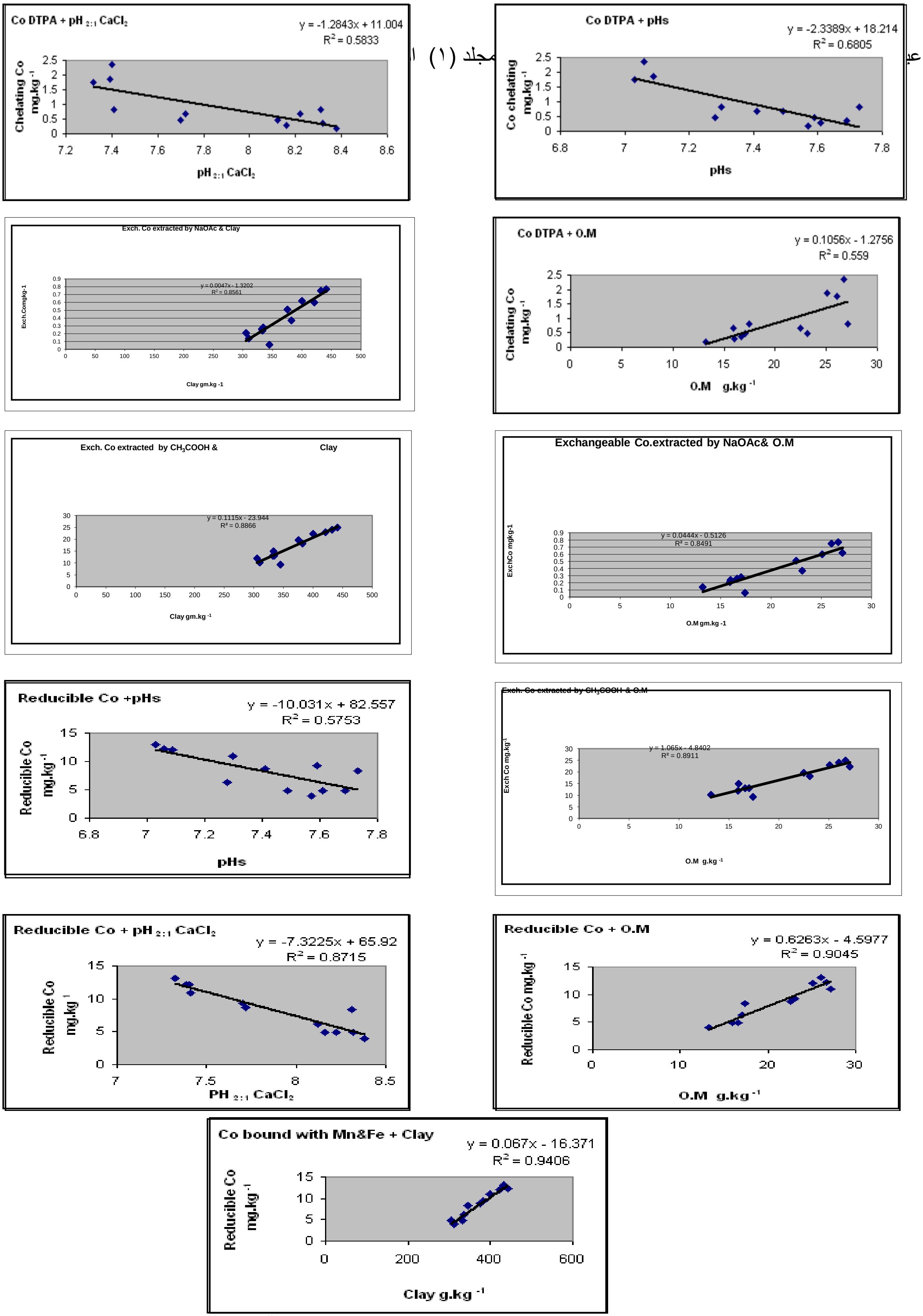
SC -- Silty Clay SCL -----Silty Clay Loam. (A/T) x١٠٠ = (Active lime / Total carbonate) x ١٠٠

Table (٢): Forms of Cobalt and its values (mgkg-١) in studied soils

Soil No	Total Co	Water Soluble	Exchange able Co	Chelating Co	Sequential extraction procedure method				
					Exchangeable Co	Reducible Co	Oxidisable Co	Co-Non silicate metals.	Pseudo -total
					Extracted with $CH_{٣}COOH$	Extracted with $NH_{٢}OH.HCl$	Extracted with $H_{٢}O_{٢}+ CH_{٣}COONH_{٤}$	Extracted with $_{٣}HCl+_{١}HNO_{٣}$	
١	٣٢,٠٠	٠,٠٩	٠,١٢	٠,١٧	١٠,٢٢	٣,٩٧	٨,٥٣	٨,٠٤	٣٠,٧٦
٢	٣٥,٠٠	٠,٢٢	٠,٢٤	٠,٢٨	١٤,٩٧	٤,٨٥	٨,٠٧	٥,٦٩	٣٣,٥٨
٣	٣٦,٠٠	٠,١٩	٠,٢٨	٠,٤٨	١٣,٠٩	٦,٢١	٧,١٢	٨,٨٥	٣٥,٢٧
٤	٤٤,٠٠	٠,٤٥	٠,٥٢	٠,٨٢	٢٢.٣٢	١٠,٩٦	٦,٨٧	٣,٦٦	٤٣,٨١
٥	٤١,٠٠	٠,٤١	٠,٥١	٠,٦٨	١٩,٦٧	٨,٧١	٦,٥٦	٥,٩١	٤٠,٨٥
٦	٤٠,٠٠	٠,٣٤	٠,٣٧	٠,٤٧	١٨,٢١	٩,٣٢	٦,١١	٥,٧٦	٣٩,٤٠
٧	٣٦,٠٠	٠,١٤	٠,٢٦	٠,٣٦	١٣,٠٦	٤,٨٥	٧,٨١	١٠,١٦	٣٥,٨٨
٨	٣٤,٠٠	٠,١٢	٠,٢١	٠,٦٨	١١,٩٦	٤,٨٦	٧,٥٤	٨,٨٦	٣٣,٢٢
٩	٣٤,٠٠	٠,٠١	٠,٠٦	٠,٨٢	٩.٣٣	٨,٣٢	٨,٣٢	٦,٨٥	٣٢,٨٢
١٠	٤٦,٠٠	٠,٥٦	٠,٧٥	١,٧٦	٢٤,٠٤	١٣,٠٥	٥,٥٩	٢,٧٥	٤٥,٤٣
١١	٤٥,٠٠	٠,٥١	٠,٦٠	١,٨٧	٢٢,٩٨	١٢,١١	٥,٧٥	٣,١٧	٤٤,٠١
١٢	٤٧,٠٠	٠,٦٣	٠,٦٧	٢,٣٦	٢٤,٩٦	١٢,٢٢	٤,٥٥	٤,٦١	٤٦,٣٤



Fig(٢) Relationship between water soluble and total Cobalt and some chemical – physical properties of studied soils



Fig(٣) Relationship between Chelating , Exchangeable , Redusible Cobalt and some chemical -physical properties of studied soils

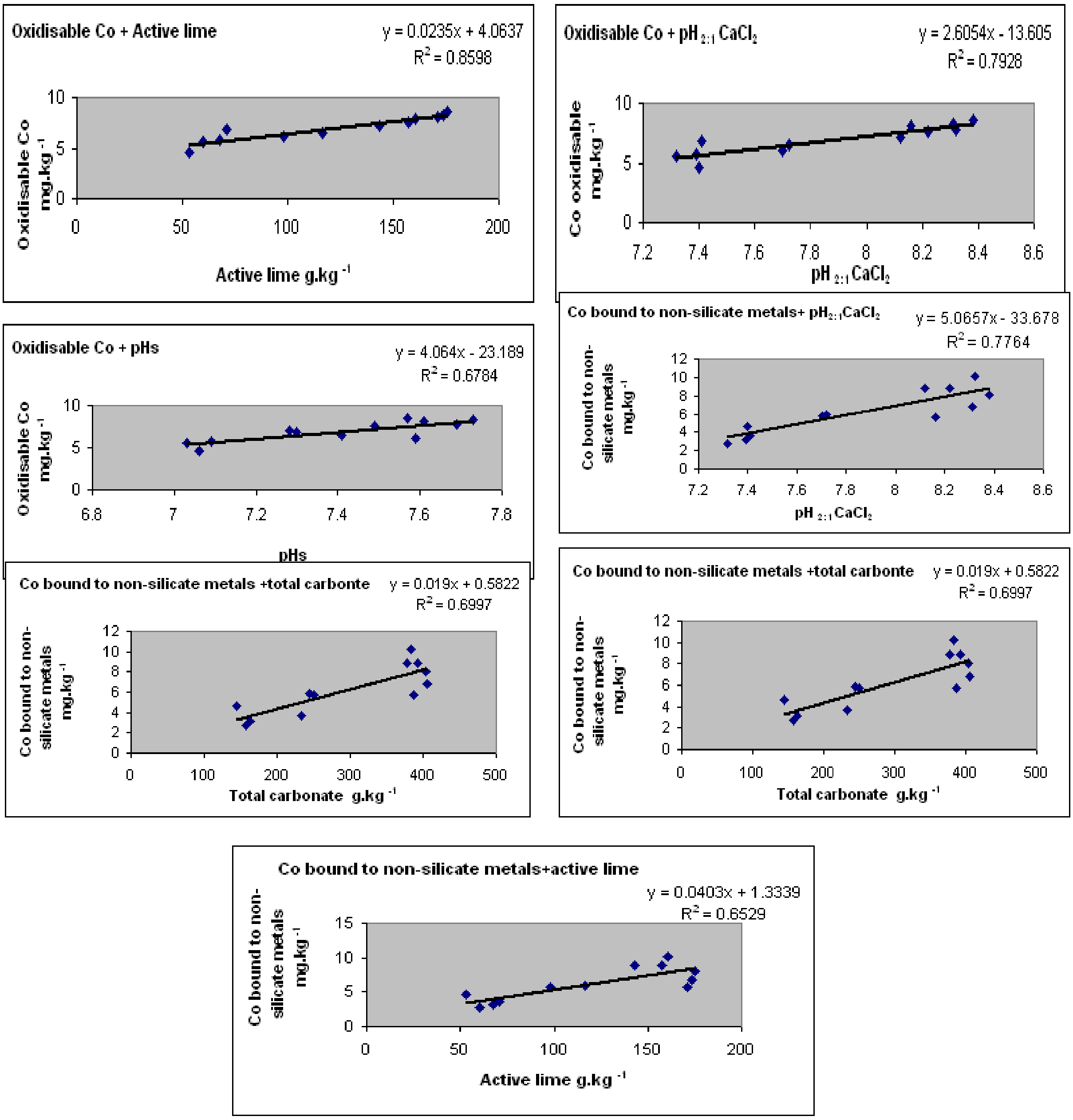


Figure (٤) : Relationship between Oxidizable , Co bound to non-Silicate metals and some chemical-physical properties of studied soils

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الصور الكلية و الجاهزة للكوبلت في بعض الترب الكلسية

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المستخلص

اجريت التجربةلدراسة صورالكلية و الجاهزة لعنصر الكوبلت (Co) في بعض الترب الكلسية والتي تم انجازها على الترب البكره السطحية (٣٠-٠) سم لأثنا عشر موقعا في مناطق مختلفة من إقليم كردستان وأجريت التحاليل الكيمياوية و الفيزياوية كما تم تقدير الكوبلت الكلي و الصور المختلفة للكوبلت في هذه الترب. بينت الدراسة بأن قيم الكوبلت الكلي تراوح بين (٣٢-٤٧) ملغم/كغم تربة والتحليل الإحصائي اظهر إن كل من الكاربونات الكلية والنشطة والسعة التبادلية الكاتيونية (CEC) ، واكاسيد المنغنيز والحديد ومحتوى الطين والمادة العضوية لها دور معنوي في تقدير قيم الكوبلت الكلية وتراوحت قيم الكوبلت الذائب في الماء بين (٠,٠١-٠,٦٣) ملغم /كغم تربة والكوبلت المتبادل والمستخلص بخلات الصوديوم تراوحت بين (٠,٠٦- ٠,٧٥) ملغم / كغم تربة. بينما تراوحت كمية الكوبلت المتبادل والمستخلص بحامض الخليك تراوحت بين (٩,٣٣- ٢٤,٩٦) ملغم/ كغم تربة ووجد علاقة ارتباط موجبة بين الكوبلت المتبادل والكوبلت الكلي وسعة التبادل الكاتيونية ومحتوى الطين والمادة العضوية . وعلاقة ارتباط سالبة مع (pH) وكاربونات الكلية والنشطة. الكوبلت المخلبي المستخلص ب(TEA+CaCl٢+ TPA) تراوح بين (٠,١٧- ٢,٣٦) ملغم / كغم هذه القيم ترتبط ارتباطا سالبا معنويا مع الكاربونات الكلية والنشطة و (pH) وبارتباط معنوي موجب مع المادة العضوية والكوبلت المرتبط بالمواد العضوية والسعة التبادلية الكاتيونية(CEC) . الكوبلت سهل الاختزال والمرتبط مع الحديد والمنغنيز تراوح بين (٣,٩٧- ١٣,٠٥) ملغم/ كغم تربة وهذه القيم ترتبط ارتباطا معنويا موجبا مع محتوى الطين والمادة العضوية والسعة التبادلية الكاتيونية (CEC)و الكوبلت الذائب في الماء و الكوبلت المخلبي وارتباط معنوي سالب مع (pH) والكاربونات الكلية والنشطة أما الكوبلت المؤكسد والمرتبط مع المواد العضوية تراوحت بين (٤,٥٥- ٨,٥٣) ملغم/ كغم تربة هذه القيم ترتبط ارتباطا سالبا عالية المعنوية مع محتوى الطين والمادة العضوية والكوبلت المخلبي وارتباط معنوي موجب مع (pH) والكاربونات الكلية والنشطةو تراوحت قيم الكوبلت المرتبط بالمعادن الغير سليكاتية بين (٢,٧٥- ١٠,١٦) ملغم / كغم تربة. هذه القيم لها ارتباطا سالبا عالية المعنوية مع كل من محتوى الطين و المادة العضوية وارتباط معنوي موجب مع (pH) والكاربونات الكلية والنشطة .