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STUDY OF THE MINERAL PROPERITIES OF GYPSUM AND CALCAREOUS SOILS IN AL-DIWANIYAH PROVINCE, IRAQ

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Abstract: In order to study the mineral composition of two gypsum and calcareous soils in Al-Diwaniyah province , Iraq, two locations were identified, the first location was in Al-Shanafiya location for gypsum soil and the second site was in Al-Nouriah location for limestone soil. The samples were taken from the study locations to a depth of (30-0) cm. After they were transferred to the laboratory, they passed through a sieve with holes 2 mm in diameter for the purpose of conducting chemical and physical analyzes. Also, the soil was separated into sand with a 50-micron sieve, clay and silt by sedimentation method. The sand and silt minerals are diagnosed by means of X-rays and their proportions are determined by the point-counting method. The clay is separated by the method of conducting transactions (saturation and heating). The results show the following: The results of the X-ray diffraction of the gypsum soil separated by sand in the Shanafiya location showed the presence of Quartz minerals (14.0%), Calcite (35.0%), Dolomite (21.3%),Albite (4.3%), Muscovite (8.1%), Antigorite (3.7%), and Gypsum (15.3) Magnetite (2.5%), Kaolinite (2.2%) and Chlorite (0.2% .) The proportions of minerals were Quartz (39.8%), Calcite (44.1%), Dolomite (1.9%), Gypsum (3.1%), Magnetite (3.1%), and Hematite (1.7%).Orthoclase (2.0%), Chlorite (3.7%), and Ilite (5.0%), and the clay part contained the minerals Montmorillonite, Chlorite, Ilite and Kaolinite. (7.9%), Antigorite ((2.7%), Gypsum ((1.0% .)Magnetite (2.1%), Kaolinite (3.8%), Chlorite (5.4%), Ilite (3.3%), Palligorskite (2.2%), Vermiculite (1.1%), and silt separated were the proportions of quartz minerals (15.3%), calcite (70.4%), and dolomite (7.3%).Gypsum (1.3%), Magnetite (2.4%), orthoclase (3.3%), chlorite (1.7%), and Ilite (0.8%). The clay part contained the minerals Montmorillonite, Chlorite, Pallygorskite, Ilite and Kaolinite.
Keywords: mineral properities, gypsum, calcareous soils

1. Introduction

The mineral composition of the soil is affected by various factors, the most important of which are climate and parent material, and it also reflects the evolutionary state of the soil.Also, the presence or absence of a certain mineral in the soil gives an idea of how the formation and development of this soil and the extent of the participation of its formation factors Also, the soils of Al-Diwaniyah province are soils of sedimentary origin of recent formation. this reason, it decided to study the mineral properties of different soils, materials of origin and different conditions of their formation. Also, sedimentary soils are undeveloped soils and do not contain the manifestations of development, and the reason is due to the predominance of some factors that are not sufficient for the development of their characteristics, such as the factor of time, topography and parent material.Al-Diwaniyah province is one of the governorates of central and southern Iraq, with a dry and semi-arid climate, with the amount of rainfall being less than 400 mm.As the mineral composition of it is due to the parent material of which this soil is composed, and these minerals are calcite and dolomite, and the percentages of Carbonate minerals range from 35-15%,[1] explained that the soils of central Iraq contain calcite, dolomite, quartz, kaolinite, Chlorite, Ilite and other minerals indicated in his study the difference of minerals in the sedimentary plain soil due to the difference in the sediments of the Tigris and Euphrates rivers. The sedimentary plain soil is rich in Pyroxene, Amphibole and Biotite minerals within the sand separation, with a very low content of zircon and tourmaline minerals in relation to the heavy minerals, due to the original rock from which the heavy minerals were formed [2].(The same researcher pointed out that the minerals available within the separated light sand are Quartz, Chert and muscovite, because the rocks from which these minerals were formed are acidic igneous rocks and metamorphic rocks, and Albite and microcline minerals are found within the Feldspar group.As for gypsum soils, they are soils that contain more than 2% gypsum in the surface layer, with a percentage of more than 14% in the subsurface soil, and the most important of its minerals is gypsum. Sedimentation on the surface of the soil The mineral composition of gypsum soil in central Iraq is gypsum, quartz, calcite, and dolomite in sand separated, or separated by Montmorillonite clay, Chlorite, Palygorskite, alite and Kaolinite [3]. Also, these soils are under different management conditions in terms of agricultural use, as well as the conditions of each soil, which leads to the emergence of distinctive signs for each of them and based on what was mentioned above, the current study aimed at the following:Study of the mineral properties of gypsum and lime soils in Al-Diwaniyah province

2. Materials and Methods

Preliminary actions

The study location was chosen within the lands located in the Al-Diwaniyah provaince, which is part of the Iraqi sedimentary plain, where two locations were chosen.

•The first location is gypsum soil in the Shanafiya location

• The second location is calcareous soil in the Al-Nouriah location

field procedures

The samples were taken from the study locations to a depth of 0-30 cm and were collected in nylon bags and transported to the laboratory and air dried, then ground with a wooden hammer and passed on a sieve with a diameter of 2 mm for the purpose of conducting the required chemical and physical analyzes as well as preparing them for metallurgical examinations.

Table (1) Some chemical and physical properties of sand dunes

studied trait	unit	gypsum soil	calcareous soil
EC . electrical conductivity	ds m^{-1}	1.89	1.41
pH		7.65	7.91
O.M . organic matter	%	0.12	0.42

Soluble calcium Ca+2		ppm	400	110
Soluble Magnesium Mg+2			678.6	304.2
dissolved sodium Na+			70	188
Soluble potassium K+			56	30
Cl- dissolved chlorine			142	2800
Soluble sulfate SO4-2			525.53	304.2
Dissolved carbonate CO3-2			Nil	Nil
soluble bicarbonate HCO3-			30	32
total carbonate		%	3.4	5.5
active carbons		ppm	Nil	Nil
gypsum		%	40.59	1.23
bulk density		$g.cm^{-3}$	1.31	1.42
Soil Texture			Sandy loam	Clay loam
Soil Separators	sand	$g.kg^{-1}$	681	326
	slit		142	203
	caly		177	471

physical analyzes
Volumetric analysis of soil separations
Estimate the relative analysis of the sand separated by hydrometer method as mentioned in [6]
bulk density
Density was estimated by (Core sample) method in [6]
chemical analyzes
Electrical conductivity (EC
It was estimated by the Wet Digestion method, according to Walkely and Black method mentioned in [7] .
Soil reaction (pH)
The degree of soil reaction in a soil suspension: water (1:1) was measured using a pH-meter as mentioned in [8]
Electrical conductivity (EC)
The electrical conductivity was measured in a soil-water suspension (1:1) using an EC-meter according to what was mentioned in [8]
positive ion exchange capacity (CEC)
The exchange capacity of positive ions was measured using ammonium acetate and sodium acetate according to what was mentioned in [7]
carbonate minerals
The carbonate minerals were estimated by titration with 1N of HCL with 1N of NaOH according to [8]
Organic matter

The organic matter was estimated by wet oxidation method by potassium dichromate according to Walkly and Black method mentioned in [8]

gypsum

The gypsum was determined by acetone precipitation, according to what was mentioned in the method [9]

Dissolved positive and negative ions

Calcium (Ca^{+2}) Calcium was determined by sintering with Fresenite (EDTA) - Na_2) using the ammonium perberate reagent according to the Lanyon and Heald method mentioned [8]

Magnesium (Mg^{+2})

It was estimated by estimating calcium and magnesium together by smearing it with fersnet using Erichrome Black T reagent, then subtracting calcium from the total calcium and magnesium according to the method of Lanyon and Heald mentioned in [8]

Sodium (Na^+)

It was estimated using the Flamephotometer [7]

Potassium (K^+)

It was estimated in a soil extract: water (1:1) using a flame photometer according to the method suggested by Knudesn et al. mentioned in [8]

Sulfate ($SO_4^=$)

The sulfate was determined by precipitation method in the form of barium sulfate contained [6]

Chlorine(Cl^-)

It was determined by grinding with silver nitrate ($AgNO_3$) at a concentration of (0.01N) in the presence of potassium chromate according to the method mentioned in [7]

Carbonates and bicarbonates (CO_3^{-2}) and (HCO_3^-)

The bicarbonate carbonates were determined by scaling method with sulfuric acid (H_2SO_4) at a concentration of (0.01N) in the presence of orange methylation index according to the method mentioned in [7]

active carbons

It was estimated using 0.2 M ammonium oxalate and skewing with 0.2 M potassium permanganate according to [10] Total carbonate

Total carbonate was determined by calcimeter method using 3N of hydrochloric acid described in [11]

active carbons

It was estimated using 0.2 M ammonium oxalate and skewing with 0.2 M potassium permanganate according to [11]

Total carbonate

Total carbonate was determined by calcimeter method using 3N of hydrochloric acid described in [12]

mineral analyzes

Separation and fragmentation

Separation of sand particles was conducted by Sieving Wet using a sieve with openings of 50 microns. Then the clay particles were separated from the silt by sedimentation method according to Stock's law, taking into account the temperature as mentioned in [7]

Soil Separators

Sand and silt separators

Sand and silt separators were taken, then scattering slides were made for them using Canada balsam, and then the minerals were diagnosed and their percentages were determined by the point-counting method and according to the method proposed by the scientist [12]

clay separated

To accurately diagnose clay minerals, it requires a separate process for the clay part by dismantling the sample with distilled water, separating the clay part and making a clay solution, and then conducted the necessary treatments to confirm the diagnosis of clay minerals according to the method of [13] The treatments include the following steps:

a. Saturation with magnesium using magnesium chloride $MgCl_2$ and magnesium acetate $Mg(OAc)_2$.

Deposition of the clays after saturation on two glass slides. One of the slides is left to dry in the air, and the second slide is saturated with ethylene glycol for 24 hours at a temperature of 60°C.

B. Potassium saturation with potassium chloride KCl and potassium acetate KOAc

The clays are depolocationd after saturation on two glass slides and then they are entered into the incineration furnace, one of them burns to a temperature of 350 C and the other is burned to a temperature of 550 C^o

3**. Results and Discussion**

gypsum soil

sand separated

The results in Figure 1 showed the X-diffraction in the sand separation of gypsum soil and the presence of minerals calcite, quartz, Albite, muscovite, gypsum, chlorite, Palygorskite, Kaolinite, magnetite, as the presence of calcite mineral at average of (35.0%), which indicates that the soil is of limestone origin, but it is high It contains gypsum content, which is prevalent in the soils of dry areas, where little rain does not help to dissolve it . The results also showed the presence of quartz at average of (14.0%), as it is considered the main component of separated sand, due to the original material rich in this mineral, as well as its transport by wind, where it is deposited when its energy momentum decreases, and Albite at average of (4.3%) is formed from basalt rocks with the availability of appropriate conditions for its formation as well. about being transported by wind. As the results showed about the presence of muscovite mineral with a percentage of (8.1%), which is inherited from the parent material, its source is due to acid igneous rocks such as granite, as well as its source is metamorphic rocks with low transformation such as gneiss and schist, in addition to its medium resistance to weathering [14] As for gypsum (15.3%), it is one of the evaporites, and its presence is attributed to the sedimentary material rich in salt and most of its presence is under the rock salt layers, as the sulfate salts are precipitated before the chloride salts during the evaporation process of salt water, or the gypsum may be formed as a result of the hydration of anhydrite, which can be distinguished from gypsum by its high hardness Its presence reflects dry and semi-arid climatic conditions, low rainfall and high evaporation [16] and [15]The results also showed the presence of chlorite (0.2%), as it is one of the minerals found within the rocks with a small percentage of 0.2% and its source is igneous rocks In northern Iraq, the percentage of kaolinite was 2.2%. This mineral requires severe washing conditions and is inversely proportional to carbonate minerals. The mineral Pallygorskite (1.7%) is a product of the weathering processes of the parent rock or from the change of the mineral Ilite. As for magnetite (2.5%), it is Iron oxides and is due to the nature of the mineral composition of the parent material and the intensity and activity of weathering processes in the soil as well as the nature of the sedimentation cycles or results from decomposition Iron-containing minerals such as hornblende, pyroxene and amphibole, which are sourced from igneous and metamorphic rocks in northern Iraq and Turkey (Latif et al., 2020). As for the mineral antigorite, it comes from silicate and metamorphic rocks. The mineral Ilite is formed when potassium is present in the surface horizon and in quantities sufficient to form it. As for dolomite (21.3 percent). It is one of the carbonate minerals due to the nature of the mineral composition of the original substance and an increase in the ratio of magnesium to calcium (Ca^{+2} / Mg^{+2}) in the horizons located below the horizon of the carbonate gathering, as the gas 〖CO_2〗 resulting from the decomposition of organic matter reduces the degree of interaction of the soil This leads to an increase in the dissolution of carbonate minerals, including dolomite, and the release of magnesium to the soil and groundwater solution increases . Vermiculite (0.5%) arises from the change of curite mineral through the effect of The chemical energy of the weathering factor and in a very small amount on the weak bonds of Chlorite mineral. This process is known in dry and semi-arid areas as the chlorite-vermiculite process.

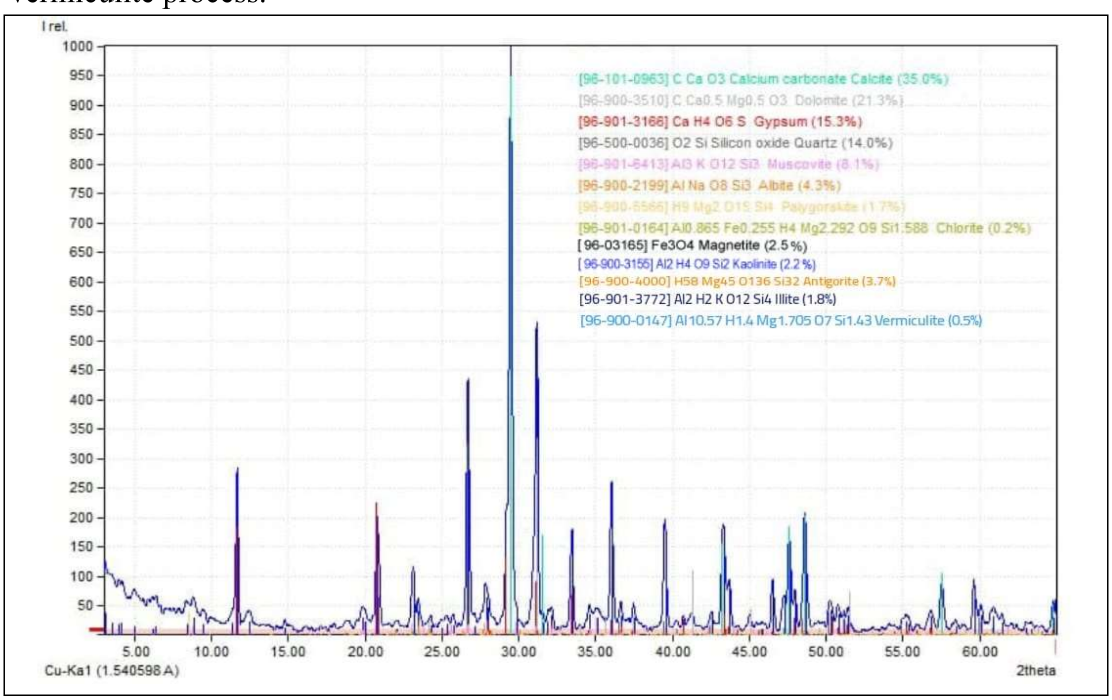

Figure (1) X- ray diffraction of gypsum soil separated by sand

silt separated

The results in Figure 2 showed the presence of calcite, dolomite, gypsum, quartz, feldspar, muscovite, orthoclase, iron oxides (hematite, magnetite), clay minerals (chlorite, kaolinite, Ilite).The predominance of calcite mineral (44.1%) and its presence in this percentage indicates that it is a gypsum soil of a calcareous origin, in addition to the transport and sedimentation processes of the mineral. The presence of dolomite (1.9%) is due to the presence of magnesium in the surface layer and precipitated soil as well as its presence in the original material. The percentage of quartz mineral amounted to 39.8%, a lightweight mineral that is transported to distances and deposited by low energy work, in addition to being a weathering-resistant mineral. As well as being in the original article. The results also showed the presence of gypsum mineral at a percentage of (3.1%), although this soil is gypsum soil, which indicates a decrease in gypsum in this separated, which indicates that this gypsum in saline soil is secondary gypsum as found by feldspar mineral at average of (1.8%), where it is subjected to destruction. Physically, it turns into semectite, as well as the precipitation and drying processes in the soil of the study (Pichler et al., 1997). it also identified muscovite mineral and its percentage ((1.7% its presence depends on the mineral composition of the source materials of the deposits [15] The orthoclase mineral reached a percentage of 2.0%, whose presence depends on the activity of weathering processes or its exposure to weathering during transportation from its locations of origin (Al-Obaidi and Issa, (2011).As for the oxides, where the percentage of magnetite was 3.1% and the percentage of hematite was 1.7%, the decrease in its percentage was due to the fact that they are undeveloped sedimentary soils, in addition to the erosion processes affecting the weathering processes, as indicated by [16]The results also showed the presence of chlorite with a percentage of 3.7% of the minerals that are difficult to distinguish due to the presence of Vermiculite and Kaolinite minerals, in addition to the transport and deposition processes of the mineral on the surface of the soil and Kaolinite (1.1%) that the conditions of this soil are not suitable for its formation, as it needs conditions Washing and reaction degree tends to acidity, and this indicates that it is a metal transported by wind or water. The percentage of Ilite mineral amounted to 5.0%, formed in the case of the presence of biological activity on the surface of the soil with an appropriate amount of magnesium as well as the source rocks for sedimentation. Also, the mineral Pallygorskite was identified at average of 2.5% due to the weathering of the mother rocks in dry and semi-arid locations or Resulted from the transformation of the metal Ilite as well as the processes of transport and deposition of the metal. From the above results, we find the predominance of calcite, quartz, Ilite, chlorite, gypsum and magnetite, respectively.

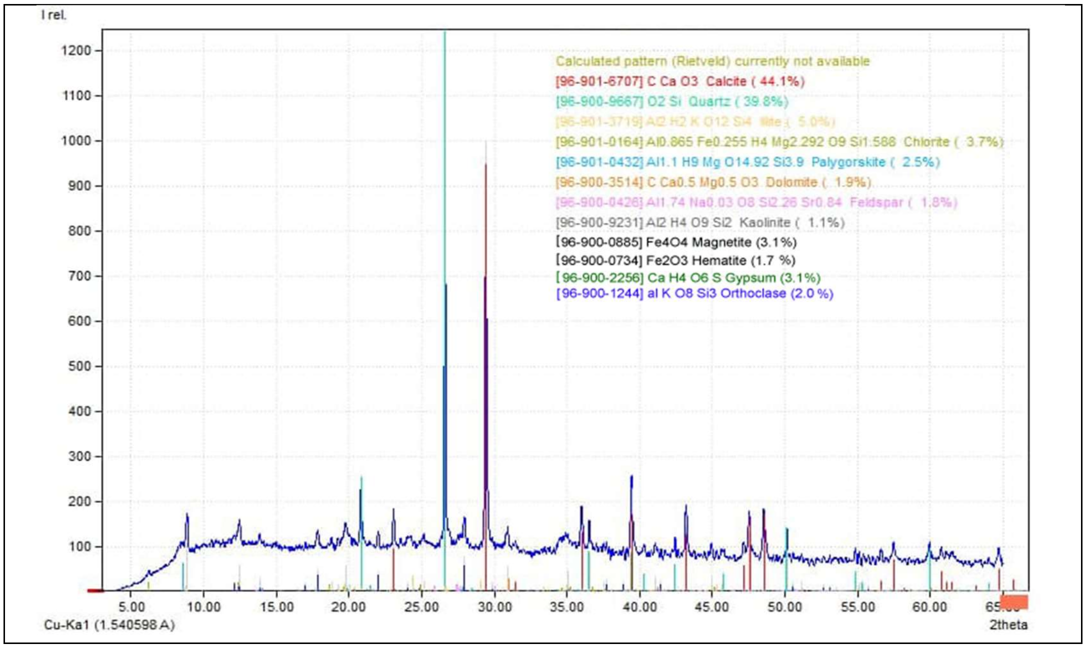

Figure (2) X-ray diffraction of gypsum soil in silt joints

clay separated

The results showed in Figure 3 the X-diffraction of the clay separated in gypsum soil. The mineral Montmorillonite was diagnosed through diffraction (16.33) for the treatment of saturation with magnesium and air drying and the characterization of the mineral in the treatment of saturation with ethylene glycol and it disappears in the treatment of saturation with potassium and heating to 350 ° C and 550 ° C. This indicates that this mineral is inherited I am from Mica. The X-ray results also showed the presence of diffraction (14.29) for the mineral Chlorite for the treatment of saturation with magnesium and air drying, as well as the presence of the metal in the treatment of saturation with ethylene glycol and saturation with potassium and heating to 350 ° C, and it breaks when saturated with potassium and heating to 550 ° C. The first is the effect of Smectite minerals by the chlorination phenomenon and its transformation towards swollen chlorite, and the second is the effect of the inner hydroxide layer of the original chlorite mineral during the transport and deposition process, which was reflected in the degree of fullness of the inner hydroxide layer, turning the mineral towards swollen chlorite. The diffraction (14.29) of Ilite metal was detected in the treatment of saturation with magnesium and air drying, as well as the character of the metal in the treatment of saturation with ethylene glycol and saturation with magnesium and heating to 350 °C and 550 °C. The diffraction (7.23) due to the mineral kaolinite was diagnosed in the treatment of saturation with magnesium and air drying, and the metal was diagnosed in the treatment of saturation with ethylene glycol and saturation with potassium and heating to 350 ° C and 550 ° C indicating the presence of chlorite

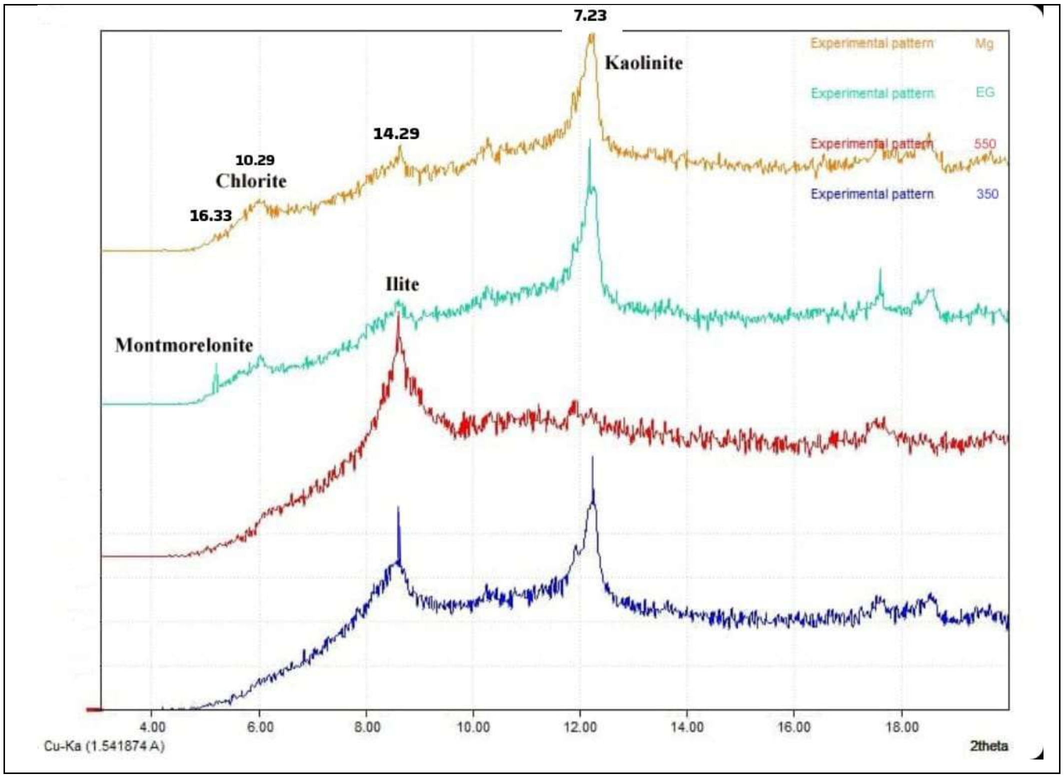

Figure (3) X-ray diffraction of gypsum soil separated by clay

calcareous soil

sand separated

The results of Figure 4 representing the x-ray diffractions of sand separated in limestone soils showed the presence of minerals Calcite, Dolomite, Quartz, Chlorite, Kaolinite, Ilite, lbite, the highest percentage was for calcite, which amounted to 41.3%).This is due to the calcium-rich parent material, which is the main component of limestone rocks and prevalent in locations of dry and semi-arid climatic conditions, as well as in igneous rocks with a low charge [16] This mineral is not found in locations where rainfall is high, and it may be formed from the transformation processes of calcium carbonate (Yang et al., 2001). The lowest percentage of dolomite was (1.7%) due to the nature of the mineral composition of the parent material and not in soils that have a high content of magnesium unless there is an increase in the ratio of magnesium to calcium (Ca + 2 / Mg + 2) in the horizons below the horizon of carbonate gathering, as The 〖CO2〗 gas resulting from the decomposition of organic matter reduces the degree of interaction of the soil and this leads to an increase in the dissolution of carbonate minerals, including dolomite, and the release of magnesium into the soil and groundwater solution increases As for the presence of Quartz mineral, it was (30.4 %), it is due to the original material rich in this mineral, as well as quartz's high resistance to weathering and its light weight of 2.65 gm. Cm3. Its energy, which is characterized by hardness and insoluble because of its strong chemical bonds in its crystal structure, and Quartz needs to be formed to special conditions of temperature, pressure and time factor The average of Chlorite (5.4%) and its presence in the sand separation is low, and this is due to the difficulty of separating the small quantities of it, especially in the case of the presence of the minerals Vermiculite and kaolinite, or it may be due to its low degree of stability and stability [20] and its source is igneous rocks and may consist of the transformation of amphibole and pyroxene minerals And Biotite and primary minerals formed from igneous rocks in northern Iraq .As for the mineral Kaolinite, with a percentage of 3.8%, its presence is due to the fact that the mineral was transported by wind or rivers from the soil of the neighboring regions, or as a result of the transformation of feldspar into Ceriseite during transport by air or rivers with the prevailing dry climatic conditions, and its small percentage is due to the lack of appropriate conditions. To be in the soils of dry and semi-arid climate, where it needs a degree of reaction tends to acidity, severe washing, and a decrease in the concentration of Carbonate minerals (calcium and magnesium) (Al-Alwani and Al-Bayati, 2011). The results also showed the presence of Ilite mineral (3.3%), which is a mineral inherited from the basalt mother rocks, and winds may participate in transferring it to the soil in very few percentages[21]. Albite also appeared with a percentage of (7.9%), and it is from the Feldspar group. Its presence is attributed to the nature of the mineral composition of the original material and the activity of weathering processes, and it is one of the medium-resistant minerals. As for the mineral Pallycorskite, it appeared at average of (2.2%). This mineral consists of the transformation of the metallic Ilite, where an increase in the double-charged magnesium ion and a decrease in the three-charged aluminum ion may result from the weathering of the original rocks. The results also showed the presence of antigorite with a percentage of (2.7%), which belongs to a group of 1:1 minerals, sourced from silicate rocks and metamorphic rocks. The mineral Gypsum with a percentage of (1.0%) is a small percentage as a result of irrigation operations that lead to its dissolution or is transported by wind, in addition to its presence in the original material, as magnetite was found at a percentage of (2.1%). It is due to the mineral composition of the original material and the nature of deposition cycles and severe weathering processes, or it is produced from Iron-containing minerals such as Amphibole, Pyroxene and Hornblende, and its source is due to igneous rocks in Turkey and northern Iraq (Latif, 2020).As for vermiculite (1.1%) arising from changing the mineral chlorite through the effect of the chemical energy of the weathering factor and in a very small amount on the weak bonds of the mineral chlorite, this process is known as chlorite - vermiculite.

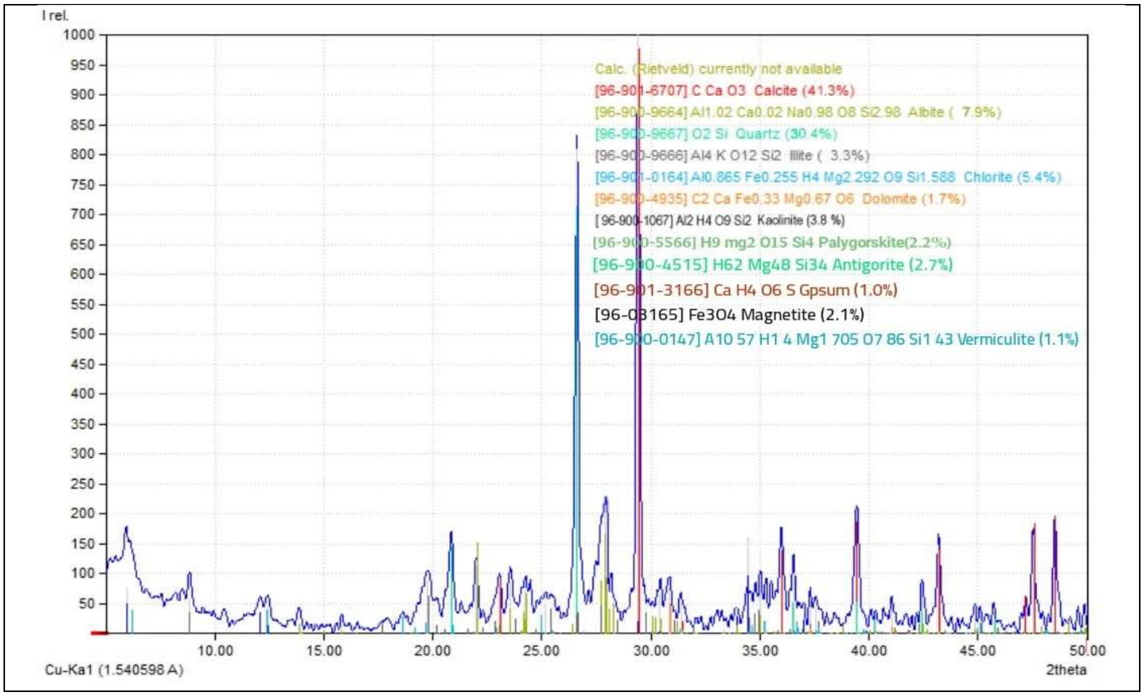

Figure (4) X-ray diffraction of calcareous soil separated by sand

silt separated

The results of Figure 5 showed the X-diffraction of the silt separated in limestone soils and the presence of Calcite, Dolomite, Quartz, Albite, Orthoclase, Muscovite, Gypsum, Magnetite, and clay minerals (Chlorite, Kaolinite, Ilite, Pallgorskite).Calcite was the predominant mineral in the study soils, reaching average of 70.4%. This high percentage is due to the fact that most of the calcite is not inherited from the parent material and that it is the source of the transport processes of fine particles of carbonate minerals or the increase in the conditions suitable for weathering processes on the surface layer, which are in contact with atmospheric conditions and therefore Fine particles increase in the surface layer.

As for the mineral Dolomite, with a percentage of (7.3%), it is one of the carbonate minerals that is found in soils in which magnesium increases in the surface layer as well as in transport and sedimentation processes. Quartz mineral has a percentage of (15.3%) as it is considered one of the light minerals as it is transferred to the soil and is deposited when it decreases The energy momentum of the transfer factor is characterized by high hardness. As for the Feldspar minerals, where the percentage of Albite (1.5%) and Orthoclase (3.3%), most of the feldspar are weakly stable and not resistant to erosion, as they are exposed to weathering during transportation from the mother location (Pichler, 1997). Gypsum mineral was identified with a percentage of (1.3%) due to transportation and deposition of sulfate salts with the dry climate where sulfate salts precipitate before the chloride salts. Contains iron such as amphibole, hornblende and pyroxene As for the clay minerals, their presence in the silt is due to the fact that their sizes are the size of the silt grains, where the percentage of chlorite mineral was (1.7%). It is due to the weathering of rocks of origin in arid and semi-arid locations Or from the transformation of Ilite when there is a deficiency in the triple-charged aluminum ion and an increase in the triple-charged magnesium ion. The mineral kaolinite is (1.5%) and its presence is caused by air transports and rivers or both, as the conditions of the study location are not suitable for its formation, as it needs conditions washing and a decrease in the degree of interaction. Ilite (0.8%) was found to be transported to the soil by wind and its source is basalt Parent rocks. It is formed in the case of potassium in an appropriate concentration on the surface horizon. The proportion of muscovite (1.3%) of the mica minerals is from igneous and metamorphic rocks, and it is a medium-resistant mineral with resistance to weathering, and its presence within the silt separated is due to the large size of its particles.

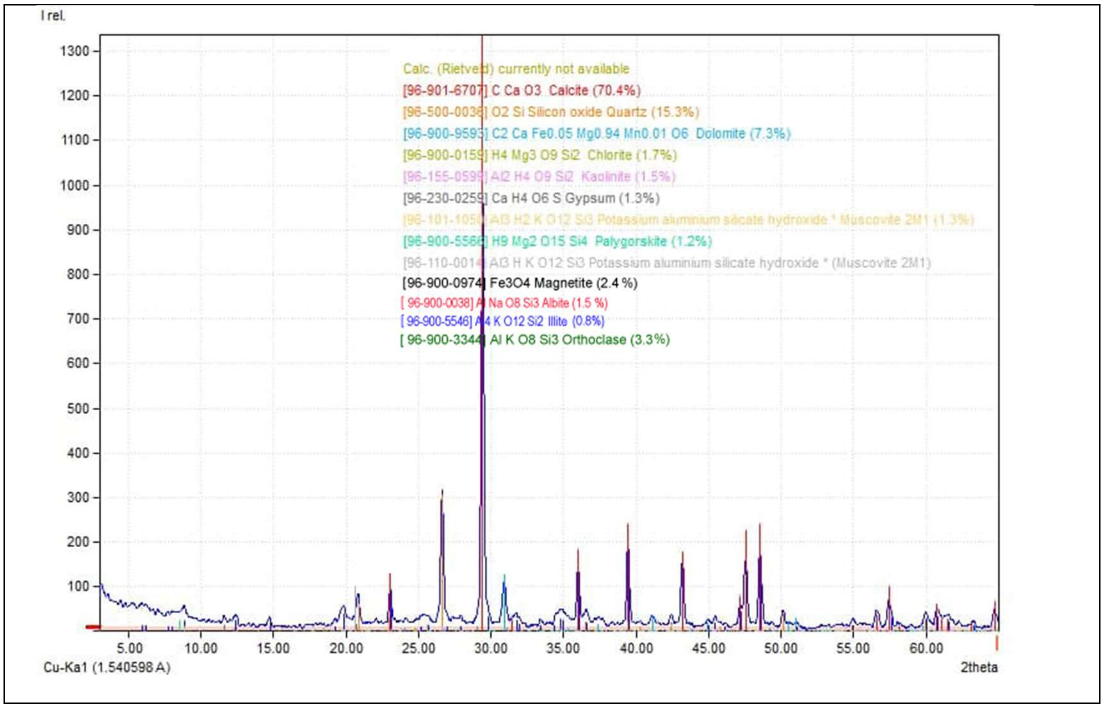

Figure (5) X-ray diffraction of silt separation in gypsum soil

clay separated

The results of Figure 6 showed the X-diffraction of the clay separated in limestone soil. The results showed the diagnosis of diffraction (16.47) in the sample saturated with magnesium and air drying of the mineral Montmorillonite and a person when saturated with ethylene glycol and saturated with magnesium and heating to a temperature of 350 ° C and its disappearance when heating to 550 ° C indicates the occurrence of Chlorination phenomenon and deposition of brucite layer within the inner layers of vermiculite mineral.As indicated by the diffraction (14.36) which is related to the mineral Chlorite for the treatment of saturation with magnesium and air drying, as well as the person of the metal in the treatment of saturation with ethylene glycol and saturation with potassium and heating to 350 ° C, and it breaks upon saturation with potassium and heating to 550 ° C. Smectite minerals by the phenomenon of chlorination and its transformation towards swollen chlorite, and the second is the effect of the inner hydroxide layer of the original Chlorite mineral during the transport and sedimentation process, which was reflected in the degree of fullness of the inner hydroxide layer, turning the mineral towards the swollen chlorite, this is what was indicated by (Al-Shahmani, (2020).Also, the diffraction (10.50) was diagnosed due to

Pallygorskite mineral for samples saturated with magnesium and air dried, as well as the character of the mineral when saturated with ethylene glycol. Channel water from the inner channels of the Pallygorskite mineral [22]The diffraction (10.29) of Ilite metal was detected in the treatment of saturation with magnesium and air drying, as well as the character of the metal in the treatment of saturation with ethylene glycol and saturation with magnesium and heating to 350° C and 550° C. Its presence in all treatments indicates that it is of the heat-resistant type [16]. The diffraction (7.23) due to the kaolinite mineral of the sample saturated with magnesium and air drying was diagnosed, that is, the metal was also diagnosed in the treatments of saturation with magnesium and air drying as well as saturation with ethylene glycol and saturation with magnesium and heating to a temperature of 350 ° C.and it disappears in the treatment of saturation with potassium and heating to 550 ° C, which proves the presence of kaolinite, or it may be a product of the weathering of Smectite minerals [17] It is one of the ways by which it can be distinguished from the mineral Chlorite

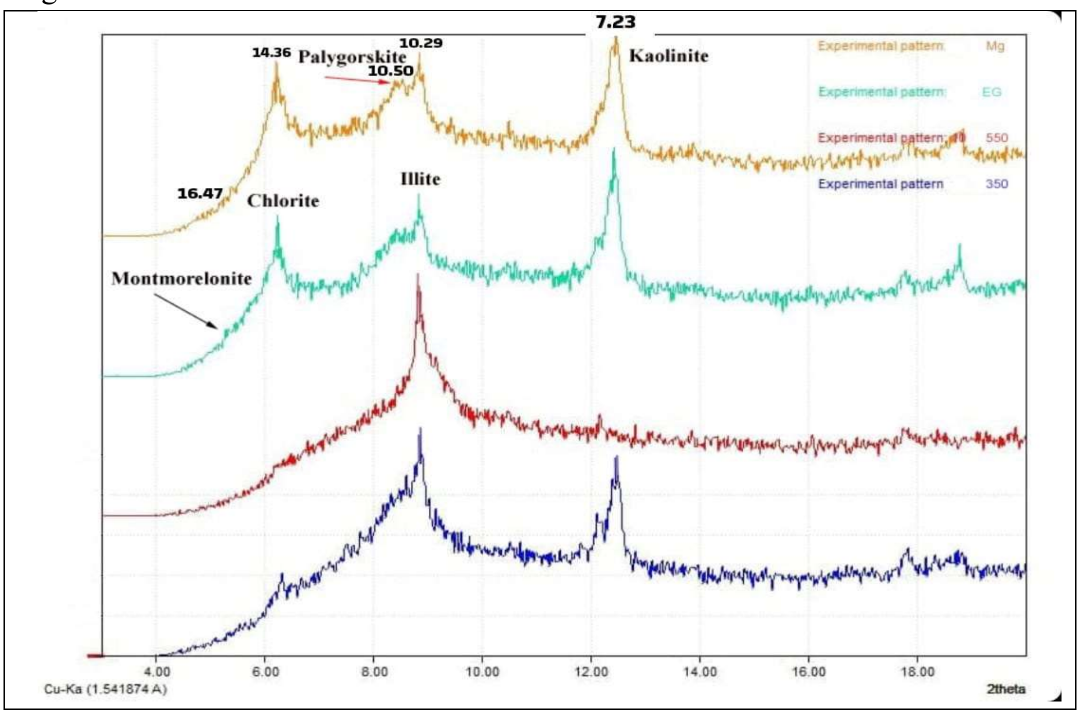

Figure (6) Sigmoid diffraction of calcareous soil clay separated

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