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Study of the mineral analysis of some gypsiferous soils in Salah al-Din and Najaf governorates using X-ray diffraction powder technique

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ABSTRACT

Six soil pedons were selected, represented by the governorates of Salah al-Din and Najaf, distributed as three pedons for each governorate and located within a study path for each of them according to the geological formation, their physiographic location and the accompanying difference in sedimentation conditions resulting from the different sedimentation sources and the parent material. The results of the mineral examinations showed the predominance of light minerals for the very fine sand fraction in all horizons of the study pedon soils, and the evaporites were dominant in it, except for the exploited zarka region, which was characterized by the predominance of carbonate rocks. The results of the mineral analysis using the x- rays of the powder of the soil models, the absolute dominance of the minerals Quartz and Gypsum with different proportions and crystal sizes, respectively, in the surface and subsurface horizons of the Fursan pedon located within the soil of Salah al-Din with a relative rate of 51.53% and an average crystal size of 30.28 nm and a rate of 73.76% and an average size of 31.41 nm The surface and subsurface of pedon zirconia exploited for the pedons of Najaf, followed by Calcite, Feldspar, Dolomite and Aragonite in different proportion and sizes, in addition to the presence of other minerals such as rutile and various iron oxides such as Goethite and Hemetite.

دراسة التحليل المعدني لبعض الترب الجبسية في محافظتي صلاح الدين والنجف باستعمال تقنية مسحوق حيود الاشعة السينية

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الخلاصة

تم اختيار ستة بيدونات ترب متمثلةً بمحافظتي صلاح الدين والنجف موزعة بواقع ثلاث بيدونات لكل محافظة وواقعة ضمن مسار دراسي لكل منهما تبعاً للتكوين الجيولوجي وموقعها الفيزيوغرافي وما يرافقها من اختلاف في ظروف الترسيب الناجمة من إختلاف مصادر الترسيب ومادة الأصل . بينت نتائج الفحوصات المعدنية سيادة المعادن الخفيفة لجزء الرمل الناعم جداً في جميع آفاق ترب بيدونات الدراسة فكانت السيادة فيها للمتبخرات، عدا منطقة الزركة المستغلة التي تميزت بسيادة الصخور الكاربوناتية، فيما أكدت نتائج التحليل المعدني باستخدام الأشعة السنية الحائدة لمسحوق النماذج الترابية السيادة المطلقة لمعدني Quartz وGypsum بنسب واحجام بلورية متباينة على التوالي في الآفق السطحي وتحت السطحي لبيدون الفرسان الواقع ضمن ترب صلاح الدين بمعدل نسبي 51.53%وبمعدل حجم بلوري 30.28 نانوميتر وبمعدل 73.76% وبمعدل حجم 31.41 نانوميتر للافق السطحي وتحت السطحي لبيدون الزركة المستغل لبيدونات النجف ومن ثم يليه Calcite وFeldspar وDolomite وAragonite بنسب واحجام مختلفة، فضلا عن وجود معادن أخرى مثل الروتايل (Rutile) وأكاسيد الحديد المختلفة مثل الجوثايت(Goethite) والهيميتايت(Hemetite).

الكلمات المفتاحية: حيود الاشعة السينية، مسحوق، معادن، صلاح الدين، النجف.

INTRODUCTION

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. About 95% of all solid materials can be described as crystalline. Soil mineralogy is studied routinely because of its strong influence on soil behavior, its use in soil classification, and its relevance to soil genetic processes. Soils commonly contain primary minerals, secondary minerals, and may have crystallographic characteristics that strongly influence the physical and chemical properties of soils. X-ray diffraction is the technique which is most genuinely relied upon in soil mineralogical analysis (Chen 1988; Sullivan 1990). Jackson (1948) explained that the mineral interpretations of modern soils are important in studying soil formation processes for agricultural purposes, with the identification of weathering activities in both soils and sediments, as this requires studying the mineral content of the clay and non-clay part.

The same researcher, Jackson (1965) explained that the study of soil minerals is an important confirmation in understanding soil chemistry, because soil minerals, especially colloidal minerals, are very important for the exchange of positive ions, chemical weathering, and the liberation of nutrients in the soil. Many studies were conducted on the mineral composition of the Iraqi sedimentary soils, where Buringh (1960) explained that the differences in the mineral composition of the Iraqi sedimentary soils are due to the differences between the sediments of the

Tigris and Euphrates rivers, which are due to the difference of their sources.(AL Rawi *et al.,* 1967, AL Taie, 1968, AL Rawi *et al.*, 1969) indecated that the mineral composition of the Iraqi sedimentary soils consists of Montmorillonite, Chlorite, and Mica minerals with some Quartz, Vermiculite, Palygorskite, Calcite, Smectite group and mixed minerals.

Al-Muhaimid (1999) noted when studying sand minerals in their heavy and light parts in one of the sites near the Al-Raed research station located north of the Faculty of Agriculture in Abu Ghraib regarding the sovereignty, especially the light sand minerals, of which specifically, Quartz minerals were in all the study pedons, and he attributed this sovereignty to the resistance of this mineral to weathering due to the nature of its bonds Chemical As for Calcite, ranked second in terms of dominance, followed by Chert and Feldspar, and the percentage of Mica minerals decreased. The reason for the decline was attributed to the weak resistance of these minerals to weathering and their transformation into secondary minerals easily.

The aim of the current study is to compare the quantitative and qualitative content of different soil minerals and determine the extent of the difference in the crystal sizes of those minerals located within the sedimentations of the Tigris and Euphrates rivers.

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MATERIALS AND METHODS

Geological of study area

The soils of the study area, especially the soils of Salah al-Din, are characterized by the presence of geomorphological phenomena in general related to their structural and geological status, as well as the occurrence of weathering and erosion processes soil pedon of Al-Fursan, which is located within the unstable pavement. The agricultural lands in this area are feed by water from wells that lie at depths of about 30 meters.

As for the University Pedon, which is exploited by wheat cultivation and sprinkler irrigation, it is also located within the upper terraces of the Tigris River at the beginning of the sedimentary plain and has a somewhat high topography interspersed with some valleys, As for the unexploited pedon Al-Alam (Arabs of China), located on the eastern side of the Al-Alam sub-district, 16 km from the center of the city of Tikrit, it is an area of undulating gravel deposits of shallow gravelly gypsum soil known geologically as the accumulating plain.

As for the pedons of Najaf, including the pedons of Al-Zarka, which is exploited by cultivating various vegetables and by the runoff method and the unexploited, in the area of Al-Zarka(Khan al-Rub') on the road Najaf-Karbala, with a gypsum sedimentary origin ,While pedon the Bahr al-Najaf located in the village of (Abhoul), is described as a transitional area between the sedimentary plain and the Western Desert region, that is, between the stable pavement and the unstable pavement (Salloum and Sakr, 1994).

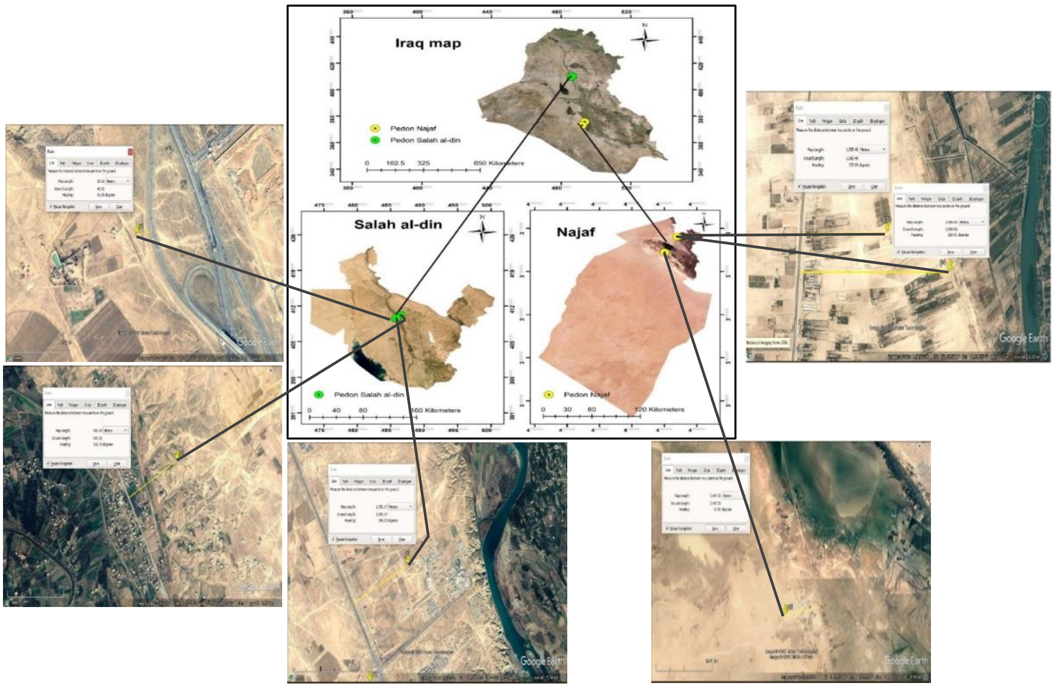

Figure 1. a map of pedon sites the study soil

Diagnosis of light and heavy sand minerals

After the sand is separated from the clay and silt using a sieve with a diameter of 50 microns, the separated sand is taken after drying it by air, as the sand group is separated. The very fine sand whose diameter ranges between 50-100 microns and air-dried, and then it is ready to separate heavy and light metals by means of a separating funnel and by using bromoform liquid ($CHBr_3$) with a specific weight of (2.89), after taking a certain weight of very fine sand (1 gm).) is fixed on a glass slide by placing a drop of Canada balsam liquid. Light or heavy sand minerals are diagnosed and estimated by a polarized optical microscope according to (Kerr, 1959) and (Milner, 1962).

Minerological Analysis of Soil Powder

The analysis included the identification of non-clay minerals by X-ray diffraction for soil powder (XRPD), where the data were collected at a diffraction angle ranging from θ = 3 – 50°2 with a step (θ 2) and at a speed of 16,000°/s. The peak areas were estimated by X-ray diffraction (XRD) based on the diffraction angle for each mineral, and the semi-quantitative estimates of the mineral ratios were calculated mathematically through the relationship between the area under the curve and the amount of difference in (2θ), and the Schiller equation was applied to calculate the crystallization volume. The samples were examined in the Ministry of Industry and Minerals (Iraqi Geological Survey) using the MAXIMA X-Ray DIFFRACTOMETER model 2009 of the Theta-type from the Japanese company SHEMADZU working with a Cu Kα (1.5418 A°) radiation tube at Kv40 and mA40.

Table 1. Percentages of light minerals in very fine sand of study soil horizons

WRL*	Others	Rock fragment	Chert Rock Fragment	Carbonate Rock Fragments	Feldspar	Quartz	Evaporites	Weight of light minerals (%)	Depth(cm)	Horizon	Location	Pedon No.
بيدونات ترب صلاح الدين												
3.02	0.9	11.8	9.7	33.5	7.00	21.2	15.9	87.90	0-15	Ap	Fursan cultivated	P_1
2.95	1.9	12.3	10.2	38.2	6.00	17.7	13.7	88.17	15-30	Bk		
3.84	1.2	9.3	6.3	16.1	4.5	17.3	45.3	97.36	30-53	C_{ky1}		
2.73	1.6	10.5	9.8	18.7	6.4	17.5	35.5	98.33	53-80	C_{ky2}		
3.71	0.9	11.3	10.3	15.7	5.2	19.3	37.3	97.18	80-100+	C_{ky3}		
2.82	1.2	9.2	9.4	25.3	6.3	17.8	30.8	96.65	0-19	A	alam noncultivated	P_2
3.16	1.5	8.8	8.4	22.3	5.6	17.7	35.7	97.85	19-54	B_y		
2.52	1.6	8.7	8.2	6.8	6.1	15.4	53.2	96.79	54-80	Cy		
3.13	0.6	9.6	6.5	35.6	5.8	18.2	23.7	94.71	80-105+	Cky		
2.58	0.9	11.7	5.7	40.9	7.3	18.9	14.6	89.78	0-20	Ap	tikrit university cultivated	P_3
3.59	0.9	9.9	7.5	25.1	4.9	17.6	34.1	92.80	20-44	Bky		
3.05	1.5	11.7	8.4	19.3	7.00	21.4	30.7	95.14	44-63	Cky_1		
2.90	0.9	9.8	10.5	29.5	6.2	18.00	25.1	96.64	63-83	Cky_2		
3.5	0.6	9.3	9.6	30.7	6.00	21.00	22.8	94.71	83-102	Cky_3		
2.50	1.5	9.3	8.8	16.3	6.9	17.3	50.3	95.80	102-126	Cky_4		
بيدونات ترب النجف												
3.22	1.2	10.1	10.1	35.8	6.3	20.3	16.2	94.84	0-30	Ap	Zarka cultivated	P_4
3.74	0.9	10.2	9.4	31.3	6.7	25.1	15.4	95.02	30-53.5	Cy_1		
4.40	0.9	10.6	12.3	30.8	5.9	26.00	13.5	97.20	53.5-92	Cy_2		
2.75	1.5	9.9	9.8	16.2	6.4	17.6	28.6	98.06	92-125+	Cy_3		
3.31	1.2	9.2	10.4	28.7	7.00	23.2	20.3	95.35	0-22	A	Zarka non cultivated	P_5
5.42	0.9	11.3	9.5	18.00	4.2	22.8	33.3	93.66	22-40	Cy_1		
5.54	1.2	9.8	8.2	11.7	5.1	28.3	35.7	96.20	40-83	Cy_2		
7.16	1.5	11.6	6.8	19.6	5.5	39.4	15.6	94.50	83-120+	Cy_3		
3.06	1.2	8.7	7.2	38.7	6.00	18.4	19.8	97.96	0-12	A	Bahr alnajaf non	P_6
3.21	0.9	10.1	6.9	40.8	5.5	17.7	18.1	98.66	12-43	Cky_1		
2.12	0.6	8.2	7.4	50.4	5.4	11.5	16.5	97.73	43-90	Cky_2		
4.26	1.2	8.9	8.4	35.3	4.9	20.9	20.4	97.63	90-115	Cky_3		

RESULT AND DISCUSSION

The current study relied on diagnosing the mineral composition using the soil powder method (XRPD) for the surface and subsurface horizons of the coarse part represented by sand and silt particles for pedon soils. The results of the forms of X-ray diffraction 1-12 and the data of the X-ray diffraction results table1 indicated the variation of the predominance of minerals in the soil separated by horizons from the study pedons, and with different weight ratios depending on the intensity of the height of the curve for each of these minerals are Quartz, Gypsum, Calcite, Feldspar, Dolomite and Aragonite Palygorskite and Illite, as well as iron oxide minerals.

In Salah al-Din soil, it was observed that quartz mineral predominated with a relative rate of 51.53% and an average crystal size of 30.28 nm within the surface horizon Ap and subsurface Bk of pedon Al-Fursan, with a value of 32.57% and a size of 28.1 nm in the surface horizon of Tikrit university. As for the Najaf soils, the results showed its dominance in the surface and subsurface horizon of the exploited pedons at a rate of 73.76%, with an average size of 31.41 nanometers, and the Cy_1 subsurface horizon of the unexploited birch with a percentage of 34.33% and a size of 29.53 nm. Through these results, these ratios approximate with the ratios of quartz to the mineral composition separated by very fine sand for light minerals table.1, that possible diagnose its main peaks at an angle of 2θ = 26.67-26.74°. The high content of quartz in the sediments of the Tigris and Euphrates rivers, which is represented by the horizons of the soils of Salah al-Din and Najaf in general, can be explained by the high percentage mainly within the sediments from which those soils were formed, whether the sediments transmitted by water or wind erosion because it is characterized by its low specific gravity of 2.65, in addition as the main component of most soils, because it is the most common mineral in the earth's crust, in addition to its high resistance to weathering, which makes it more abundant in sand and silt parts (Senkyl et al, 1985). Therefore, it has a more stable crystal lattice. For the gypsum mineral, the main diffraction angle for it was determined at 2θ=11.45-11.73°. It was a clear superiority for the pedons located within the soils of Salah al-Din, especially the surface horizon A and the subsurface horizon By, belonging to pedon Al-Alam, at a rate of 40.13%, and with an average crystallization size of 27.8 nm, as well as at a rate of 33.39%, and with a crystallization size of 25.3 nm in the subsurface horizon Bky belonging to pedon University and with sharp peaks and elevated.

As for the Najaf soil, it distinguished be gypsum the as a dominant mineral in the surface horizon A of the unexploited pedon of Zarqa and the subsurface horizon of the pedon of the Sea of Najaf, it had a content of 33.50% and a crystal size of 27.55 nm and 40.77% and a crystal size of 31.80 nm respectively, in addition to that it is noted from The above results are the absence of a special diffraction angle for gypsum in pedon Al-Fursan belonging to Salah al-Din soil. This may be attributed to the low quantitative content of gypsum in those horizons, unlike the other horizons.

Table2. The semi-quantitative relative abundance and crystallization size of the major (non-clay) minerals of the study pedon horizon soils

Mineral sequence	Diagnostic non clay minerals									Depth cm	Horizon	Location	Pedon .No
	Hematite	Goethite	Rutile	Aragonite	Dolomite	Calcite	Gypsum	Feldspar	Quartz				
	Relative abundance %												
	Crystalline Size (nm)												
soil Pedons Salah Al-Din													
Qz>Ca>Fsp>Gt>Ar	/	4.46	/	2.18	/	20.60	/	16.51	56.22	0-15	Ap	Fursan cultivated	P_1
		33.7	/	32.5	/	28.32	/	27.35	31.06				
Qz>Ca>Fsp>Ar>Rt>Gt>Hm>Gy	2.70	3.46	3.48	3.56	/	47.44	0.63	15.51	46.84	15-30	Bk		
	32.55	32.9	25.9	34.4	/	27.51	58.7	32.05	29.5				
Gy>Ca>Fsp>Qz>Hm>Dl>Rt>Gt	5.80	1.50	2.41	/	5.22	13.78	42.82	9.45	7.93	0-19	A	alam noncultivated	P_2
	25.6	27.6	24.2	/	29	22.4	27.05	27.33	30.65				
Gy>Ca>Hm>Fsp>Dl>Rt>Qz	7.58	/	2.35	/	6.29	24.67	37.45	7.06	1.92	19-54	By		
	27.55	/	28.4	/	27.6	22.82	28.55	30.3	31.6				
Qz>Ca>Gy>Fsp>Hm>Dl>Rt>Gt>Ar	6.09	2.69	2.85	0.6	3.78	26.35	14.21	10.13	32.57	0-20	Ap	tikrit university cultivated	P_3
	25.4	29.2	23.8	42.3	23.8	33.55	39.6	36.4	28.1				
Gy>Ca>Qz>Hm>Dl>Fsp>Rt>Gt	8.37	1.60	2.39	/	7.47	31.21	33.39	6.38	8.10	20-44	Bky		
	27.00	25.3	30.6	/	26.2	22.26	25.3	24.56	29.65				
soil Pedons Najaf													
Qz>Ca>Fsp>Gy>Gt	/	3.19	/	/	/	9.40	5.22	8.82	62.60	0-30	Ap	Zarka cultivated	P_4
	/	30.8	/	/	/	27.45	24.3	39.45	30.96				
Qz>Ca>Gt>Ar	/	4.67	/	2.41	/	7.98	/	/	84.92	30-53.5	Cy_1		
	/	34.2	/	34.7	/	30.5	/	/	31.86				
Gy>Qz>Ca>Hm>Dl>Fsp>Gt>Rt>Ar	6.98	2.72	1.48	1.27	5.73	10.81	33.50	4.90	32.11	0-22	A	Zarka non cultivated	P_5
	25.2	31.9	26.8	17.2	25.2	22.1	27.55	40.6	29.83				
Qz>Gy>Hm>Ca>Fsp>Dl>Ar>Gt>Rt	8.46	1.81	156	2.21	5.63	7.77	30.34	6.70	34.33	22-40	Cy_1		
	26.95	30.9	25.7	31.1	26.2	30.4	28.50	24.4	29.53				
Qz>Ca>Gy>Fsp>Rt>Gt>Hm>Dl	2.67	3.08	3.16	/	2.61	30.97	12.46	6.80	38.20	0-12	A	Bahr alnajaf non cultivated	P_6
	33.45	31.3	27.8	/	21.6	27.41	29.3	28.2	28.7				
Gy>Qz>Ca>Fsp>Hm>Dl>Gt>Rt	5.93	2.81	1.31	/	4.04	18.03	40.77	6.05	21.02	12-43	Cky_1		
	25.35	32.4	31.1	/	28.6	27.65	31.80	29.00	28.40				

The results of the mineral analysis of soil powder showed the presence of calcite mineral in all the study soils. Its atomic reflection angle was at 29.24-29.56° = 2θ, as it ranked second after mineral Quartz and gypsum for all of the soils of Salah al-Din, with different intensity, with average values of 34.02, 19.22 and 28.78%, and with average sizes of 27.91, 22.61, 27.90 nanometers. As for the pedons of Najaf soils, they were also of varying proportions and sequences between the same pedons or horizons, which were between the third and fourth, in order, except for Pedon the exploited Zarka and the surface horizon of pedon Bahr Al-Najaf. gave similar behavior to the soils of Salah al-Din in terms of the sequence diagnosed in general, As indicated light minerals table. 1.

As for feldspar, it was the least major mineral found in the study soils, mostly plagyoclase and K-feldspar, as it was detected at its diffraction angle was 2θ=23.41-23.48° for plagyoclase and 2θ=27.55-27.59° for K-feldspar. The results presented in Figures 1-12 and table .2 showed that there is a discrepancy in the feldspar content of the study soils, and according to the mineral sequence, it ranked third for the soils of Salah Al-Din, especially pedon the fursan ,its value reached by rate of 16.01% and average crystallization size of 29.7 nm and the surface horizon of the alam by 9 45% with a crystallization size of 27.33 nanometers. As for the Najaf soil, it was volatile and its content was somewhat less than that of Salah al-Din soil. In addition, a complete absence of this mineral was observed, as in the subsurface horizon of the exploited pedons. In general, its value ranged between 4.90-8.82%, the lowest percentage was in the surface horizon of the unexploited pedon, and the highest percentage In the surface horizon of the exploited pedon and its crystalline size in the range of 24.4-40.6 nm, the lowest volume in the subsurface horizon Cy_1 of the unexploited pedon zirka and the highest size in the surface horizon of the same pedon. The results showed the presence of dolomite mineral at a reflective angle of 31.12-31.18 = 2θ in all pedons of the soils under study except for Figure 32 and 33 belonging to the first pedon of the fursan within the Salah al-Din soil pedons, as well as Figures 38 and 39 belonging to the fourth pedon located within the horizons of the Najaf soils pedons. As for aragonite, it is one of the carbonate minerals present after calcite and dolomite, which located at reflection at a degree of 2θ = 45.72-45.86, as shown in the results with a decrease in the intensity of its diffraction in all horizons of the study soil with the complete absence of the pedon Al-Alam in the soil of Salah al-Din and Bahr al-Najaf which belongs to the soil of Al-Najaf **.** The results indicated the presence of very small percentages of rutile mineral as well as clay minerals that were diagnosed with coarse particles such as mica, kaolonite, and palygoroskit. The main and secondary diffractions of Figures (1-12) of the primary soil particles diagnosed using the XRPD method can be illustrated as follows.

Quartz :- A⁰ 4.23-4.24, 3.33, 2.28, Feldspar: Plagioclase Feldspar- A⁰4.00-4.01,3.22, 3.17-3.19, K-Feldspar:- 3.78-3.79 A⁰, 3.23, Gypsum: -7.53-7.71 A⁰, 4.26-4.27, 3.06-3.07, Calcite: 3.83-3.85 A⁰, 3.02-3.05, 2.12, 1.87-1.89, Dolomite: 2.86-2.87 A⁰, Aragonite :- 1.97 A⁰, Rutile:- 2.49 A⁰, Kaolonite :- 7.05 A⁰, 4.44-4.46, Palygroskite: 10.16-10.47 A⁰, Mica :- 10.28 A⁰

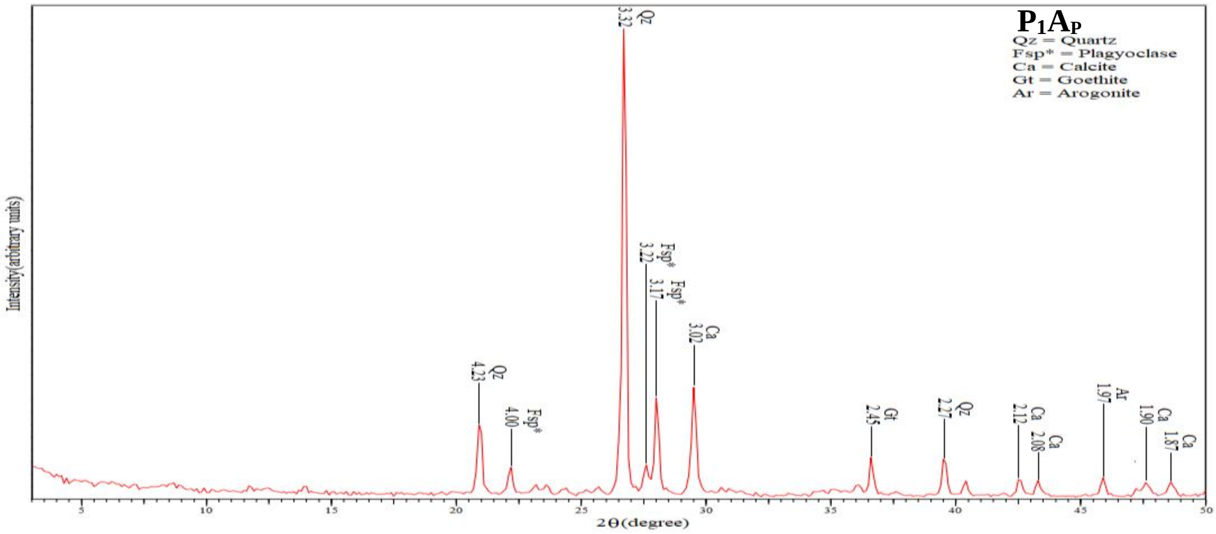

Figure 2. X-ray diffraction diagram in the surface horizon Ap of Pedon Al-Fursan

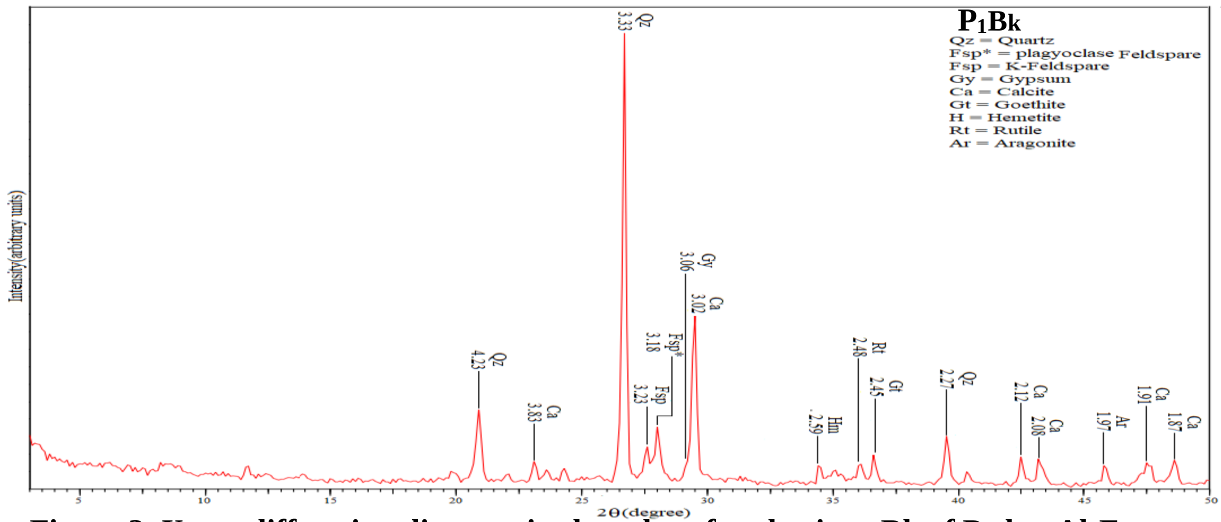

Figure 3. X-ray diffraction diagram in the subsurface horizon Bk of Pedon Al-Fursan

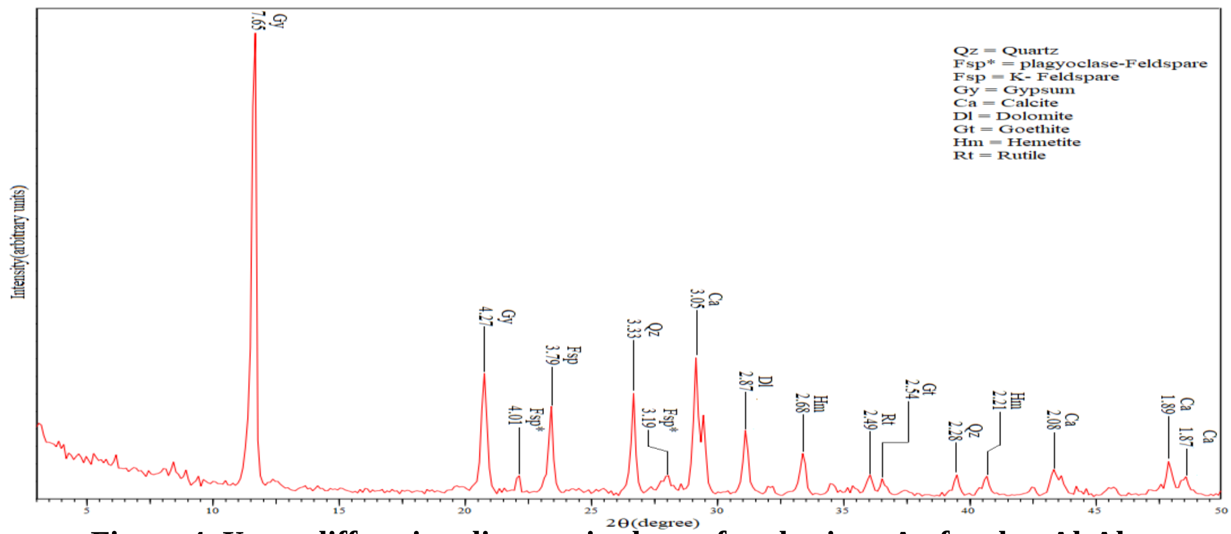

Figure 4. X-ray diffraction diagram in the surface horizon A of pedon Al-Alam

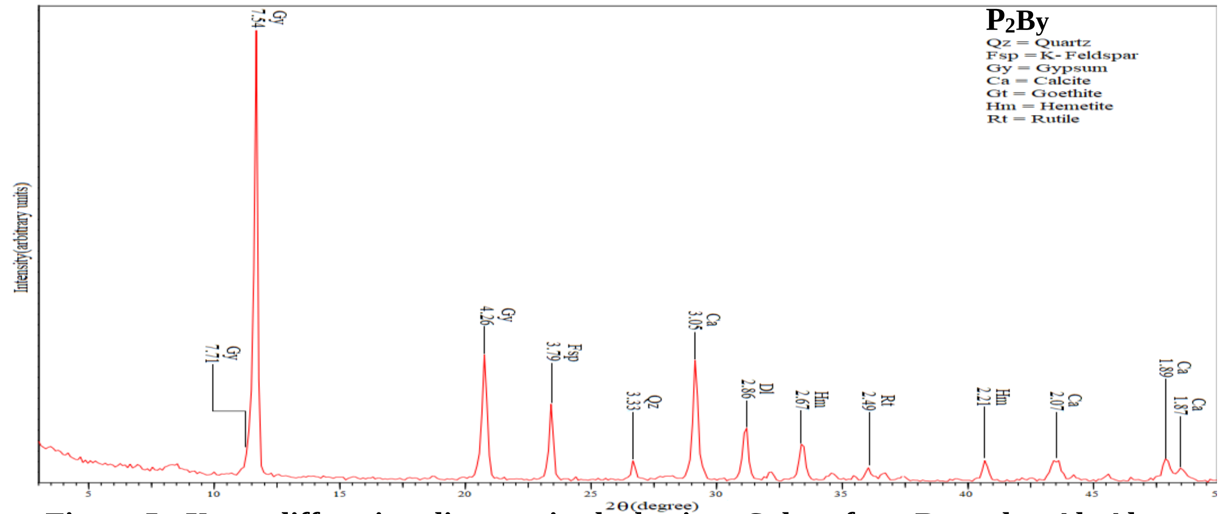

Figure 5. X-ray diffraction diagram in the horizon Subsurface By pedon Al -Alam

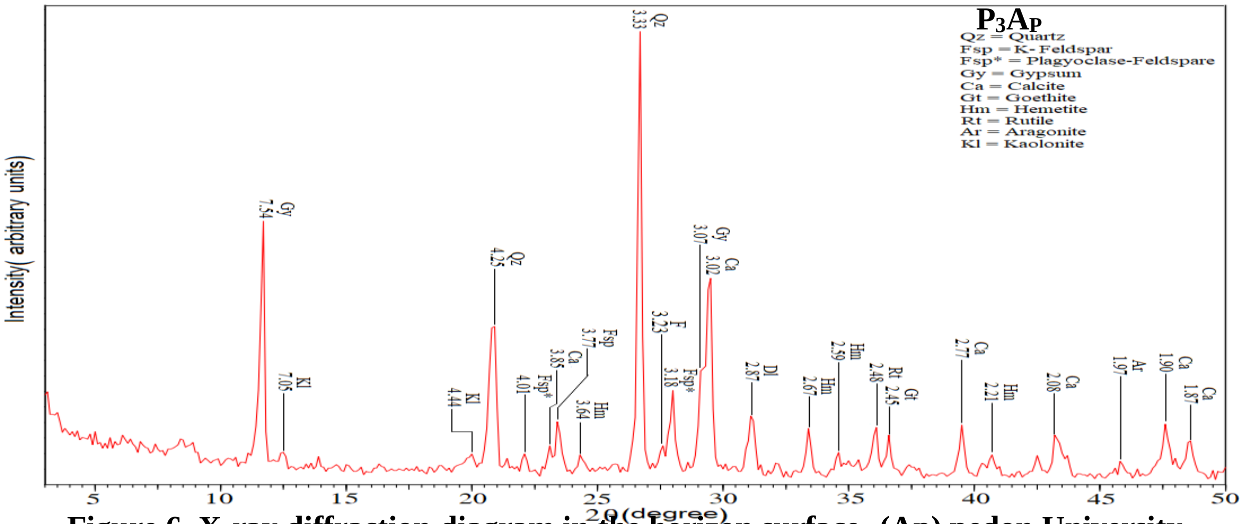

Figure 6. X-ray diffraction diagram in the horizon surface- (Ap) pedon University

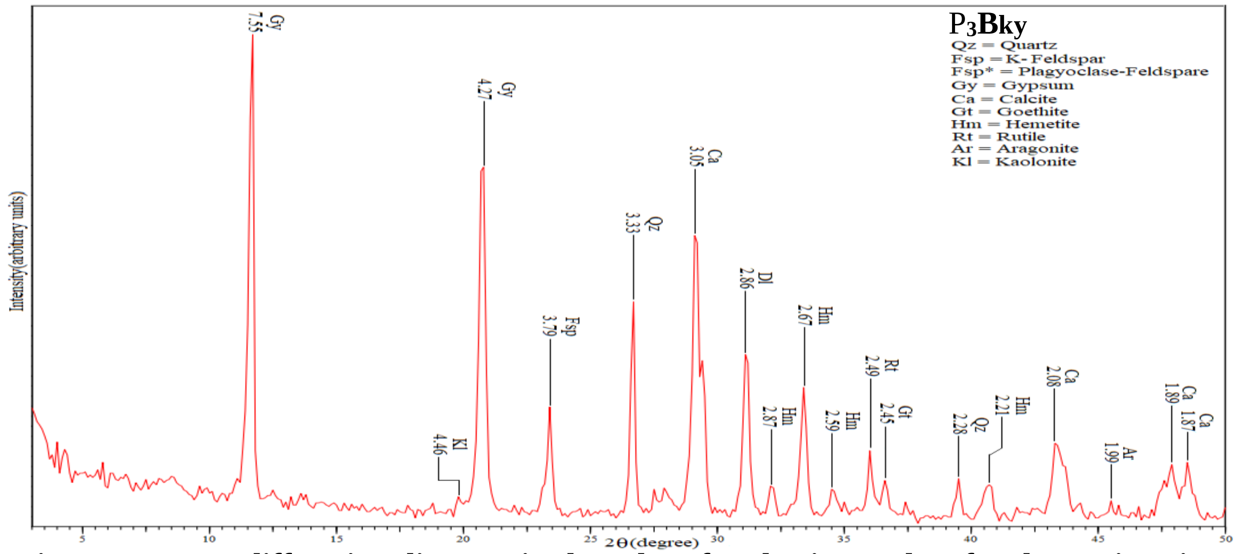

Figure 7. X-ray diffraction diagram in the subsurface horizon Bky of pedon University

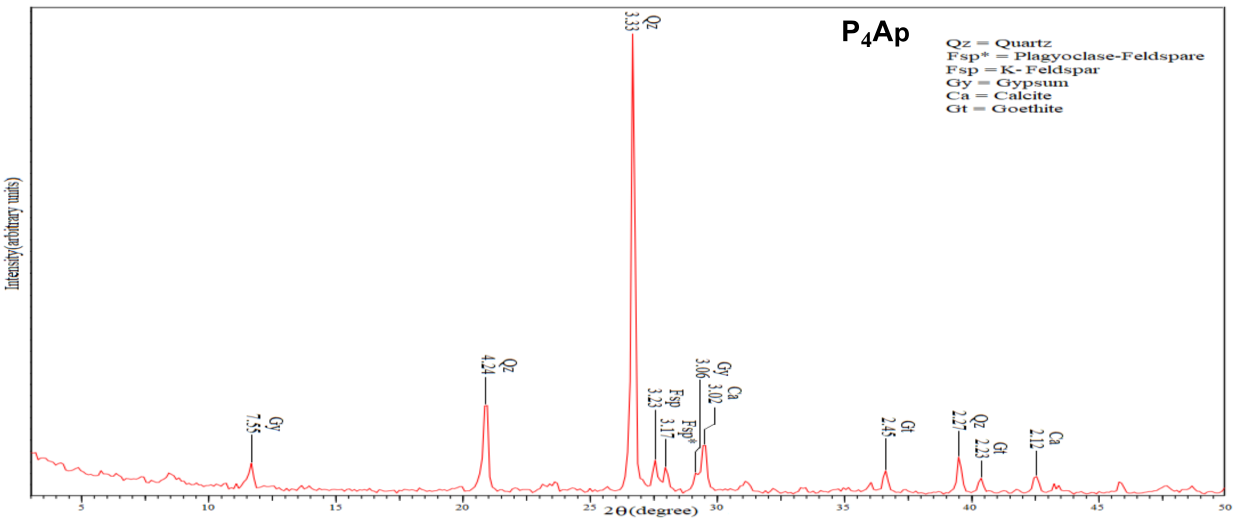

Figure 8.X-ray diffraction diagram in the surface horizon Ap for pedon zarka exploited

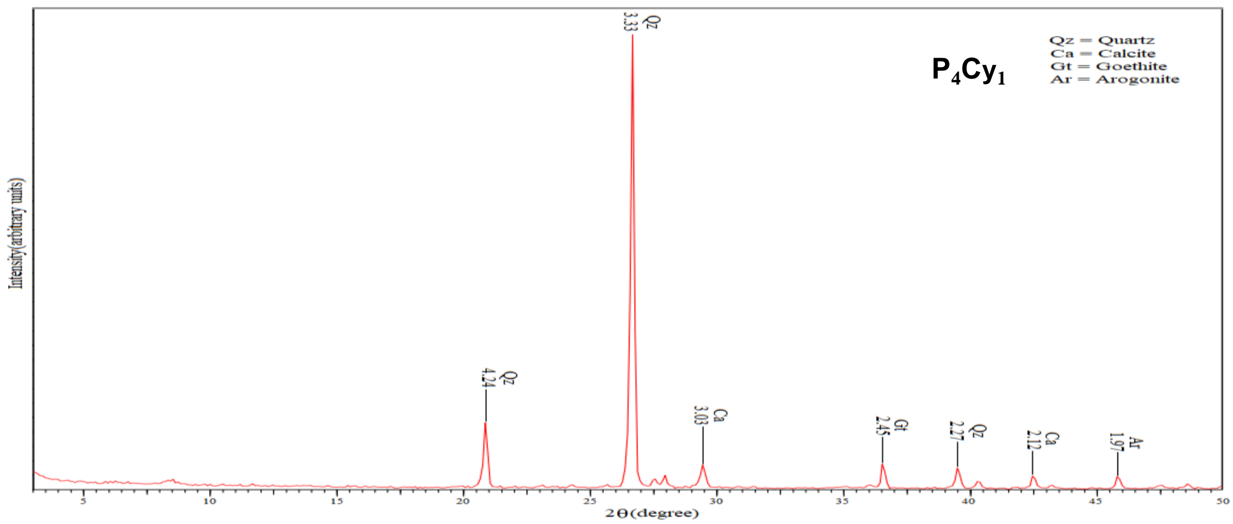

Figure 9.X-ray diffraction diagram in the sub surface horizon Cy_1 for pedon zarka exploited

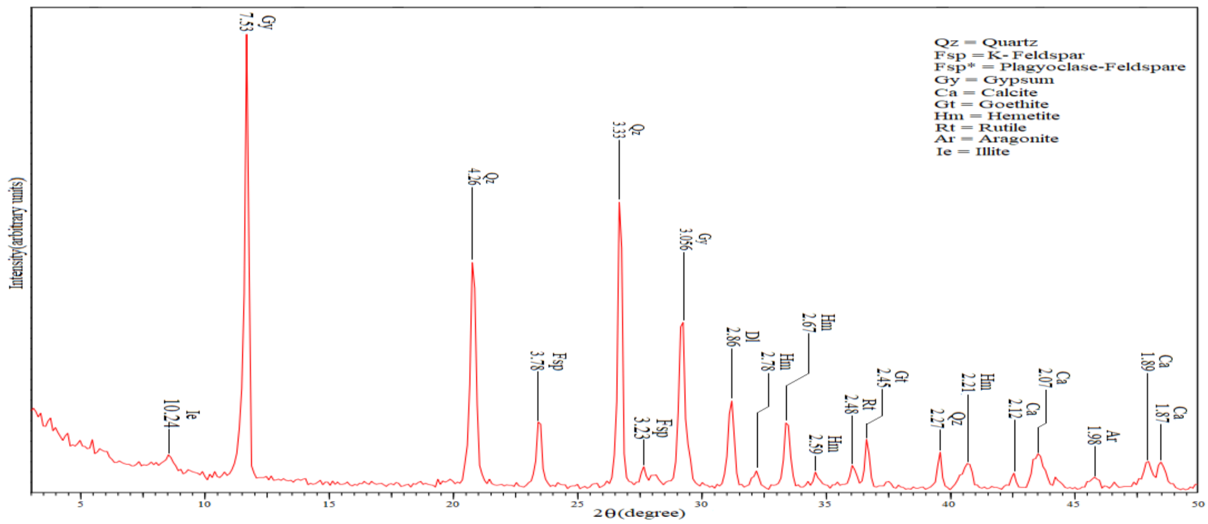

Figure 10. X-ray diffraction diagram in the Surface horizon A for pedon zarka unexploited

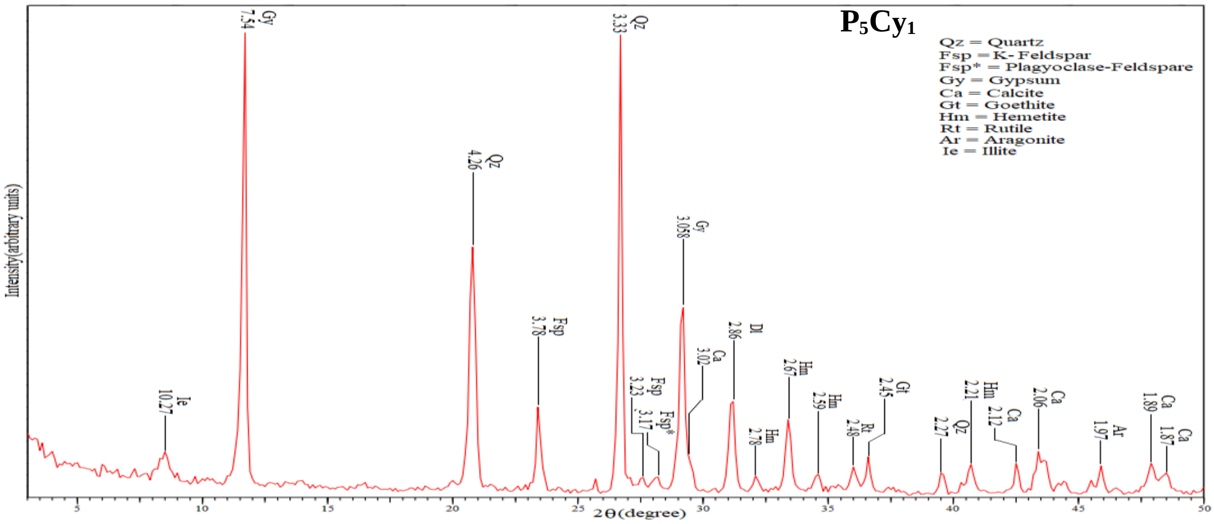

Figure 11. X-ray diffraction diagram in the Subsurface horizon Cy_1 for pedon zarka unexploited

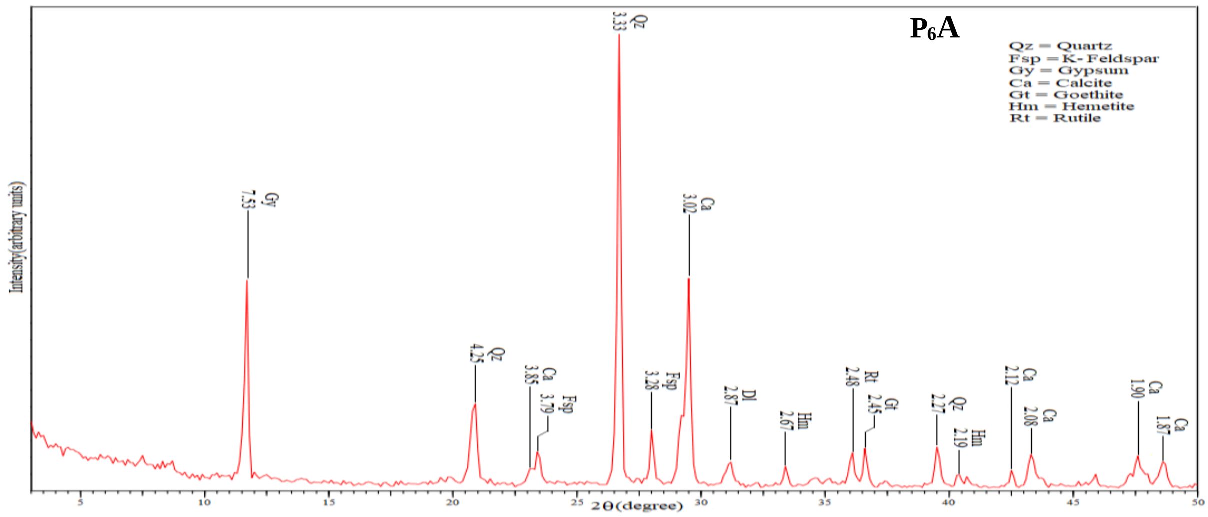

Figure 12. X-ray diffraction diagram in the Surface horizon A for pedon Bahr Al-Najaf

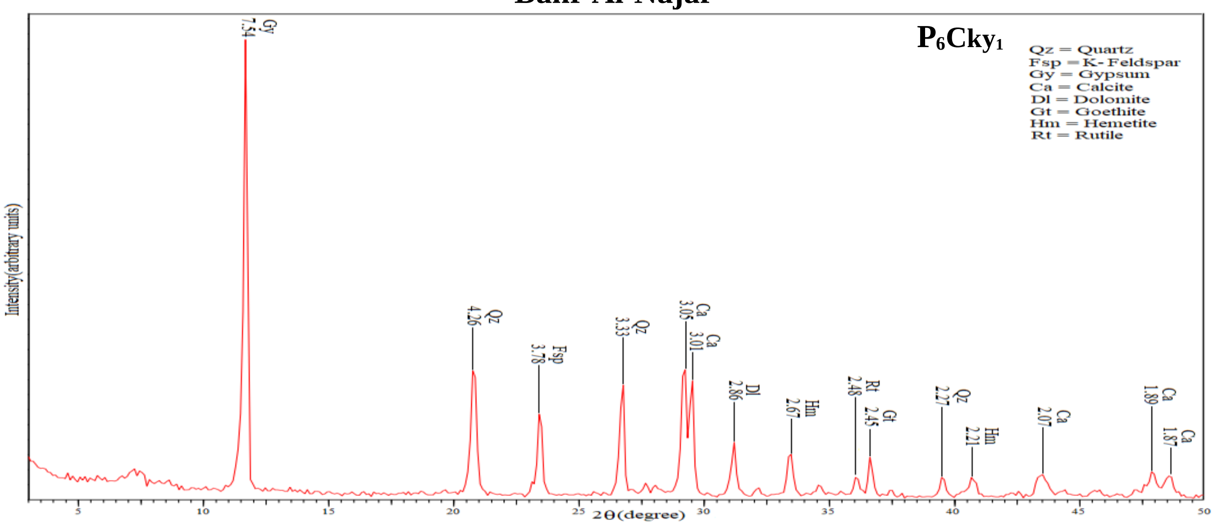

Figure 13. X-ray diffraction diagram in the subsurface horizon Cky_1 for pedon Bahr Al-Najaf

The different oxides of the studied pedon soils were also diagnosed, and the values of each mineral and its basal distance d-spacing were determined based on the apparent diffractions with an X-ray diffraction apparatus.

Goethite **-:** A°**2.45**, Hematite **-:**2.78 A°**, 2.59,** 2.67**,** 2.21.

Schwertman and Tayler (1977), through their experiments, concluded that one of the mechanisms of hematite and goethite formation are the following environmental factors that can affect the ratio of goethite to hematite, such as temperature, organic matter content, soil reaction degree, total content of iron and other trace elements, Accordingly, the results of the x-ray diffraction examinations of the studied soil models confirmed the appearance of different diffractions of iron oxides, especially goethite and hematite in all curves of the figures,for goethite, α-FeOOH the lowest value in the surface horizon to pedon Al-Fursan is 1.5%, and the highest value in the surface horizon to pedon Al-Fursan is 4.46%, and with a relative rate of 2.72% and an average crystal size of 29.74 nm to its complete absence in the subsurface horizon By pedon Al-Alam belonging to the soils of Salah al-Din, while its percentage in Najaf soils ranged between 1.81-4.67% with a relative rate of 3.04% and an average crystal size of 31.91 nM and the lowest content was in the subsurface horizon Cy_1 of the unexploited pedon zarka and the highest value in the subsurface horizon Cy_1 to pedon the exploited Zarka.

As for the hematite α-Fe_2O_3 for the soils of Salah al-Din, its appearance was observed in all studied horizons except for the surface horizon of pedon Al-Fursan. Its value was between 2.70-8.37%, with a relative rate of 6.10%, and with an average crystal size of 27.62 nm, lowest percentage on the subsurface horizonto pedon Al-Fursan and the highest value in the surface horizon to pedon university , while in Najaf soils its quantity was in the range of 2.67-8.46% with a rate of 6.01% and an average size of 27.73 nm. The lowest content in the surface horizon to pedon Bahr al-Najaf and the highest content in the subsurface horizon Cy_1 to pedon. Unexploited Zarka.

These results are in agreement with the findings of Al-Jubouri , 2019 and Beauchmin et al., 2003 that the interconnected existence of these two minerals is often prevalent in the soils of dry and semi-arid areas, due to the characteristic in these regions of drought, lack of rain and high temperatures.

The results shown in Figures 1-10 and table.2 showed the presence of hemitite in greater quantities than the rate of goethite. In light of this Schwertman and Taylor ,1977 instructed that the factors that favor the formation of hematite over the formation of goethite are those that favor the formation of ferihydrite, such as a high release rate of High Fe ions, and low concentration of complex organic iron compounds, by allowing a higher concentration of inorganic ferric iron ions.In addition, once frihydrite is formed, hematite is preferred over goethite with increasing temperature because dehydration involves the conversion of ferhydrite to hematite, as well that low influence of organic matter and increase in pH It led to the rise of the hemites at the expense of the goethites

CONFLICT OF INTEREST

The authors declare no conflicts of interest associated with this manuscript.

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