Mineral Analysis and Percentages of Oxides (Hematite and Magnetite) in Two Cultivated and Uncultivated Soils in the Governorates of Al-Qadisiyah, Babylon and Najaf / Iraq

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Abstract. The aim of the research is to study the mineral analysis and oxides ratios in two cultivated and uncultivated soils in the governorates of Qadisiyah, Babylon and Najaf. And the determination of the proportions of hematite and magnetite oxide minerals, the following results showed that there is a great predominance of minerals (quartz and calcite) in all the soils of the middle Euphrates, and the proportions of the following minerals were diagnosed in Al-Qadisiyah Governorate, calcite 32.8%, which came in the first place for the uncultivated soils, while the cultivated soils prevailed Quartz mineral by 47.1%, while the province of Babylon showed the predominance of the mineral calcite at a greater rate than the rest of the minerals, by 33.6%, 30.8% for cultivated and uncultivated soils, respectively, while Najaf governorate recorded the highest prevalence of quartz mineral, which amounted to 38.1%, 34.8% for cultivated soils The oxide minerals (hematite and magnetite) recorded ratios of (2.0, 1.4, 1.0, 1.7, 0.9, 1. 1) The magnetite mineral reached (2.1, 2.5, 0.9, 2.7, 2.0, 1.0) for the governorates of (Al-Qadisiyah, Babylon, Najaf) for the cultivated and uncultivated soils, respectively.

Keywords. Magnetite, Hematite, Iron oxides.

1. Introduction

The Middle Euphrates is the geographical area south of Baghdad in the Euphrates Basin region. It is considered the most fertile spot in Iraq. It includes the governorates of Najaf, Karbala, Diwaniyah, Babylon and Muthanna. Many studies have been conducted on the mineral composition of Iraqi sedimentary soils. Sedimentary soils are newly formed soils due to the accumulation of different river deposits in the tissues. Therefore, they do not exist except with the presence of rivers and torrents. Their texture becomes softer the farther we move vertically from the river, as well as being deep soil, but it varies in the level of the depth of the ground water and its topography is level, fertile and productive In most cases, it also suffers from some obstacles and is different from one place to another depending on its location in the course of the river, where it is exposed to flooding in some sites and affected by salts in another site. Sedimentation and its development in central Iraq due to the distance and proximity to the sedimentation source.

The texture of the study soils ranged from fine to medium coarse. And that most of the tissues tend to be a mixture and with a high content of lime minerals [1]. Most of the Iraqi sedimentary soils are of secondary origin, transported from places exposed to weathering processes and collected in a place other than the place where they were weathered and transported. This gathering was due to continuous

sedimentation processes. And that these processes occur due to a number of factors, including the floods of rivers, streams, winds and estuaries. He also showed that most of the sedimentation of Iraqi soil is the result of erosion processes and was transferred from the highlands of Turkey, Iran, Iraq, Syria, Jordan and the Iraqi desert.

Where [2], 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 in their sources. Studies have found that the mineral composition of the Iraqi sedimentary soils consists of the minerals Montmorillonite, Chlorite and Mica with some Quartz minerals. Vermiculite, Palygorskite, Calcite, and Smectite group are mixed minerals in clay minerals, while heavy sand minerals predominate in Amphiboles, Pyroxene, and small amounts of Zircon, Tourmaline and Rutile, while light sand minerals predominate in Quartz, Calcite, Gypsum,[3-5] when studying the sediments of the Tigris and Euphrates rivers, while the clay minerals were muscovite, palycorskite, allalite and chlorite. X-ray models of particles separated by silt and for all study soils. They are soils with a single source resulting from sediments transported by the Tigris and Rivers. The Euphrates, where the mineral components of separated silt particles were very similar to those of separated clay particles for those soils, and this is attributed to the fact that the mineral content of both separated particles belongs to one source where the chlorite minerals were the dominant.

The aim of the research is to study the mineral analysis in the cultivated and uncultivated soils of Qadisiyah, Babylon and Najaf governorates and the proportions of hematite and magnetite oxide minerals in them.

2. Materials and Methods

Two soil sites were chosen for the purpose of sampling, the first is cultivated soils, the second is uncultivated soils whose coordinates are shown in Table (1). The proportions of minerals and oxides (hematite and magnetite) were diagnosed using X-ray diffraction using the powder method, where refracted X-ray diffraction analysis of minerals was carried out. By powder method, using an X-ray device, model Shinadzo6000, of Japanese origin, and the type of program used (ICDD) was used to identify the nature of minerals.

Table 1. Coordinates of the study areas for cultivated and uncultivated soils.

Governorate	Agricultural exploitation	Coordinates
Al-Qadisiyah	Cultivated (Alfalfa)	32°00'09.0"N 44°35'03.1"E
	uncultivated	32°00'09.6"N 44°35'00.6"E
Al-Najaf	cultivated(Medicago sativa)	31°54'45.6"N 44°29'31.3"E
	uncultivated	31°54'46.0"N 44°29'21.6"E
Babylon	cultivated (Medicago sativa)	32°23'26.9"N 44°35'45.0"E
	uncultivated	32°23'16.5"N 44°36'15.0"E

3. Results and Discussion

3.1. Al-Qadisiyah Governorate

The results of the X-ray diffraction presented in Table (2), shown in Figure (1) and presented in percentages, were characterized by the predominance of calcite mineral 32.8%, which came in the first place, then quartz figure 28.4%, and feldspar (albite) 12.2% , mica (ilite) 10.3%, chlorite 9.1%, gypsum 6.2%, magnetite 2.5%, magnesite 2.5%, dolomite 2.0%, vermiculite 1.3%, kaolinite 1.2%, palicorskite 1.0%, montmorillonite 0.8%, hematite 1.0%, These results are in agreement with [6], when studying soils in Wasit Governorate, where he found a high percentage of the mineral quartz and calcite in a large proportion, as well as many clay minerals including, dolomite, gypsum, halite, alite, and chlorite, and it agrees with what was found by [4], when they study the mineral composition and free oxides of the sediments of the Tigris and Euphrates rivers in the province of Qadisiyah.

The results of Table (2) of the single X-rays shown in Figure (2) for the agriculturally exploited soils in Al-Qadisiyah governorate showed the dominance of quartz mineral by 47.1%, which came in the first place, then calcite 29.3%, and feldspar (albite) 14.2 %, gypsum 6.2, mica (ilite) 3.8%, magnesite

3.5%, chlorite 2.2%, dolomite 2.2%, montmorillonite 1.8%, hematite 1.5%, vermiculite 1.3%, kaolinite 1.2% and pallicorskite 0.4%. These results agree with the findings of Al-Quraishi, (2019) The predominance of calcite and quartz minerals over the rest of the minerals in the soil, and she attributed the reason for this to the predominance of the mineral within the rocks generating the transported sediments.

Table 2. Percentages of cultivated and uncultivated soil minerals in Al-Qadisiyah Governorate.

Mineral %	Soil cultivated	Soil uncultivated
Calcite	29.3	32.8
Hematite	1.5	1.0
Magnitite	2.5	2.5
Magnesite	3.5	2.5
Quarts	47.1	28.4
Chlorite	2.2	9.1
Albite	14.2	12.2
Illite	3.8	10.3
Palygorskite	0.4	1.0
Montmorilonite	1.8	0.8
Vermiculite	1.3	1.3
Kaolinite	1.2	1.2
Gypsum	6.2	6.2
Dolomite	2.2	2.0

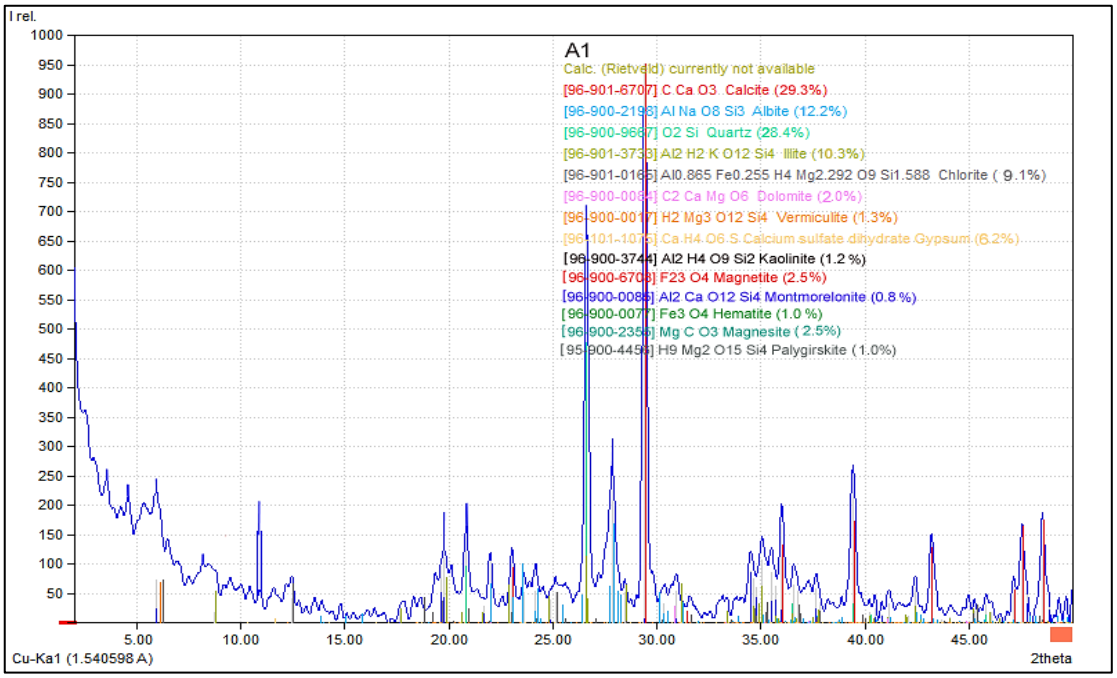

Figure 1. X-ray diffraction of uncultivated soils in Al-Qadisiyah Governorate.

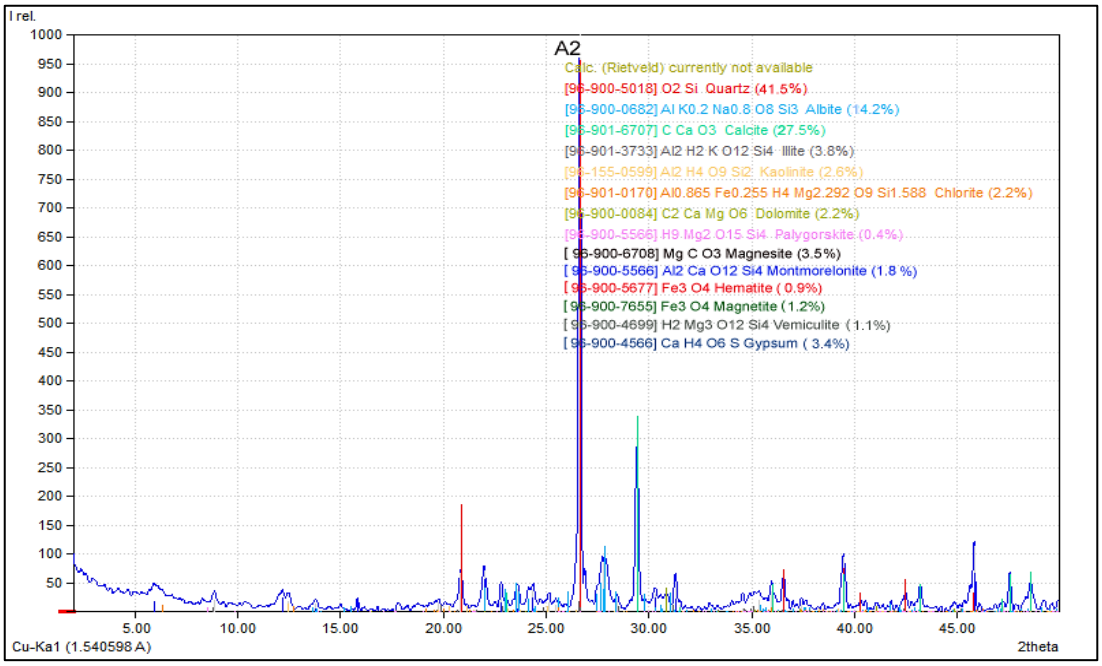

Figure 2. X-ray diffraction of cultivated soils in Al-Qadisiyah Governorate.

3.2. Babylon Province

The results of the assays presented in Table (3) X-ray diffraction for uncultivated soils (Figure 3) showed that calcite was dominant over other minerals by 29.1%, then quartz came in second place with a percentage of 28.4%, and mica (alite) came in second place. 16.3%, feldspar (albite) 12.2%, chlorite 10.1%, magnetite 2.1%, magnesite 2.6%, hematite 2.0%, montmorillonite 1.3%, palicorskite 1.3%, dolomite 1.0%, gypsum 0.8%, vermiculite 0.3%, gypsum 0.2% These results are consistent with the findings of [7], in his study of southern Iraq, the predominance of calcite minerals in the first degree and in a high percentage, and then quartz, alite, alite, dolomite, chlorite and halite, and this was confirmed by [8], in a study of some of his Middle Euphrates soil, Iraq. The results of X-ray diffraction, as shown in Figure (4), for the cultivated soils in Babylon, showed the predominance of calcite mineral, which amounted to 30.8%, then came several among the minerals quartz, which amounted to 23.4%, and mica (ilite) 12.4% feldspar (allbite) 9.4%, kaolinite 7.7%, dolomite 7.4%, chlorite 2.3%, gypsum 2.2%, hematite 1.7%, montmorillonite 1.2%, magnetite 0.9%, magnesite 0.9%, palicorskite 0.8%, rami colite, 0.7%, and this 0.7% The results are with what [9], observed in his study of the minerals of the sedimentary plain soil, where the study showed the predominance of calcite and quartz minerals in all the study pedestals, and he attributed this sovereignty to the resistance of these minerals to weathering due to the nature of its chemical bonds and its high resistance to weathering conditions, and it agrees with what [5] found, when studying the mineral content of the sediments of the Tigris and Euphrates rivers in some soils of the middle Euphrates.

Table 3. Percentages of cultivated and uncultivated soil minerals in Babylon Governor.

Mineral %	Soil cultivated	Soil uncultivated
Calcite	30.8	29.1
Hematite	1.7	2.0
Magnitite	0.9	2.1
Magnesite	0.9	2.6
Quarts	23.4	28.4
Chlorite	2.3	10.1
Albite	9.4	12.2
Illite	12.4	16.3
Palygorskite	0.8	1.3

Mineral %	Soil cultivated	Soil uncultivated
Montmorilonite	1.2	1.3
Vermiculite	0.7	0.3
Kaolinite	7.7	0.8
Gypsum	2.2	0.2
Dolomite	7.4	1.0

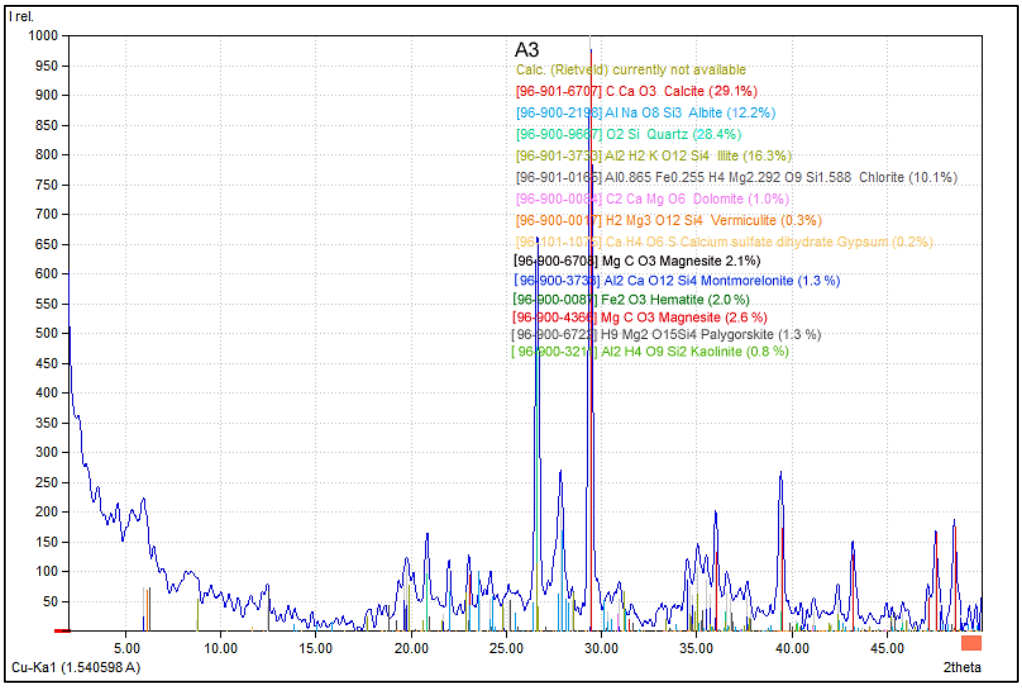

Figure 3. X-ray diffraction of uncultivated soils in Babylon Governorate.

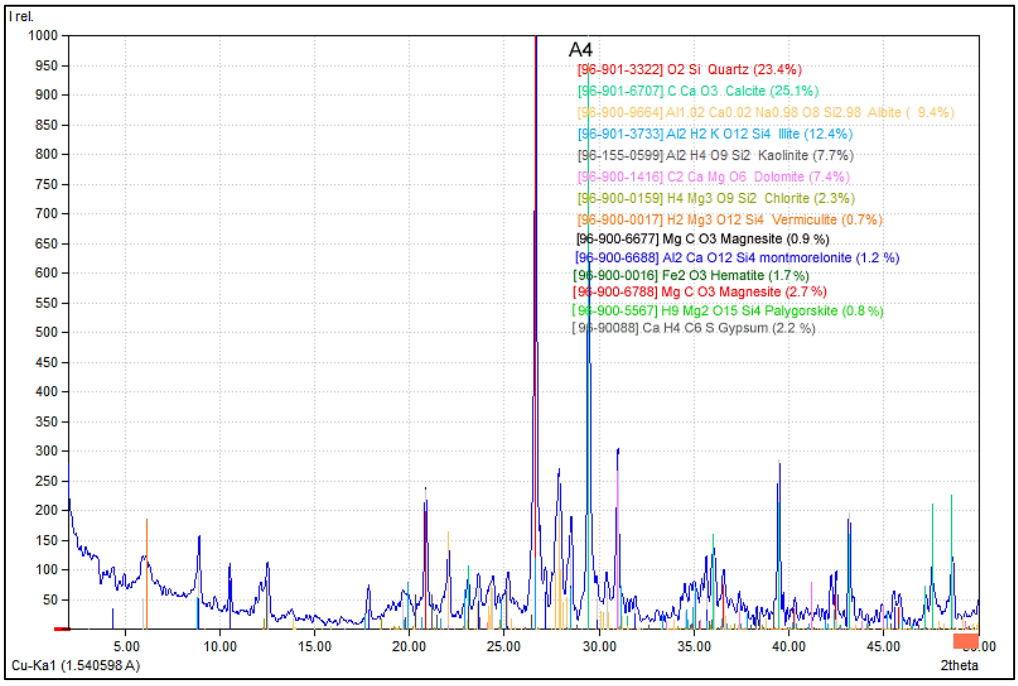

Figure 4. X-ray diffraction of cultivated soils in Babylon Governorate.

3.3. Najaf Governorate

The results of the X-ray diffraction assays presented in Table (4) and shown in Figure (5) for uncultivated soils in Najaf governorate showed the predominance of quartz mineral, which amounted to 38.1%, then came calcite 23.7%, gypsum 20.3%, and chlorite 10.3%, pallicorskite 7.7%, alite 6.5%, abite 4.6%, dolomite 3.2%, magnetite 2.0%, magnesite 1.8%, kaolinite 1.6%, vermiculite 0.4%, hematite 1.4%, and montmorillonite 1.2%, and this is consistent with what Jarallah found. , (2007) on the dominance of the mineral quartz and calcite when studied in the sedimentary plain areas.

The results of the X-ray diffraction diagnosis of cultivated soils showed the Fig. (6) in Najaf governorate, the predominance of quartz mineral with a higher percentage than the rest of the minerals 34.8%, followed in order as cite 22.2%, abit 10.4%, alite 6.3%, gypsum 3.8%, kaolinite 3.1%, Chlorite 3.1%, magnesite 2.8%, magnetite 2.7%, dolomite 2.6%, pallicorskite 1.4%, hematite 1.1%, vermiculite 0.4%, montmorillonite 0.4%. From this it turns out that carbonate minerals are one of the most important basic components of soil as they spread in most of the world's soils. Especially in the soils of dry and semi-arid areas, including Iraq, as most studies conducted on these minerals in the soil indicate that their percentage ranges between 5-35% and may exceed 40% in the regions, as is the case in some areas of southern Iraq [10].

Table 4. Percentages of cultivated and uncultivated soil minerals in Najaf Governorate.

Mineral %	Soil cultivated	Soil uncultivated
Calcite	22.2	23.7
Hematite	1.1	1.4
Magnitite	2.7	2.0
Magnesite	2.8	1.8
Quarts	34.8	38.1
Chlorite	3.1	10.3
Albite	10.4	4.6
Illite	6.3	6.5
Palygorskite	1.4	7.7
Montmorilonite	0.4	1.2
Vermiculite	0.4	1.6
Kaolinite	3.1	1.6
Gypsum	3.8	20.3
Dolomite	2.6	3.2

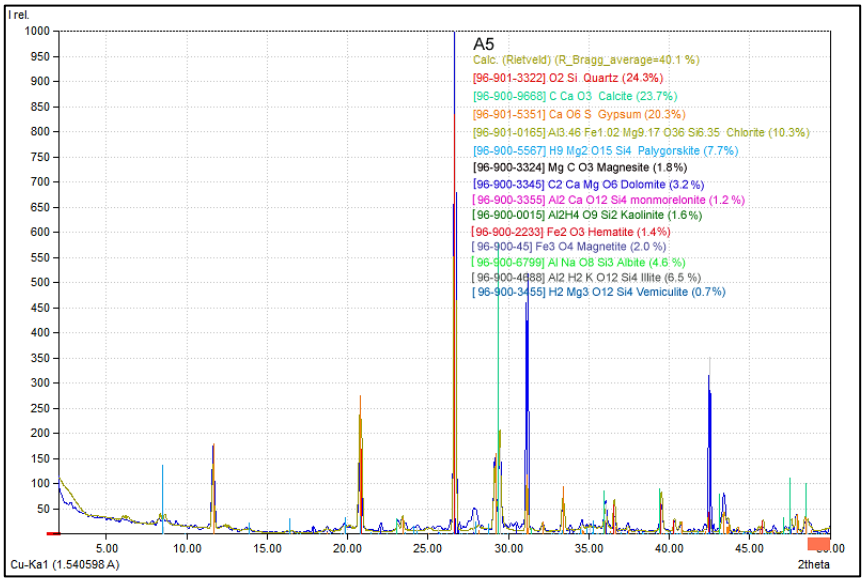

Figure 5. X-ray diffraction of uncultivated soils in Najaf Governorate.

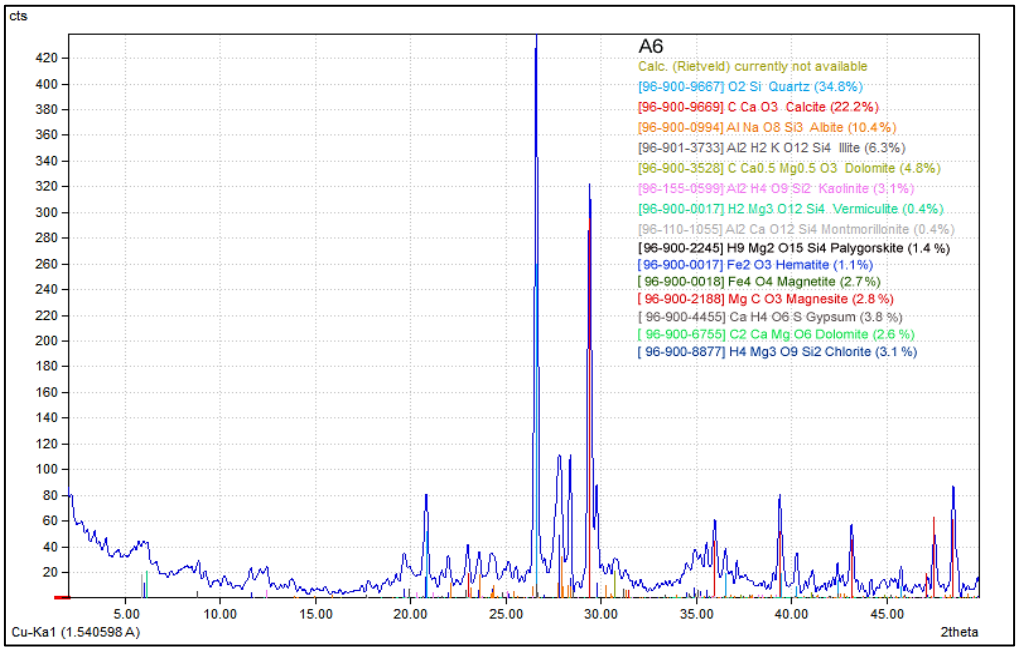

Figure 6. X-ray diffraction of cultivated soils in Najaf Governorate.

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