Geomorphotectonic effects to determine the weathering front according to spectral reflectivity properties and visual interpretation of (RS) data for the southeastern slopes of Sinjar fold.

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Abstract:
This study is concerned with determining the prevailing type of weathering for the southeastern slopes of Mount Sinjar. Therefore, the use of remote sensing data to solve this issue is one of the most important trends today. In order to employ (RS) data in this field, the researchers relied on soil moisture and temperature according to the wavelength of each spot provided by the data of the American satellite (Landsat 8) and using modern computer software. Each type of surface component was sorted with a specific wavelength according to its physical and chemical properties, following its moisture ratios, and then each type was given a specific weight, showing chemical weathering its dominance in this spot.

Key words :
Effects, tectonic, weathering, spectral reflectivity, data (RS).

Introduction :

Geomorphology is broad in scope, to the extent that it includes many fields, including studies on weathering, so the geographer needs information that covers a wide field, and remote sensing data can provide us with abundant information about the phenomena of the Earth's surface if it is better to use that data.

The spectral reflection of the components of the Earth's surface is the main criterion for distinguishing between these components, and this comes as a result of the nature of the composition of those components, and the resulting differences in heat and moisture content, and then the speed of response of the rocks to them in terms of vulnerability.

Research problem :

The research problem is the following question (Is it possible to employ remote sensing data and modern software to determine the type of weathering?)

Research hypothesis:

The hypothesis represents a preliminary answer that expresses what the researcher believes about the effectiveness of remote sensing data in the inventory and analysis of weathering processes, and as such, these techniques have proven their feasibility in studying and determining the type of weathering.

Research Methodology :

No researcher can reach results without relying on a set of principles, rules and guidelines, which represent the scientific research method, and on the basis of that the research relied on the following approach:

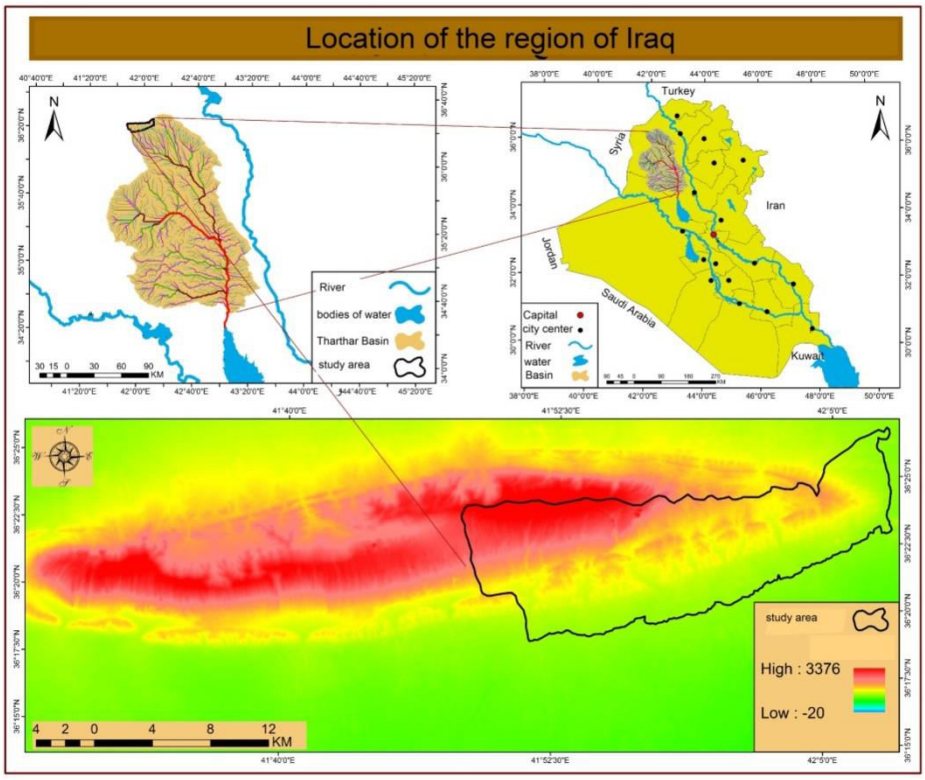
The inductive and analytical approach leads to the adoption of quantitative methods and methods in the use of mathematical standards and spatial information systems software in order to build models that simulate reality to provide an analytical vision of work mechanisms.

Search objective:

The main objective of choosing such a topic is for the purpose of clarifying the accuracy of using remote sensing data in determining the type of weathering.

Location and space:

The study area is located in northwestern Iraq within the upper sources of the Wadi Al-Tharthar basin, specifically within the southeastern slopes of the Sinjar fold. 20 '49 ° 41 - "9 '10 ° 42) east, see map (1). As for the area, the total area of the area is (369.14) km2.



Map (1) The location of the region in Iraq

Source: From the researcher's work, relying on the Ministry of Water Resources, the General Authority for Survey, the administrative map of Iraq,1000000:1 scale, Baghdad, 2000, using the program (Arc GIS 10).

the study data:

The study relied on the data of the satellite (Landsat 8), as shown in Table (1): -

The satellite	Precision	Date	Raw	path	sequencing
Land sat 8	30×30	2019/4/20	35	170	1

Table (1)
Characteristics of the spatial data used in the study

Software:

A set of modern computer programs have been used as shown in Table (2):

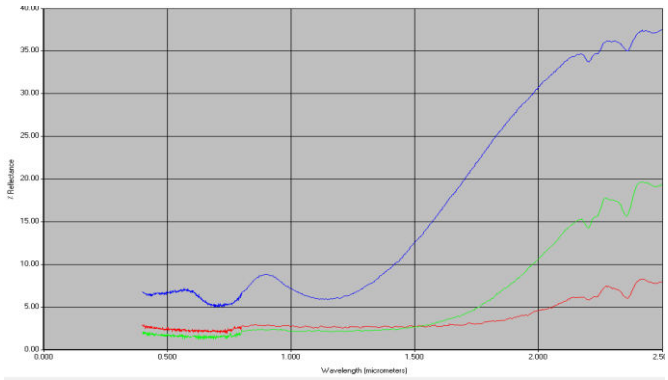
table(2)
Software used in the study and its work

sequencing	Applications	Program name
1	Derivation, data analysis and mapping	Arc GIS 10.4
2	Land sat + 8 data debugging and merging	Erdas Imagine 14
3	Derivation of temperature and humidity values	Geomatica 2015

Spectral reflectivity properties of rocks:

The most important feature of the satellite (Landsat 8) visuals is that it gives the visible and the near and medium infrared part of the electromagnetic spectrum valuable information about rocks as a result of changes resulting from electronic processes and vibration (Daghestani 2003).

Within this field, three bands were used with the candidates represented by the third, fourth and sixth bands, and on the basis of that the results were interpreted according to Figures (1, 2, 3) and according to the wavelengths of the minerals contained in the rocks as shown in Table (3), which is limestone Sand and clay (Hunt, GR, and Salisbury JW, 1976).



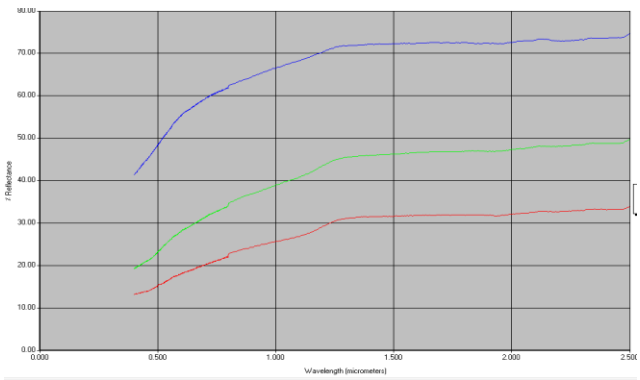


Figure (1) The wavelength of carbon metal Figure (2) The wavelength of carbon metal

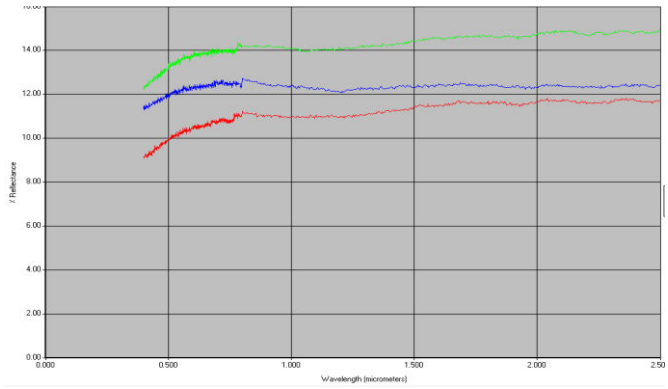


Figure (3) The wavelength of carbon metal
Source: From the researcher's work based on data (8 Landsat) and using the Erdas Imagine 14 program.

Table (3)
Absorption channels between (0.3 - 2.5) µm

(Wavelength (µm	Metal
2.35 – 1	Carbonate
2.3 – 0.5	Clay
2.4 – 0.5	iron

Source: Nabil Sobhi Al-Daghestani, Remote Sensing: Fundamentals and Applications, Al-Balqa Applied University, Dar Al-Manaraj for Publishing and Distribution, first edition, 2003.

Spectral reflectivity properties of soils:

The physical properties of soil constituent materials affect the nature of the interaction of rays with soil, so there are influential properties that must be taken into account when studying the spectral property of different soils or studying the same soil under different conditions (Hoffer, RM, Fleming, MD, Bartolucci, LA, Davis, SM, and Nelson, RF, 1980).

Therefore, to understand this, we can rely on different characteristics, and one of these characteristics is the moisture content of the soil, which is of great interest to us here to determine the type of weathering. GR, Salisbury JW and Lenhoff CJ, 1973).

In order to show the moisture characteristics of the soils of the region, the thermal spectrum was used, which is the most efficient method in this field, because the soils containing a certain amount of water are cold and dark in color, while dry soils appear on the contrary and have a lighter color in the thermal spectrum (3-15).) micrometers (Bartolucci, LA, 1976). As shown in Figure (4).

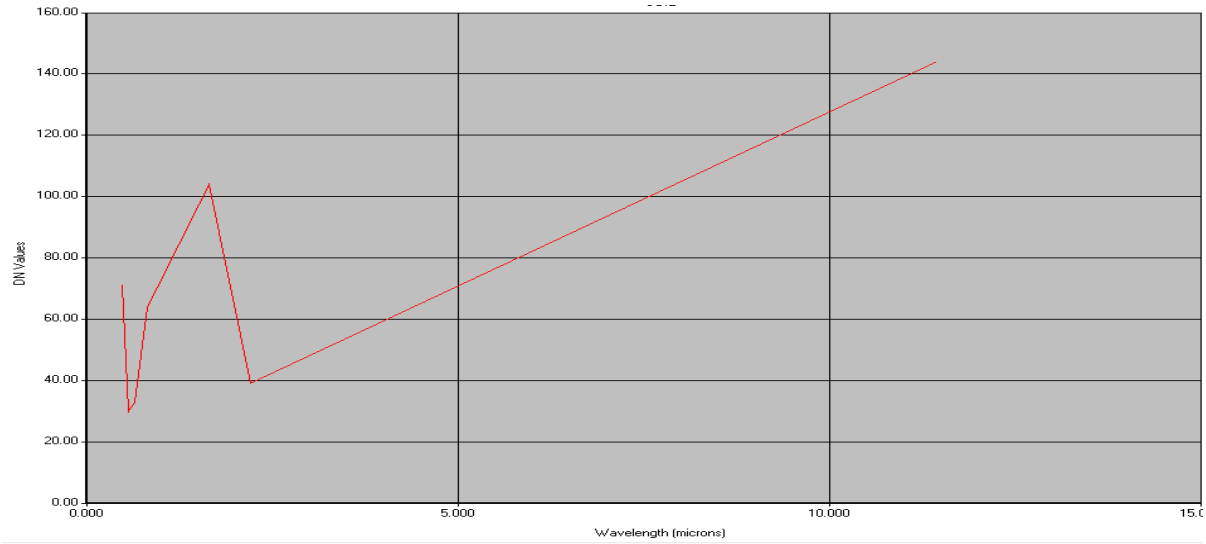


Figure (4) shows the soil of the region within the thermal spectrum (3-15) micrometers

Source: From the researcher's work based on data (8 Landsat) and using the Erdas Imagine 14 program.

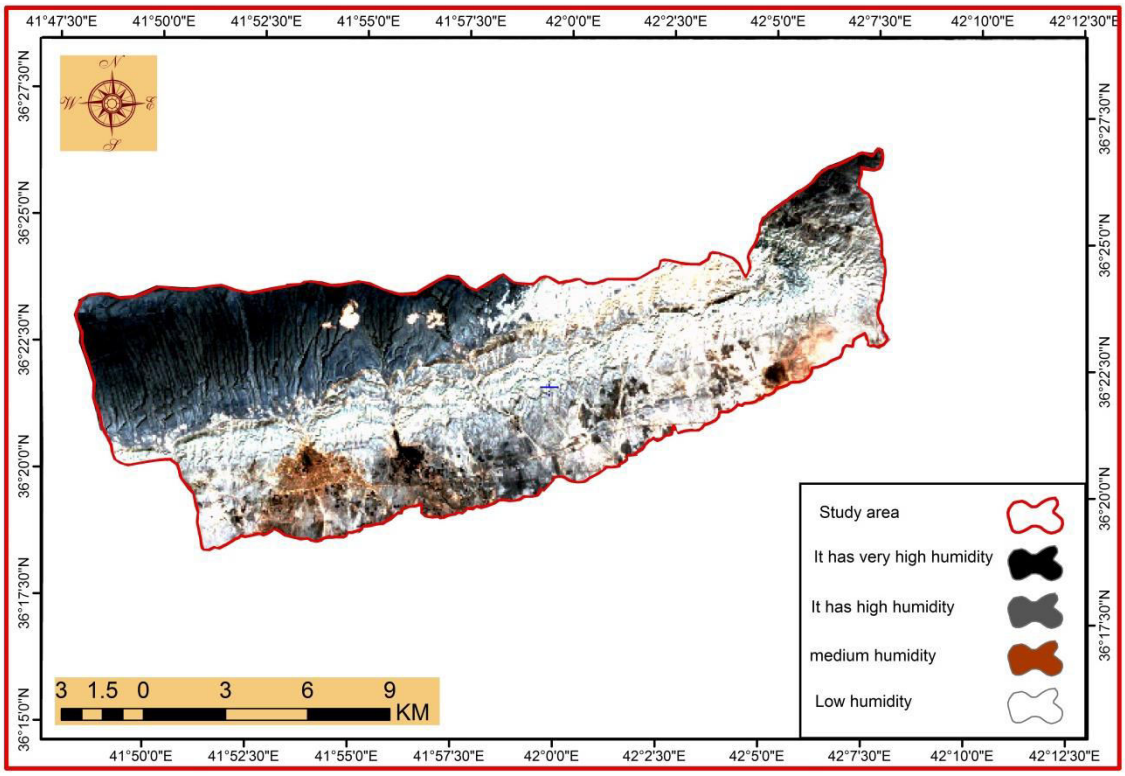
The study relied on the properties of spectral reflectivity within the wet season, which is as shown in the history of the space data above, and accordingly, its properties were determined as shown in Table (4) and Map (2), according to the following two-band equation (the Normalized Difference Moisture Index):

NDMI = (Band 5 - Band 6) / (Band 5 + Band 6)

Table (4)
Soil moisture areas by degree

sequence	(Area (km2	Class
1	97.14	Very high humidity
2	88.59	high humidity
3	64.27	medium humidity
4	119.14	low humidity
the total	369.14	-

Source: From the researcher's work based on (8 Landsat) data and using the Geomatica 2015 program.



Map (2) showing the distribution of areas according to soil moisture
Source: From the researcher's work based on data (8 Landsat) and using the Arc GIS 10.4 program.

As for the soil temperature, the data was processed using the Geomatica 2015 Erdas Imagine 14 software, by adopting the sixth range as the thermal range, and the conversion from the pixel value to radiation is carried out according to the reverse Planck method as in the following formula

Radiance = (lmax – lmin) / (ocalmax – ocalmin) 1254 × (DN – 1) + lmin

Since:

Lmax = maximum value of radiation.

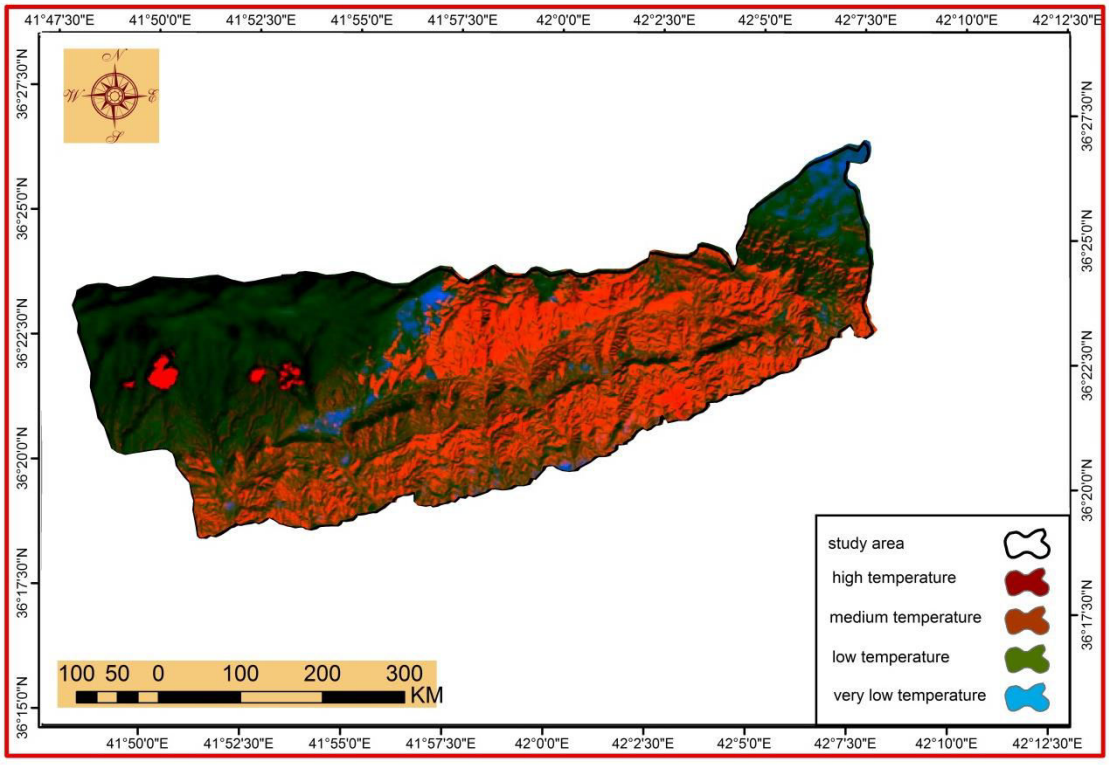
Lmin = Minimum value of radiance.

ocalmax = the highest pixel value.
Ocalmin = the lowest pixel value
To convert from radiation to heat, we follow the following equation:
Temperature = K2 /(Log) (K1/Radiance) +1
Since:
K2 and K1 are fixed values extracted from files attached to the (8 Landsat) visuals.
After these calculations, the results were included as shown in Table (4) and Map (3).

Table (4)
Soil moisture areas by degree

sequence	المساحة (كم^2)	Class
1	38.19	high temperature
2	198.10	medium temperature
3	67.49	low temperature
4	65.36	Very low temperature 65.36
the total	369.14	-

Source: From the researcher's work based on (8 Landsat) data and using the Geomatica 2015 program.



Map (3) showing the distribution of areas according to soil temperatureMap (3) showing the distribution of areas according to soil temperature

Source: From the researcher's work based on data (8 Landsat) and using the Arc GIS 10.4 program.

Conclusions:

1- Through the wave reflectivity of minerals in the region, it is proved that the dominant rocks are limestone.

2- The analyzes showed that the area belongs to the semi-humid areas according to the properties of temperature and soil moisture.

3- According to the above, it is proved that chemical weathering is the dominant characteristic.

Recommendations:

1- Keeping facilities and buildings away from places with high humidity, as it poses a danger resulting from the rapid decomposition of limestone.

2- The feet of the folds constitute places for the rise of groundwater, on the other hand, the upper slopes represent good drainage areas that are formed, which makes the feet of the folds the most attractive incentive for agricultural and industrial investment.

Sources and references:

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