PalArch's Journal of Archaeology of Egypt / Egyptology

MORPHO-MANIC PROCESSES AFFECTING THE SEDIMENTARY PLAIN IN ANBAR PROVINCE

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Alaa Awwad Rajab Salih, Asist. Prof Dr. Waleed Hanosh Hamed, Morpho-Manic Processes Affecting the Sedimentary Plain in Anbar Province -- Palarch's Journal of Archaeology of Egypt/Egyptology 19(1), 1593-1608. ISSN 1567-214x.

ABSTRACT:
The research dealt with Morpho-manic processes affecting the sedimentary plain within Anbar province, as the geomorphological study of the region was based on field study, maps and photographs, and the morphological processes represented by physical, chemical and life changes, which clearly influenced the preparation of surface materials for subsequent geomorphological processes have a prominent and important role in changing and altering the forms of the earth's surface, The climatic processes included physical weathering, which was represented by thermal change and weathering due to frost, saline weathering and natural weathering by living organisms, chemical weathering, which consisted of watering, coding and oxidation, as well as life weathering. The main factor that has stimulated these processes is the climate within the region, which has a semi-dry to dry climate, as well as the extent to which sedimentary rocks respond to these processes because of their uneven rigidity.

INTRODUCTION:

Morpho-manic processes have included physical, chemical and life changes, and all have clear effects in the preparation of surface materials for subsequent geomorphological processes that have a prominent and important role in altering the forms of the Earth's surface.

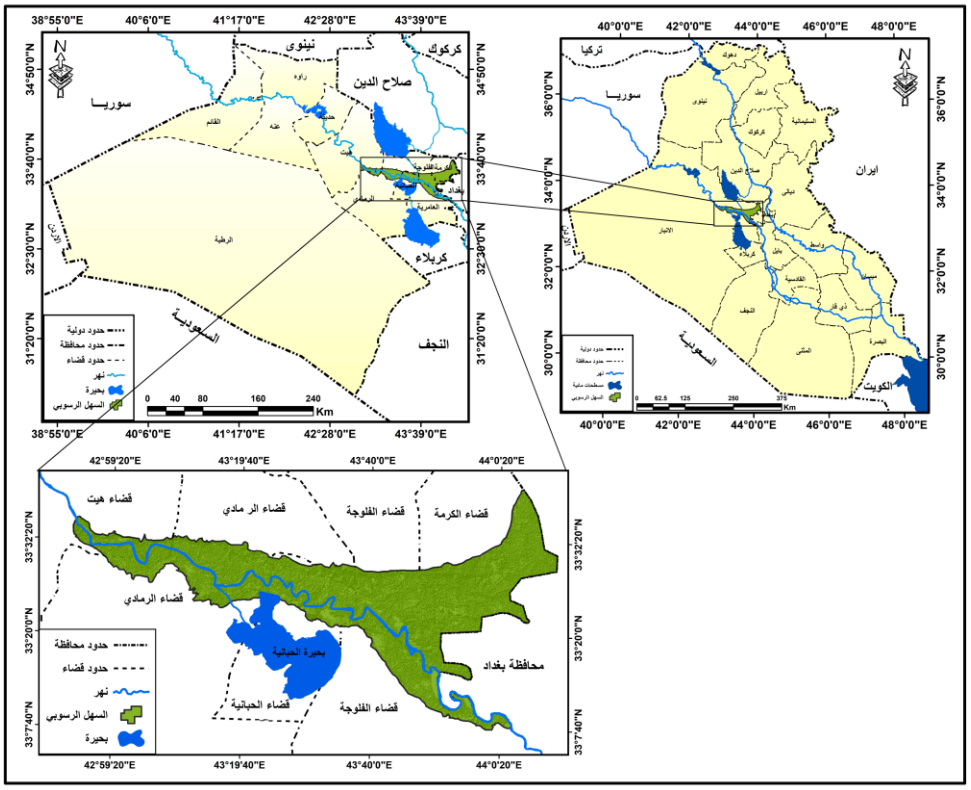
This is one of the appropriate climates for the activation of these processes, as well as the extent to which sedimentary rocks respond to morphomic processes due to their unevenness, which alter the forms of the Earth's surface.

Research problem: Have morphometic operations affected ground forms within the sedimentary plain within Anbar province?
Research hypothesis: The research assumes the presence of morphous effects that have altered and altered terrestrial shapes within the sedimentary plain range.

Research objective: The research aims to detect the impact of morpho morphological processes on terrestrial forms, which is the result of the interaction between climatic and geomorphological processes.

Study area location: The study area is located in western Iraq, and includes the north-eastern part of Anbar province, extending from the southeast of hit city to the northwest, to the southeast of Fallujah, and its astronomical location is located between two latitudes (49˚33-7=-35˚33-39=) north, and between two length lines (50˚42- 52=-13˚44-9=) east, as in map No. 1.

Map No. (1) Location of the study area from Iraq and Anbar province



Source: Republic of Iraq, Ministry of Water Resources, Directorate of Public Space, Map of Iraq and Anbar, 2001, Scale (1:1000,000).

First Chapter: Weathering Processes

Weatherization is defined as the process of dismantling, destroying and degrading rocks, and is present in their original natural sites in chemical, physical or life ways. The effect on rocks, and introduces with it another type of weathering which is the life-star weathering of the effect of living in rocks[1].

[1] Abdullah Salem Al-Maliki, Basics Geomorphology, Faculty of Arts, Basra University, First Edition, 2016, p.119.

Geomorphological Importance of Weathering Processes:

Weatherizations of different types have contributed to their apparent impact on the earth's forms in the study area, as weathering processes gain geomorphological importance through their role in preparing rock materials for the processes of sculpture, transportation and sedimentation that contribute to the construction of applicable sedimentary rocks, and this importance can be illustrated by the fragmentation of rocks, the formation of soils and solid crusts and the construction of some forms of land and the geomorphological importance of the weathering processes in the study area by:

A- Preparation of rock materials for erosion and transportation: Various erosion and transport factors, such as rivers and winds, transport the rocky materials resulting from the weathering of the rocks so that in terms of size and weight they are commensurate with the characteristics of these factors at their sites, as a force of traction and speed, which influenced the remnants of the ground shapes within the study area[1].

B- Soils and hard crusts: Soils are produced by weathering processes of both mechanical and chemical types, but the properties of the resulting soils vary according to the quality of the weathering. Either the soil forms metal granules or rough rock crumbs similar in its chemical properties to those of the mother rock, or to be in the form of soft metal chemical compounds, and differ in their chemical properties from those of the entire mother rock, In the first case, soil is caused by mechanical weathering and is incomplete or medium-sized, i.e. low fertility. In the second case, the soil is produced by chemical weathering, and is mostly regional, i.e. highly fertile, which invests in different areas and extensions within the study area.

C- Terrestrial forms resulting from weathering: Weathering processes contribute to the emergence of special terrestrial forms, varying according to the quality and rate of weathering (mechanical, chemical, vital), these ground forms are exfoliation domes resulting from mechanical peeling that are active in dry regions, rocks or cardiac gelams, isolated hills, carst pits, cliff evolution, and landslides[2].

Factors Affecting Weathering:

Significant factors overlap in weathering processes, their activity and effectiveness, as weathering processes result from the interactions of all environmental factors that interfere with their effects on the earth's shape , but at the same time leave one to stand out as a key influencer. The impact in the study area is:

A. Mineral composition of rock materials: The mineral components of rocks vary from region to region within the study area, as the minerals that make up the rocks or soil represent the theatre in which the weathering processes carry out their various activities, and this is observed through the ground forms in the

[1] Hassan Ramadan Salama, Geomorphology Origins, University of Jordan, First Edition, 2004, p.111.

[2] Hassan Ramadan Salama, Geomorphology Origins, Former Source, P115.

study area, which the mineral content has had an impact on the composition of its terrestrial forms.

B. Climate: The atmosphere affects the weather through temporal and spatial changes in weather and climate elements, particularly temperature, rainfall and wind, as these elements vary in different regions.

C. Topography: The topography of the earth's surface affects weathering processes through thermal variation and variation in the amount of precipitation due to decrease and rise from sea level as well as different direction of terrain and sunlight, as well as variation in the degree of decline of the earth's surface that leads to variety and varying rates of weathering processes, and the topographic nature of the study area has had a clear impact in determining the nature of the geomorphological effects of the ancient climate within this region.

D. Biosphere: Which includes both plants and animals that affect weathering processes.

E. Time: The time factor has had a clear impact on the nature of terrestrial forms and the effects of ancient climate have included these forms, as the minerals and rocks that make up them vary at the time they need to be fully analysed, and the susceptibility of minerals to spatial degradation varies according to prevailing environmental factors, the most important of which is climatic conditions.[1] Weatherizations are divided into three main sections:

First: Physical Weathering: Physical Weathering

Physical weathering means rock shattering into rock crumbs smaller than the original rocks, without any change in the chemical composition of the resulting rocks, and this type of weathering plays an important role in increasing the surface area of rock crumbs resulting from the destruction **of the original** rocks[2]. They are the processes of rock disintegration, fragmentation or decomposition while remaining in place[3], and are one of the least complex types of weathering because they are purely mechanical processes that do not involve the reactions or formation of new materials[4], a process that physically breaks rocks and includes physical weathering (expansion and contraction by the influence of solar radiation and temperature variation, frost crystallization, saline crystallization, and the action of living organisms).[5] There are a number of factors that contribute to the activation of the role of mechanical or physical weathering, which are summarized as follows:

Thermal Change:

The remnants of terrestrial forms dating back to the ancient climate in the study area were affected by the factor of thermal changes, as thermal change occurs

[1] Hassan Ramadan Salama, Geomorphology Origins, Former Source, P118.

[2] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P119.

[3] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Imam Mohammed Bin Saud University, Saudi Arabia, 1993, p.258.

[4] Wafiq Hussein Al-Khashab, Geomorphology, Faculty of Education, University of Baghdad, 1977, p.66.

[5] Taghlib Georges Dawood, Applied Earth Surface Shapes, Faculty of Education, Mustansiriyah University, 2002, p78.

when rocks in dry and dry areas are exposed to extreme heating during the day due to exposure to sunlight, and because they are barren and free of vegetation, the minerals that make up those rocks expand each according to their longitudinal expansion factor, and when temperatures in those areas decrease during the night, Where the daily thermal range is large, the minerals of these rocks are reduced by their contraction coefficients, and due to the inequality of stretching and shrinking coefficients of all rock-forming metals, the recurrence of this process leads to the disintegration and destruction of rocks[1]. The difference in the expansion and contraction of the rock due to the succession of heating and cooling, as the metals expand by heating as they shrink by cooling, each according to its longitudinal stretching coefficient. [2] However, some laboratory experiments and field evidence reduce the act of heating and cooling as a single factor in the fragmentation or peeling of rocks. In the Griggs experiment in 1936, the repeated heating of some cubes of granite rock at a temperature of 140°C and then cooled to a temperature of 30°C to 89,400 times, or the equivalent of repeated heating and cooling in a period (244) years that took three years of laboratory work, to any rocky break-up. In another experiment, the granite rock was introduced to (5000) a cycle of freezing (-12°C) and heating (20°C) without resulting in any obvious manifestations of rock fragmentation, but when these rocks were soaked with sodium sulfate solution (for 17 hours and at room temperature) and then dried for seven hours at a temperature (105°C)[3] they disintegrated after repeated heating and cooling (42) times. The factor of expansion and rock contraction due to thermal change, despite the multiplicity of factors leading to physical weathering, has an important role in these factors, but the factors that lead to the movement of rock-forming particles that disrupt the relationship and bond between rock components[4], as shown in Figure no. 1.

Picture (1) Shows Physical Weathering Due to Thermal Change in The Study Area

Source: Field Study on February 27, 2022

[1] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P120.

[2] Mohamed Sabri Mahsoob, Mahmoud Dhiab Radhi, Geomorphological Operations, Culture Publishing and Distribution House, Cairo, 1989, p.22.

[3] Hassan Ramadan Salama, Geomorphology Origins, Former Source, P130.

[4] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P67.

Frost-Induced Weathering:

The effect of frost is one of the most influential physical weathering factors, as the volume of water when frozen increases to about 9% of its previous size. Freezing water inside cracks, joints or pores in rocks increases volume, increases pressure and breaks down those rocks into small pieces. Temperatures allow the process of insemination and melting to be refined, and sedimentary rocks are more affected by this process than fire rocks due to large joints and cracks in them[1]. Freezing water leaking through vacuums and rock cracks causes rocks to break up due to the resulting increase in volume and a dependent increase in confined pressure, which also leads to low water freezing, due to the fact that the freezing of water begins at the top of the rock vacuums. This is equivalent to the pressure produced by a 15-ton granite block above each square inch. Freezing weathering produces angular rock crumbs that depend on the nature of the rock bed, but often up to a few centimeters and in some cases up to a few meters. In order to be active, therefore, an appropriate amount of water must be available, most of which will be leaked into the rocky spaces as well as appropriate thermal conditions ranging from freezing to melting daily or quarterly[2].

Saline Weathering:

Saline weathering processes in the study area are formed from one place to another and from time to time, as the saline weathering process is activated as a result of the crystallization of water-dissolved salts when they evaporate. This depends on the availability of a source of salt water such as groundwater or seawater through leakage deep into the rock, soil or above the surface during the tide process, in addition to the high temperatures and the availability of rocky materials or soils of high porous, and these conditions prevail in dry areas. It carries salts into rock pores, and salt crystals break up rocks through the pressure they cause in confined rock spaces and pores resulting from increased size[3]. Which exceeds what many metals and rocks achieve when exposed to high temperature, such as granite or limestone, and the action of salt crystals differs from their snowy counterparts in that they continue to activity when formed by high temperature, and that any decrease in temperature does not lead to melting unless the right humidity is available, and the daily thermal changes characterized by dry regions increase their activity, Tavoni pits are one of the most important results of saline weathering[4]. Saline solutions resulting from the melting of some components of the rock with rain water or otherwise, if they find their way to the apparent fractures on or during the rock surface or even to the boundaries between granules and particles forming rocks, lead to a break-up of the rocks so that the components of these rocks then take the form of

[1] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P120.
[2] Hassan Ramadan Salama, Geomorphology Origins, Former Source, R131.
[3] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P121.
[4] Hassan Ramadan Salama, Geomorphology Origins, Former Source, R132.

individual granules[1]. It is observed in nature, Certain processes also appear to be important in dismantling rocks with salts. [2] As shown in Figure2.

Picture (2) Showing Saline Weathering In The Study Area

Source: Field Study on February 27, 2022

Natural Weathering by Living Organisms:

This type of weathering has clear effects within the ground forms in the study area, as organisms can break rocks mechanics in different ways, plant roots penetrate into rock cracks and the growth of those roots helps to expand these cracks. This helps to break up the rock[3]. Various human activities, including mining and road construction in the study area, have also contributed to the process of rock fragmentation and soil removal, and the more tree-type plants or shrubs with strong wooden roots play a greater role in automated weathering, expanding and weakening rock cracks[4]. Plant roots embedded and embedded through the voids and rock cracks are increasingly stressed by the increased size of their growth, and the growth of plant roots in confined spaces is a major factor in the fragmentation and cracking of rock detectors where plants or trees are found in-depth roots. [5].

Second: Chemical Weathering

Chemical weathering comprises a range of complex chemical reactions between minerals and chemical compounds, performed by various substances such as

[1] Cook.and Smalley,T.J. Sait weathering in deserts, Nature, vol.220,p.126.

[2] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P[70].

[3] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P[121].

[4] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y[263].

[5] Hassan Ramadan Salama, Geomorphology Origins, Former Source, R[134].

water, oxygen, carbon dioxide and acids, which, when influenced in rocks, change minerals and chemical composition[1]. Chemical weathering includes specific processes that vary clearly in the type of changes to which they are associated and the substances they produce, yet there are general results shared by these processes for the chemical weathering affecting the study area, these results are:

A. All processes increase the size of the substance affected and thus lead to internal pressures in the substance.
B. The materials that result from them are generally relatively low in density.
C. Decrease in the size of the granules or atoms that make up the material, resulting in an increase in the visible area of the material relative to its size.
D. The formation **of new metal** compounds[2].
E. Therefore, chemical weathering is a process of chemical decomposition of rocks, i.e. the chemical composition of rocks changes, and includes processes (hydrogenation and water-water dilution, carpenton melting, oxidation[3], and the most important of these processes involved in chemical weathering are:

The Process of Filling:

Chemical degradation of certain minerals is meant by water, and it is this particular process that leads to the degradation of feldspar minerals, one of the most important pyrotechnic compounds, and although this degradation usually occurs in pure water, its speed would be greater if the water was carrying some carbon dioxide, and this watering process is the main process responsible for converting the metal of the flaspar into clay and qualin[4]. Watering means taking water as a chemical element because most of the minerals created by rock disintegration contain a high percentage of water, and one of the most common of these minerals is clay, which is caused by feldspar dilution[5]. It means the chemical reaction between water and rock minerals, and the effectiveness of water lies in the completion of hydrolysis in hydrogen ions that can permeate and break up the crystalline composition of silicate. Potassium flaspar reacts to water, which in turn contains amounts of carbonic acid, and a new mineral, the qualin, is produced from the reaction as in the following equation:

$$2KALSi_3O_8+2H_2CO_3+9H_2O \rightarrow AL_2Si_2O_5(OH_4)+4HSiO_4+2K(HCO_3)$$

(botasium piccarbons + silic acid + water → occilin + carbonic acid + potassium flaspar)

[1] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P122.
[2] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y267.
[3] Taghlib Georges Dawood, Earth Surface Shapes Science, Former Source, Y78.
[4] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y269.
[5] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P73.

Thus, one of the solid fire granite minerals has been converted into calalin, a metal that cannot resist erosion factors, particularly running water[1]. It usually results in bulging metal or rock, which contributes to the exposure of the rock to peeling or granular fragmentation[2].

The Process Of Inking:

Carbon is meant to melt some rocks, such as limestone rocks, into dissolved water with carbon dioxide, and this usually occurs when the rains carry some carbon dioxide from the air and turn into very diluted carbonic acid, but it can still convert calcium carbonate into water-soluble calcium bicarbons, but it is known that carbonate is not a fixed mineral. Therefore, it returns to deposition again after evaporation of dissolved water[3], and this process includes the union of carbon dioxide in the atmosphere or soil with water, consisting of carbonic acid, which dissolves some of the elements in the rocks and turns into carbons with great meltability, as in the melting of limestone due to water containing carbonic acid, It is transformed into bicarbons that are many times more meltable than limestone, and all the interactions above are clearly impacted in the ground forms within the study area, as in the following equation:

$CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$
(calcium biocarbon → carbon dioxide + water + limestone)

It should be noted that pic carbons are transmitted as they melt in the water, leaving other substances that do not melt at the same speed in place, and in this way most karst forms and caves have been formed[4].

Oxidation Process:

Oxidizing the oxygen union is meant with some minerals such as iron or materials that are included in their composition. When these substances are exposed to air and moisture, the iron unites with oxygen and turns into iron oxides that are brown or reddish, and these oxides are weakly resistant and quickly crumble. If mixed with rocks or soil, they dye them in color[5]. Oxidation also occurs when oxygen in the atmosphere combines with rock-forming minerals, and oxidation is activated where in rock and soil vacuums there is moisture and air in appropriate quantities, resulting in rock discoloration and oxidizing soil in red, and in general the oxidation process is weak in the fiery rocks and mutant rocks and increases its activity in sand, limestone and clay sedimentary rocks. For example, these rocks make up a large proportion of geological formations within the study area, the weathering process increases very significantly. [6] -

[1] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P122.
[2] Hassan Ramadan Salama, Geomorphology Origins, Former Source, R134.
[3] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y268.
[4] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P124.
[5] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y268.
[6] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P123.

$Fes_2 + 2O_2 \longrightarrow Feso_4 + S$
(sulfur + iron sulfate $\longrightarrow$ oxygen + perret)

Laboratory experiments on rocks and non-rigid substances in particular have shown that the depth and severity of oxidation increases with the age of rocks, and that this increase is in fact a slow process within the geological time range, and in fact we observe oxidation effects on rocks above all others[1].

Third: Bio Weathering

This type of weatherization clearly affects the study area and represents a type of weathering that overlaps with physical and chemical weathering, otherwise it is appropriate to study both species together, the physical effect is mentioned in a simple way when talking about the role played by plant roots in addition to the effect of animals that work on the drilling of the earth, as indicated by the chemical effect Life when talking about the phenomenon of acquiring some metal ions. The main effect of plants and animals is reflected in the increase in carbon dioxide in the soil, through the breathing process, as this gas increases to a few times what it is in the gaseous atmosphere, so the role played by carbon dioxide comes through the life cover and not through the gaseous casing. In addition, some microscopic animals interact with rock-forming metal ions, including chemical breeding bacteria that oxidize certain minerals such as sulphur and iron, as well as the effect of animal waste that is in fact capable of irrigating limestone rocks[2]. Microbiology is also present in the soil in large quantities, especially in temperate humid climatic regions, and the presence of different organisms in the soil is a complex substance known as organic matter, and these dissolve in water, which is acid-low-concentration, which in turn converts insoluble minerals into agricultural solutions that are easy for the roots to absorb, and bacteria store the aortic matter and convert sulphate into sulphide[3].

Second Chapter: Processing Operations

Erosion has affected the types of erosion of water and wind erosion or both in the impact on the ground forms in the study area, as the word erosion is a comprehensive term given to the various ways in which moving factors obtain and transport rock fragments, and the definition of erosion may be limited if we are to be very precise as subjecting the material to a moving factor and therefore transport is not part of it[4]. Erosion involves many processes, consisting of carving rocks and moving their materials from their places, which means that they perform two opposing functions, one of which is detection and demolition by carving rocks and transporting their materials, and the second is construction by sedimenting materials transported in new places[5]. The erosion process is

[1] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P73.
[2] Wafiq Hussein Al-Khashab, Geomorphology, Former sourceAM77.
[3] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P124.
[4] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P41.
[5] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y271.

prepared from distinct geomorphological processes that leave clear and significant effects on the earth's surface, as over time it changes the contours of the surface continuously and non-stop, and is to varying degrees depending on the forces causing it and the environment in which wet or dry occurs, and the work of erosion varies from place to place influenced by the following:

A- The nature of the forces causing nudity, whether it be water, wind or snow.
B. The type of formations that are exposed to erosion are solid or fragile.
C- The nature of the decline in the region.
D- Type and density of vegetation.
E. Moisture of formations that are exposed to erosion [1]

The impact of these factors mentioned above has had a clear impact on the nature of the ground forms in the study area, which increase in frequency or decrease depending on the location of the area within the study area, the nature of its decline and the type of vegetation prevailing in it, the most prominent of which are the types of erosion within the study area:

First: Rain Erosion:

This type of erosion occurs in areas where rain falls in the form of severe rain showers and large drops, and something like a bomb occurs when it hits the ground as it breaks up the granules of the coherent soil and turns them into single grains jumping with the parts of the rain drop scattered towards the sides, and this is clearly shown on the slopes as the scattered parts move down more than the direction upwards due to the force of gravity, causing the flow of water downwards to the cliff. The strength of the impact of rainfall on the type of soil depends on the impact of the soil as it increases its impact on disassembled soils and decreases in coherent soils, as well as in areas without vegetation, and its impact decreases in areas where there is a vegetation cover that weakens the strength of the rain, increases soil cohesion and reduces the speed of flow, as well as the effect of decline, the greater the impact and vice versa.[2] As in picture 3.

Picture (3) Showing Rain Erosion in The Study Area

Source: Field Study on February 27, 2022

[1] Khalaf Hussein Ali al-Dulaimi, Applied Earth Shape Science (Applied Geomorphology), Anbar University, Iraq, First Edition, 2012, p.289.
[2] Khalaf Hussein Ali al-Dulaimi, Applied Geomorphology (Applied Earth Shape Science), Eligibility for Publishing and Distribution, Amman, 2001, p.135.

Second: Wind Erosion:

The wind strips the surface of the earth when it is frictiond, activates its work when it increases its speed and disturbs the air currents, and becomes able to lift the earth's fragments upwards. [1] Winds are the most important climatic factor that directly contributes to the formation of the earth's surface and its impact is clear in the desert regions because the wind in these regions is strong most of the time and because its land is exposed to the surface is not protected by a vegetation cover, so the wind has become responsible for the formation of many topographic phenomena scattered there, and includes the role of wind in forming the surface of the earth on four specific processes: Sculpture or wild, refinement in a simulated manner, and the atomic transportation, and genealogy[2]. Land forms and geomorphological processes resulting from wind action are associated with wind characteristics that are flowing or mobile air as a result of different atmospheric pressures between adjacent locations, and air usually moves from high-pressure areas to low-atmospheric pressure areas, and the greater the difference in these atmospheric pressures, the faster and more severe the wind, as well as the location of atmospheric pressure systems identify different wind directions that classify the wind accordingly[3]. The wind is distinct from the rest of the forces of erosion as free movement and changing direction, and its work is clear in desert and dry areas that are subject to large-scale weathering operations, working to disintegrate the components of soil and surface rocks, which makes it easier for the wind to strip them of discharges, atomics, refinement and land, and shows its effects on human beings and its various activities, especially in the Arab world, where desert areas occupy a large proportion of its land up to (85)% of the total area of its area. Most settlement centres are located within this range or under the influence of the desert environment of heat, coldness and pollution[4]. Wind sculpture is one of the main demolitions carried out by the wind and its effect varies from place to place depending on the strength of the wind and the amount of dust and sand it carries, these materials, especially if they are rough sand, are the tools that help the wind cool the rocks, and the effect of this process in homogeneous rocks differs from that of heterogeneous rocks, If the rocks are homogeneous in composition and hardness, the sculpture process leads to their hardness and may in some areas lead to the refinement of large areas of the earth's surface, but if they are heterogeneous, the sculpture process erodes soft parts before solid parts, so these rocks take different forms depending on their composition, and the sculpture process is particularly strong. At about one foot of the earth's surface, at this level the wind is strong and retains most of its load of sand, especially rough sand, and the higher the height, the lower the load, the smaller the sand size, and therefore the reduced wind's ability to sculpt. Below this level, the friction of the wind on the ground reduces its speed and thus reduces its ability to land and sculpt, although its load of sand is greater than at higher

[1] Taghlib Gerges Dawood, Applied Earth Surface Shapes, Former source, r[141].

[2] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P[219].

[3] Hassan Ramadan Salama, Geomorphology Origins, Former Source, R[258].

[4] Khalaf Hussein Ali al-Dulaimi, Applied Earth Shape Science (Applied Geomorphology), Former Source, P[318].

levels[1]. Another factor that greatly limits the wind's ability to sculpt is the so-called roughness and capacity of the surface, the more rough the surface, the greater its resistance to wind and at the same time affect the movement and speed of [the] wind[2]. Dry areas are characterized by low air humidity and low rainfall, which has been reflected in the low density of natural vegetation, so they are the scene of geomorphological wind activities such as erosion, transportation and precipitation that contribute to the formation of terrestrial forms. The wind's action depends on its speed, direction, frequency of gusts and the amount of rock crumbs it carries.

Atomicism:

It is the[3] removal of the weathering product (surface rock debris) due to horizontal wind movement, called the blowing process. This occurs when the wind carries sand granules and rock fragments, whether derived from flood or ice deposits or coastal sands, and transports them from their original locations to other places depending on the speed of the wind and the extent to which they can carry these fragments, where this ability increases when the drought intensifies and the surface consists of disjointed incoherent sand and lacks or decreases natural vegetation.

Wild (Refinement):

This process occurs when the wind refines the rock surfaces by monopolizing the grains of sand and other fragments of those surfaces, and the effect of this process increases in the levels close to the surface of the Earth, which are no more than one meter high, and the degree of rock hardness affects the process, as soft rocks are more affected than the very hard rocks.[4] As in picture 4.

Picture (4) Showing Wind Erosion in The Study Area

Source: Field Study on February 27, 2022

[1] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, ٢٧٢.

[2] Mohamed Sabri Mahsoob, Natural Geography Foundations and Modern Concepts, Faculty of Arts, Cairo University, Arab Thought House, 1996, p.99.

[3] Asbahia Younis Al-Mohsin, Geomorphology Forms of the Earth, Faculty of Education, Mosul University, First Edition, 2013, p.169.

[4] Abdullah Salim al-Maliki, Basics of Geomorphology, Former Source, P243.

Third Chapter: Deposition Processes

Wind deposition processes play an important and effective role in influencing the ground forms in the study area, the more material they deposit and thus greatly their role in construction, and it is customary that the wind deposits its load gradually so that the rough sand deposits first, then the soft sand and then the dust, The fine dust continues to hang on to it for a long time[1]. The flow of erosion also has a significant impact on various projects and activities, particularly wind-borne sand soils from desert areas to different human ammonia centres[2].

First: Wind Deposition:

The wind exerts its geomorphological effect in the study area through erosion, transportation and sedimentation of surface materials and according to the nature of the conditions prevailing in the region, which increase or reduce wind deposition processes in the study area, and these processes may be integrated together in nature, especially in dry and semi-dry areas, as sand brought by wind contributed to the degradation of agricultural land, It also threatens residential areas and vital and industrial facilities[3]. Wind deposits its load when its speed decreases due to the length of distance it travelled and its distance from high-pressure source areas and its entry into areas with low air pressure, or due to friction with a topographic or plant barrier, and if the wind load of sand granules and other rock fragments increases to suit its capacity in the transport of that load, it deposits excess quantities of energy. [4] Sand movement and sedimentation are carried out in desert areas indiscriminately, but are found in specific patterns that are more associated with wind than topographic appearances[5]. The role of the wind is to deposit or build in different forms, the most important of which are:

1- Some types of soft clay soils, such as lois soil.
2- The beach dunes that extend along many of the sea coasts, consisting of white lime sands formed as a result of the deposition of layers of lime around the fine grains of continental sand transported by the wind from land, and the wind plays the main role in distributing them and assembling them in dune form.
3- The formation of desert dunes.

In fact, these accumulations are the most important geomorphological manifestations that illustrate the significant role that the wind has in shaping the Earth's surface[6].

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[1] Wafiq Hussein Al-Khashab, Geomorphology, Former Source, P224.
[2] Khalaf Hussein Ali al-Dulaimi, Applied Earth Shape Science (Applied Geomorphology), Former Source, P440.
[3] Taghlib Georges Dawood, Applied Earth Surface Shapes, Former Source, Y138.
[4] Abdullah Salem al-Maliki, Basics of Geomorphology, Former Source, P251.
[5] Mohammed Sabri Mahsoob, Natural Geography Modern Foundations and Concepts, Former Source, P104.
[6] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's SurfaceFormer source, p.278.

Second: Water Deposition:

Because of its location within the tectonic regions of Iraq, the study area is significantly affected by water deposition processes, which have clearly defined effects in the study area, as the sediments that dump running water above the ground are called flood deposits, and they vary greatly depending on the size of the sediment granules and the type of rocks from which they break up, and that the water can transport large quantities of sediments. The river's load of these materials depends in particular on the size of the river, while the size of the grains that the river water can carry depends on the speed at which these waters run, which is why flood deposits are usually distributed in a special order depending on the speed of the flow of water that they have deposited, when rivers descend on the sides of the land and the high plateau rims, they carry with them a lot of glammed and pieces of crushed rocks and gravel, But when it reaches the plain areas, its speed decreases and it has to drop its load, first throwing heavy objects near the base of the plateau rims and then throwing the lighter materials, the lighter and so on, and the clay deposits and the fine clay may remain stuck in the waters of the river or valley for several tens or hundreds of kilometers until it reaches the mouth of the valley or river Even if the river itself is short and ends at an internal depression, the materials suspended by its water are deposited above the bottom of the low in order, so that the deposition begins first with heavy materials and then the lighter, lighter materials are deposited on top of it[1]. Rivers transport large quantities of sediment and receive it in their estuaries and the volume of sediments transported between (15,000-20,000) million tons per year is estimated, but the construction of dams has changed the patterns of sculpture and sedimentation carried out by running water, because the restriction of water to dams has reduced the volume of running water behind the dam and reduced its speed and capacity to transport sediments that are clustered in front of the dam. It begins to flow from a distance of hundreds of meters from the body of the dam and lasts for tens of kilometers, where the thickness of the sediment reaches a few meters, so the coarse granules are deposited first and then the soft granules, and control the amount and size of the sediments three factors:

1- The riverbed has receded.
2- The size of the granules.
3- The size and shape of the dam.

By applying these factors, the amount of sediment is reduced if the waterway is steep, and the river transports soft atoms, while the sediment increases if the river is low and transports rough deposits, and the sedimentary energy of the rivers increases if the dams are not equipped with drainage vents, where they are deposited (99%) of the total load transported, while the sediment rate (10) is in dams with openings[2].

[1] Abdul Aziz Tarih Sharaf, Natural Geography Forms of the Earth's Surface, Former Source, Y[296].

[2] Taghlib Georges Dawood, Applied Earth Surface Shapes, Former Source, Y[118].

RESOURCES:

Al-Dulaimi, Khalaf Hussein Ali, Applied Earth Shape Science (Applied Geomorphology), First Edition, Anbar University, Iraq, 2012.

Al-Dulaimi, Khalaf Hussein Ali, Applied Geomorphology (Applied Earth Shape Science), Oman, Eligibility for Publishing and Distribution, 2001.

Al-Khashab, Wafiq Hussein, Geomorphology, Faculty of Education, University of Baghdad, 1977.

Al-Maliki, Abdullah Salem, Basics of Geomorphology, First Edition, Faculty of Arts, Basra University, 2016.

Al-Mohsen, Asbahya Younus, Geomorphology Forms of the Earth, First Edition, Faculty of Education, Mosul University, 2013.

Mahsoob, Mohammed Sabri, Natural Geography Foundations and Modern Concepts, Faculty of Arts, Cairo University, Arab Thought House, 1996.

Cook,and smalley, T.J.sait weathering in deserts,Nature,vol.220,p.126.

Dawood, Taghlib Gerges, Applied Surface Shapes, Faculty of Education, Mustansiriyah University, 2002.

Mahsoob, Mohammed Sabri, and Mahmoud Diab Radhi, Geomorphological Operations, Cairo, Culture Publishing and Distribution House, 1989.

Salama, Hassan Ramadan, Geomorphology Origins, First Edition, University of Jordan, 2004.

Sharaf, Abdul Aziz Tarih, Natural Geography Forms of the Earth Surface, Imam Mohammed Bin Saud University, Saudi Arabia, 1993.