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Terrestrial Shapes in Habbaniyah District

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ABSTRACT

The research aims to study the terrestrial shapes in Habbaniyah district, latitudes (0 "12" 33 °, 0 "28 '33 ° N), and longitude (0" 12 "43 °, 0" 36' 43 ° E). As the region is one of the dry areas in Anbar Governorate within the western plateau in Iraq. The research includes problem, hypothesis, importance, objectives of the research, and the boundaries of the study area, and the research included the terrestrial shapes in the Habbaniyah district, which included six varieties, including structural forms, hydrophobic forms, water sedimentary forms, and wind sedimentary forms in addition to the shapes resulting from the action of the organisms (human, animal, plant).

Introduction

Geomorphological studies mean investigating the shapes of the earth's surface and the factors that helped in its formation and development, as it is concerned with the spatial distribution of various geomorphological phenomena and the reasons for this distribution. Its fields include the topics of the geographical distribution of the surface features of the earth, the study of its origin and the stages of its development and the geological times in which it was formed. The areas characterized by the geomorphological phenomena and shapes have received the attention of a large number of specialists. Therefore, the researcher found the necessity to conduct a geomorphological study of the Terrestrial Shapes of the Habbaniyah district due to the characteristic of this area in terms of the presence of forms. Earth resulting from various geomorphological processes.

Research problem

Every research must have a basic problem that will be the main motivation for the research, so the research problem can be identified with the following questions:

1. What are the geomorphic factors that helped form the terrestrial shapes in Habbaniyah district?
2. Does a variety of earthly shapes appear according to the nature of the force causing them?

Research hypothesis

The hypothesis is defined as an intelligent guess or conclusion that the researcher gets at and adheres to temporarily based on his scientific explanations and smart ideas related to the problem of the study, and based on this the researcher assumes that there are many terrestrial shapes that make up the surface of the earth in the Habbaniyah district, as there is a direct effect of factors Geomorphology in the process of forming these shapes.

Research goals

The research aims to identify the most important terrestrial shapes found in the region on the basis of the geomorphic processes that compose them.

Research limits

The study area is located in the central part of Iraq, southeast of the city of Ramadi and on the right bank of the Euphrates River within the administrative boundaries of Anbar Governorate, as is evident in Map No. (1) that shows this. On the one hand, the sedimentary plain on the other hand, and the boundary line between these two regions is unclear in some parts, due to the fact that the gradient in the gradient is minimal and imperceptible.

Astronomically: The study area is located between longitude (0 "12 '43 °, 0" 36' 43 ° E) and latitude (0 "12 '33 °, 0" 28' 33 ° N).

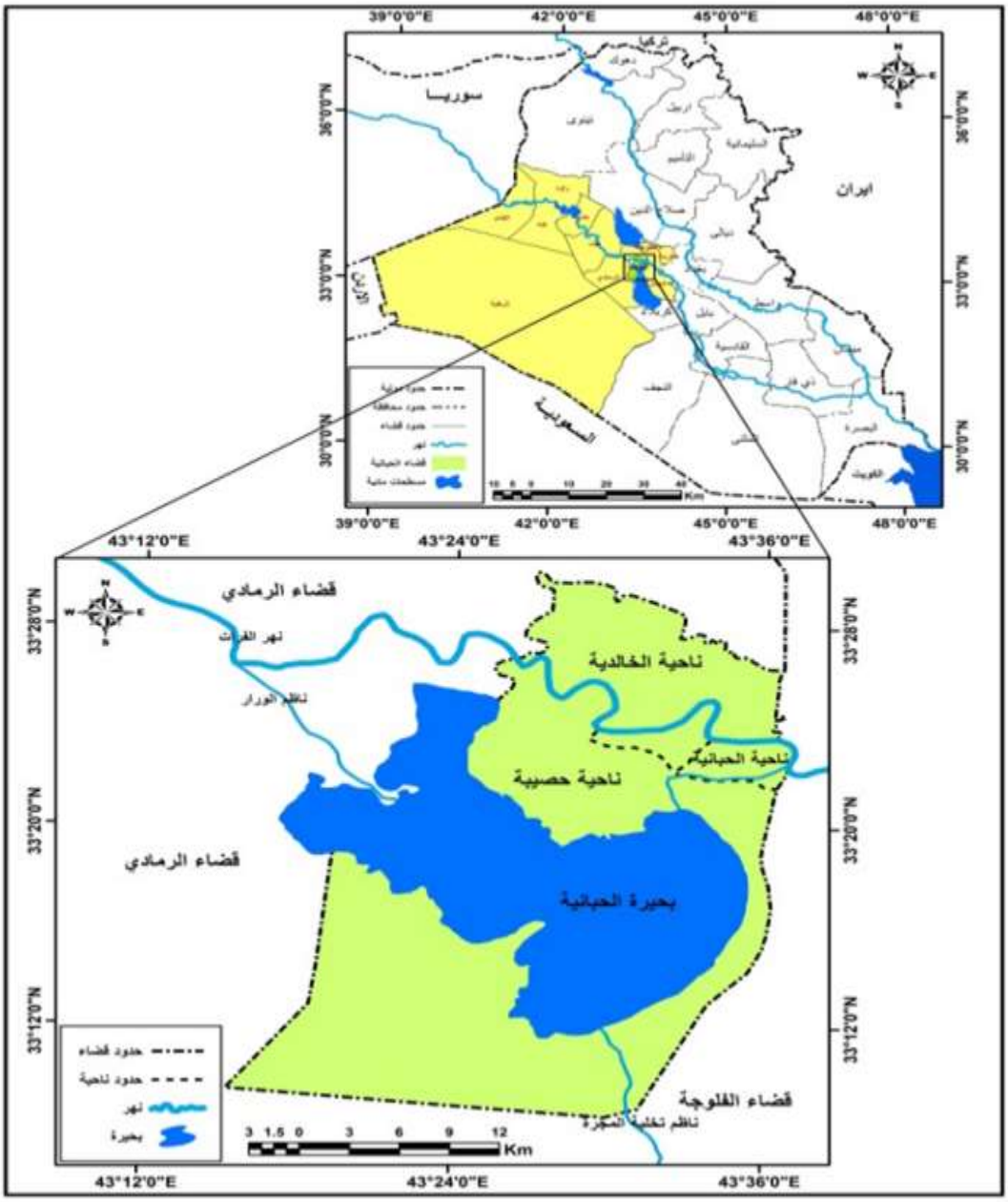
Terrestrial Shapes in Habbaniyah district

It is not possible to explain the earth shapes in the study area without examining the most important geomorphological processes that affected it, as these processes have a great role in bringing about clear changes to the features of the earth's surface, in the past and in the present. Earth shapes and the formation of some of them through the strength of the processes and the factor that affects them. These processes are represented by mechanical and chemical force, Among the most important operations that are active in the region are:

I. The geomorphological processes prevailing in the study area

It is not possible to interpret the earth shapes in the study area without examining the most important geomorphological processes that affected it, as these processes have a great role in bringing about clear changes to the features of the earth's surface in the past and in the present. The geomorphological process is known as a natural tool and means that affect the rocks of the earth's crust and cause changes to Earth shapes and the formation of some of them through the strength of the processes and the factor that affects them. These processes are represented by mechanical and chemical strength, and among the most important processes that are active in the area are:

Map (1)
The location of the study area for Iraq and Anbar Governorate.



Source. Republic of Iraq, Ministry of Water Resources, Public Survey Directorate, Map of Iraq and Anbar, 2018, scale (1,000,000: 1)., And Arc Map 10.4.1 program outputs.

1. **Morph dynamic processes:**

The process of movement of the earth's surface materials is the transfer of large or small rock materials from the top of the slope to the bottom because they are affected by various pressing processes (wind, water) that worked on the occurrence of cracks and openings leading to the division of large rock masses over time and the formation of rock debris, which works on the fall of the blocks down from the base of the slope by gravity, and these processes are divided into the following:

1.1 Rapid operations, such as:

1.1.1 Rock Slid

The process of rock slides is active in slopes whose slope is more than (45 degrees), which consists of a stratigraphic sequence inclined towards the slope [(1)] and not linked to the parent rocks due to its exposure to weathering processes, which made cracks and joints in it and then disintegrated and fragmented, which leads to movement The individual rock blocks on the slopes of the slope[(2)] slide down in the form of debris or they remain preserving their shape, and their occurrence frequently when rain falls. This would be noted in Picture No. (1).

Photo No. (1).
Rock slides in the study area

Source: Researcher's field observation on 1/1/2021

1.1.2 Landslides

Landslide processes are active in slopes whose slope is more than (30 degrees)[(3)] and by the action of the Earth's gravity, and this depends on the rate of the difference in altitude from the sea level and the increase in the slope, because the Earth's gravity increases when the slope increases[(4)]. And it works to increase the amount and speed of transport, so a large mass of rock slides from the top of the hill to the bottom with the help of secondary factors such as the rock formation, which consists of the succession of soft and hard layers or sandstone and limestone layers with the help of rain and the time that it breaks.

1.1.3 Rock Fall

Rockfall is one of the phenomena of rapid occurrence in a sudden and intermittent manner, as it

(1) Abd al-Baqi Khamis Hammadi Ahmad al-Muhammadi, Geomorphological analysis of the Al-Jazeera region in Anbar Governorate using remote sensing techniques and geographic information systems, PhD thesis (unpublished), Ibn Rushd College of Education, University of Baghdad, 2015, p.83

(2) Aseel Sami Majeed, Ayed Jassim Al-Zamili, The Impact of Geomorphic Operations on Shaping the Landscape of Al-Munather District, Journal of the Islamic College, Issue 5, p.522.

(3) Is-haq Saleh Al-Akam, Zain Ibrahim Hussain, The Movement of Earth Materials and Its Dangers in the Erbil Governorate, Journal of the College of Education, Volume 2, Issue 6, 2015, P297

(4) Hobbs B.‹ Means E.D‹ William P.‹ an Outline of Structural Geology‹ New Yorke‹ John Wiley‹ Sons‹ 1976‹ P.17

is active on slopes whose slope varies between (45-90 degrees) and the size of these blocks is (square meters)[5] and they fall either in a rotating manner or freely to the bottom of the slope due to its coherence and imbalance It falls and collects at the base of cliffs and is called Talus[6].

1.1.4 Mud flow

It is one of the geomorphological phenomena that activate quickly and suddenly on the slopes, as a result of thunderstorms, due to gravity, and the lack of vegetation cover, and when water-saturated mud formations are available, as water has a fundamental role, whether it is rainwater, underground water or surface water, as water works on the lack of its cohesion and the rendering of a sticky substance that is easy to move down the slope[7].

1.1.5 subsidence of the earth's surface.

This process is activated as a result of the availability of underground water, as it works to dissolve limestone by means of dissolution, hydration and carbonation, and with the help of other factors such as the thermal contrast between the seasons, which works to freeze water droplets in the freezing period and then sudden melting when the temperature rises, which leads to the separation of the surface layer and the subsidence of the upper sediments[8].

1.2 The slow-going operations, which are as follows: -

1.2.1 Rock aggregates

It is one of the slow occurrence phenomena and cannot be noticed easily, as it is active in slopes of steep and smooth slopes due to the absence of soil and vegetation cover, and is directly proportional to the slope, this process is active in places that have witnessed rapid morphodynamical processes (such as rockfall and rock slides).[9]

1.2.2 Soil encroachment.

It is one of the slow-on-occurring phenomena that cannot be noticed easily, but it leaves its clear traces and is active in slopes with a slight slope of (10 degrees)[10] and in sandy rocks, especially if they are subject to cracking and separation, and the factors that help to activate them and their occurrence are as follows[11]:

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(5) Ali Mohsen Jaafar, Hydrogeomorphological Modeling of Wadi Hassab Basin and its Impact on Environmental Development, PhD thesis (unpublished), Faculty of Arts, University of Kufa, 2018, p. 108.

(6)Abd al-Baqi Khamis Hammadi Ahmad al-Muhammadi, previous source, p.83.

(7) Mohamed Magdy Tarab, The Geomorphological Encyclopedia, Egypt, Cairo, 2012, p. 46.

(8) Muhammad Majdi Tarab, The Shapes of Deserts (A Study of the Most Important Geomorphological Phenomena in Arid and Semi-Arid Areas), previous source, pg.

(9) Hussein Kazem Abdul Hussein, Geomorphological Hazard Analysis in the Penguin Area, Previous Source, pg. 126.

(10)Ishaq Saleh Al-Akam, Zainab Ibrahim Hussain, The Movement of Earth Materials and Its Dangers in the Erbil Governorate, previous source, p. 307.

(11) Muhammad Hassan Ali Hamid al-Jubouri, Estimation of the Volume of Erosion in the Jouka Sur-Madokan Basins (An Applied Geomorphological Study), Master Thesis, University of Baghdad, College of Arts, 2013. pg. 155.

a. The high rates of heat that work to expand and the low rates that work to shrink.
b. Wrong cultivation and tillage and low moisture content.
c. Lack of vegetation cover and overgrazing.
d. As a result of mechanical weathering action (frost).

2. Morph climatic Processes

The earth shapes are a clear reflection of ancient and modern climatic changes. They are closely related to geomorphological processes. The response of geomorphological processes varies according to the type of climatic regions. It differs in dry regions from wet regions.(12) And that the study area is located within regions with arid and semi-arid climates, so we will deal with the morphological processes, which are as follows:

2.1 Weathering Processes

Weathering affects changing the features of the surface of the earth, and it is the first stage that precedes other processes, as it leads to crushing and fragmentation of rocks, which makes them suitable for operations (transport and sedimentation). Weathering into mechanical (physical) weathering, chemical weathering, and biological (natural) weathering are as follows: -

2.1.1 Physical Weathering

Mechanical weathering works on breaking and fragmenting rocks automatically, by the effects of rock movement or mechanical factors without changing their chemical properties(13), and physical weathering includes the following most important processes: -

2.1.1.1 Weathering due to temperature variation

The temperatures are responsible for the occurrence of this process as the variation in the average temperature between night and day and between the monthly and annual ranges leads to physical weathering activity, especially in dry and semi-arid environments represented by the study area, which is characterized by high temperatures and their extreme variation, as the monthly range reached the summer season during the following months (June, July, August) at Ramadi station (14.3, 16.1, 16.8) and (17.8, 16.8, 16.9) for Haditha station for the same months respectively, while the annual range was about (14.5 and 14.6) for Ramadi and Haditha stations. Respectively, as noted in Table No. 1.

Table (1)
The monthly and annual range of temperatures for Ramadi and Haditha stations

Station	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Average
Ramadi	10.5	12.2	14.9	14.4	15.2	14.3	16.1	16.8	17.1	15.3	14.9	12.6	14.5
Hadeetha	11.1	11.9	13.7	14.3	15.9	17.8	16.8	16.9	17.1	15.3	13.2	11.0	14.6

Source: From the researcher's work, depending on climate data for the period (1981-2019)

As this variation has an effect on the activity of geomorphological processes, through the

(12)Hassan Ramadan Salama, The Fundamentals of Geomorphology, Dar Maisarah for Publishing and Distribution, Edition 1, 2004, p.

(13) Hassan Abu Sammour, Ali Ghanem, Introduction to Natural Geography, 1st Edition, Dar Safaa for Publishing and Distribution, Jordan, 1998, p. 120.

expansion of minerals in the rocks due to high temperatures and then their contraction when the temperature decreases and the availability of moisture.

2.1.1.2 Weathering by varying the processes of moisturizing and drying

The study area is exposed to this process, especially in the parts that are characterized by its low and the accumulation of water inside it, such as the north-eastern and central parts, as it is active during the winter season when rain falls, so the entry of water through the pores, holes and cracks into the soil, especially clay soils that have a high absorption rate, leads to a lifting Soil moisture rate, and when these formations are exposed to drought during the summer season due to high temperatures, they form hives-like forms.(14)

2.1.1.3 3. Frost weathering

This process is active in the winter season as the fall of rain drops and the high level of humidity lead to the gathering of water particles inside the cracks and holes in the rocks and in the pores of the soil, and when the temperature drops during the freezing period in short periods it works to convert the water particles into ice crystals (frost) Its size will increase by (9%)(15) which leads to the swelling of the rocks and generating external pressure.

2.1.1.4 4. Weathering by (salt) crystal growth

This weathering is considered to be very similar to weathering by crystalline growth (frost), as this process occurs when underground water is available accompanied by high temperature ranges, when the temperature ranges rise, the water rises from the earth by means of (capillary property) and works on the evaporation of water leaving behind dissolved salts in the rocks themselves or over the rocks.

2.1.2 Chemical weathering

Chemical weathering works on the erosion and decomposition of the rock, as it results in a change in its mineral composition, and usually arises from the interaction of air gases such as oxygen, carbon dioxide and water vapor with the elements that make up the minerals of rocks(16). Since the study area is characterized by low precipitation and increased evaporation rate as a result of high temperature, so the climatic conditions are prepared for the action of chemical weathering in the study area, and perhaps the evidence for this is the types of soils present in the area as they are thin or non-existent soils, and there are rarely areas with fully formed soils. The most prominent manifestation of chemical weathering in the study area is the formation of gypsum crust, which forms a solid and thick layer, formed as a result of the lack of sufficient water to filter the salts present on or near the surface to rivers or underground water and these salts remain on the surface or very close. From it, chemical weathering includes the following most important processes: -

(14) Cook. A. U .and warren. A‹Geomorphology in DESRT‹BTB.Atsford ltd ‹London‹1973. p.69.

(15)Saad Ajeel Al-Darraji, Basics of the Geomorphology of the Earth, Dar Kunooz Al-Ma'rifah Al-Ma`rifah for Publication and Distribution, 1st Edition, Jordan, 2014, pg. 97.

(16) Judah Hassanein Joudeh and Fathi Muhammad Abu Ayyana, General Geographical Basics, Natural and Human, Previous Source, pg. 112.

2.1.2.1 Dissolving process weathering

This process is considered one of the most prominent chemical weathering processes, and it is activated as a result of the interaction of water containing minerals such as underground water and rainwater that carries acids with it during its passage into the atmosphere, and with the help of other factors such as surface area and the speed of water movement through the pores of soil and rocks as well as heat, which affects the rocks and may be the rocks themselves hold minerals.

2.1.2.2 Weathering by the process of hydration

This process is activated by the union of water molecules with minerals in the rocks to produce minerals known as water minerals. The hydration process leads to an increase in the volume of minerals by (80%)[17], which works on the separation of the surface layer of the rock in the form of crusts.

2.1.2.3 Weathering by the oxidation process

This process is active and has a great effect in hot environments when the oxygen element (O2) available in air or earth water interacts with minerals in rocks such as sedimentary rocks that contain iron, copper, magnesium and aluminum minerals in them, and these elements have the ability to unite with water when they are exposed. These rocks to the air are oxidized by oxygen with iron and produce what is called iron oxide, which has a reddish-brown color, or so-called iron hydroxide, which has a yellowish color[18]. Especially in clay formations that contain a high percentage of iron, as this process weakens the resistance of rocks to the different weathering process, as well as weakening their resistance to hydrolysis.

2.1.2.4 Biological weathering (bio)

Biological weathering resulting from human activities carried out in an intended or unintended manner, or through plants that extend their roots in the earth and cracks, or through the decomposition of their remains and what generates chemical reactions, as well as the pits that animals make in the earth have a great impact on changing the land surface features are as follows:

2.1.2.4.1 Weathering by human activities.

The human factor is one of the factors that have a great influence on the surface of the earth, as man can through his various activities in the activity of geomorphological processes (erosion, transportation, sedimentation) as well as influence the earth shapes themselves and the formation of geomorphological forms.

2.1.2.4.2 Weathering by animal activity

(17) Walid Abdul-Malik Al-Sheikh and others, Geology, King Fahd National Library, Saudi Arabia, 4th Edition, 2007, P.18.

(18) Abdullah Sabbar Abboud, Walaa Kamel Sabri, Chemical Weathering and the Terrestrial Shapes Resulting from it in the Badia of Al-Muthanna, Uruk Magazine, Volume 9, Issue 3, p. 234.

Animals are one of the factors that affect the effectiveness of geomorphological processes, whether they are animals that live in the earth, such as rodents, or animals that spread on its surface, such as sheep.

2.1.2.4.3 Weathering by natural vegetation

The natural plant is a factor that affects the geomorphological processes, and its role is either positive or negative, as the positive role is represented by permeating the roots of plants into the earth, and this works on the cohesion of soil particles. As for the negative side, it is represented in rotting, organic decomposition, and the production of acids that help dissolve mineral elements such as iron[(19)]. This creates pits due to weathering, as well as the plant splits rocks, smashes them, breaks them up, and prepares them for various weathering factors (wind and water).

2.2 Erosion operations

Erosion represents the second group of external forces factors and represents the next stage of weathering, as the surface became prepared after the weathering completed its work, to the role of other factors represented by erosion to carry out its work.

The types of erosion affecting the study area include the following:

2.2.1 Water erosion

This type of erosion depends on the abundance of rain, the length of their period of precipitation, the size of the raindrops, the length and inclination of the slopes, and the density of vegetation. What distinguishes the study area is its exposure to monsoon rains, which are not limited by the presence of obstacles in front of it, such as dense vegetation. Therefore, these rains have a prominent role in the process of erosion.

2.2.2 B. Wind erosion

The wind is the second factor after the running water responsible for eroding, transporting and depositing the materials of the surface of the earth, as the winds strip the surface of the earth when it contacts it, and its work becomes active when its speed increases and the turbulence of the air currents and becomes able to lift the earth crumbs to the top, and the ability of the winds to lift the materials of the surface of the earth is determined. By the result of the following forces (lifting, shearing, and pressure of the materials transported on the surface materials of the earth, which must exceed the forces of gravity, friction, cohesion)[(20)].

2.2.3 C. Sedimentation processes

The sedimentation process is one of the most important geomorphological processes, as it is the final (constructive) stage, after the processes of (pressing, transport), as when the activity of destructive processes decays, the (constructive) sedimentation processes are activated in both types (water and wind) and result in different forms depending on the type of sedimentation and the type. The load consists of sedimentary forms that can be used or that pose geomorphic hazards, and the most important deposition processes are water and wind deposition.

(19) Ali Mohsen Jaafar, Hydrogeomorphological Modeling of Wadi Hassab Basin and its Impact on Environmental Development, Previous source, pg. 140.

(20) Dr. Taghulb Zarzis, Applied Geomorphology, Dar University for Printing, Publishing and Translation, Basra, 2002, p. 4.

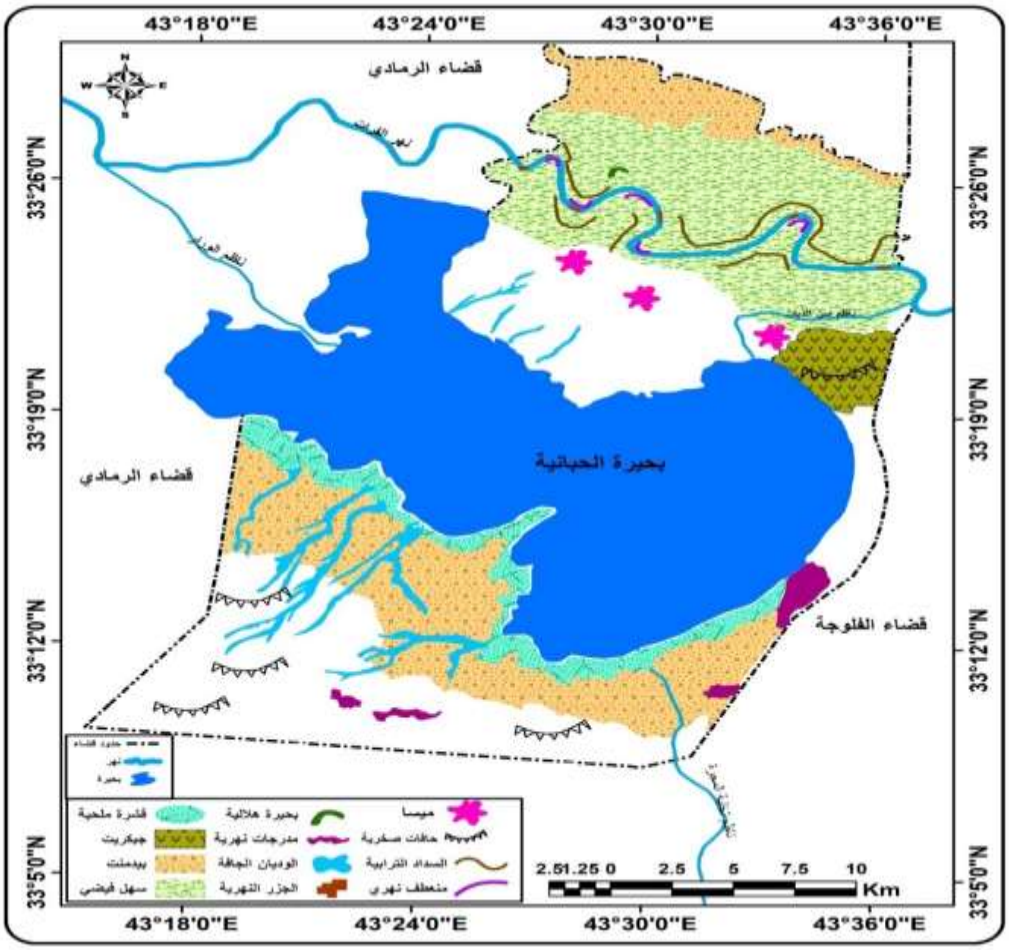
II. The terrestrial shapes in the study area

The study of terrestrial shapes gained the attention of geomorphologists throughout the twentieth century and it is still a major focus in geomorphological studies. This study constitutes an important stage in the development of geomorphological thought.

A geomorphological map was drawn for the study area, Map No. (2), which shows some of the places where these shapes are distributed, while others have difficulty distinguishing them on aerial images, and thus they do not appear on the geomorphological map compared to the scale of aerial photographs and the geomorphological map, but it was documented in the field through the study. Field and can be classified as follows.

Map No. (2)

Earth shapes in the study area



Source: DEM satellite image analysis with 30m discrimination resolution, Space Shuttle (SRTM) and processing using ARC software. GIS. 10.1 The field study and the Anbar topographic map at a scale of 1/1000000.

1. Structural Earth Forms - So:

It includes the structural earth shapes that go back in their origins to the difference in the composition of the rock layers, their construction system, the degree of inclination and their direction, and from these shapes that can be distinguished within the area under this heading are:

1.1 Plateaus

It is a land that is elevated above the level of the surrounding earth and has semi-flat surfaces, and it has a sudden rise or fall from the surface of the plateau towards the neighboring lands[21].

(21)Abd al-Ilah Razooqi Karbal, the science of terrestrial shapes, previous source, p. 407.

The study area, as a whole, is a sprawling plateau that was completed within the stable pavement during the last decade of the Precambrian era. The plateaus are the largest geomorphological forms of an area within the study area.

1.2 Hills

They are high areas characterized by slight slopes on the sides, their height comparable to the height of the plateau from which they were cut off by erosion and as a result of chemical weathering processes and the watery erosion during times of rain and the erosion activity later in times of subsequent drought, their height above the earth ranges between (15-20 m)[22]. One of the most important examples of hills in the study area is Al-Mashaid hill located to the west of the study area and shown in picture No. (2).

Picture No. (2)

The hills in the study area (Mashahid Hill)

Source: Researcher's field observation on 1/1/2021

1.3 Mesa

They are flat-surface earth forms that are formed in arid and semi-arid regions when there are soft rock layers covered by solid rock layers and with steep ridges[23]. These shapes are clearly common in the eastern Husaybah region.

1.4 Biotat

They are high earth forms of small size, with steep surfaces, similar to (Mesa), but smaller in size, and they are the product of activity that insisted on the soft rocks that made up the Mesa. We notice the spread of this type of shapes in the eastern Hasibah region near the Sheikh Masoud plateau.

1.5 Rock steles

The rock evidence arises and consists of the remains of limestone of hardness resistant to the

(22) The field study dated 1-1-2021, where the height was measured by G.P.S

(23) Khalaf Hussain Al-Dulaimi, Terrestrial Shapes, a Field Study, Dar Safa for Publishing and Distribution, Amman, 1st Edition, 2018, pg 350.

processes of weathering and erosion[24], this phenomenon is spread in separate places in the study area.

2. Synthetic earth forms – Erosion

The existence of those shapes is related to the tectonic situation through the existence of successive solid horizontal rock layers on top of other soft layers. A steep slope whose slope exceeds (40) and sometimes reaches (90)[25]. Its origin and development is related to the system of horizontal stratigraphy and these ridges were formed as a result of solid formations of limestone and limestone rocks dolmite and this is what made them little response to the surrounding environmental conditions[26].

3. Forms of earth erosion

The terrestrial shapes resulting from erosion processes differ in their two types (water and air) from one place to another, depending on the severity of the factors affecting the formation of these appearances and shapes, and these shapes vary in the study area as it dates back in its origins to the Triple Era.

3.1 Forms of (water) earth erosion

Which are:

3.1.1 Dry valleys

It is considered one of the most important terrestrial shapes in the study area, which was formed as a result of water erosion processes and its origins date back to the rainy ages.

3.1.1.1 The valleys of the secondary streams

This group includes all small and narrow secondary valleys with short slope and where flood plains do not develop as the effect of erosion appears on the valley earth[27]. These valleys are spread in large parts of the study area, where they are in the form of an irregular network, the direction, shape and size of which determine the general rock composition in the area.

3.1.1.2 Pediment

It is one of the earth shapes that characterize desert environments. It is located below the slopes. It consists of soft crumbs that were brought from washing the aggregate material over the slopes of the slopes. This element ends at the base level at an angle between (0-7) degrees[28] and appears convex towards the top. A thin crust of alluvial material lying on top of the base rocks.

(24)Muhammad Majdi Tarab, As-Sahari Illustrated Forms, previous source, p. 282.

(25) Ayed Jassim Hussain Al-Zamili, Terrestrial shapes in the discontinuous edges of the western plateau between Sawa and Razzazah lakes and their impact on human starch, PhD thesis, University of Baghdad, College of Arts, 2007, p. 136.

(26) Zuhair Nooraz Yassin Al-Alousi, Geobidohydromorphometric analysis of the area bounded between Haditha Dam and Wadi Houran, an applied study in the northern desert in western Iraq, PhD thesis (unpublished), College of Education for Human Sciences, Anbar University, 2011, p. 48.

(27)Manal Shaker Ali Al-Kubaisi, The Geomorphology of the Rutba Area, Previous Source, pg.224.

(28) Ayed Jassim Hussain Al-Zamili, Earth shapes in the discontinuous edges of the western plateau between Sawa and Razzazah lakes and their effect on human starch, previous source, p. 150.

3.1.1.3 River Bends[29]

They are curvatures that occur in the riverbed according to the stage it passes through and are large when the river passes through the aging stage[30]. River turns are formed when the river reaches the base level line where the river reaches the stage of maturity and then the velocity of the current decreases and the river activity turns from lower carving to side erosion Which affects the lateral loose sediments of the banks of the river. When the stream collides in its path towards the mouth, it takes the convex sides and at the entrance to one of these meandering turns back towards the concave side of it and then turns to the other side.

3.2 B. Forms windswept earth

Wind is a major factor in the formation of special landforms, and this does not mean that there is no role in relation to other factors, but the effect of winds is more pronounced in dry and semi-arid regions. Other geomorphological processes: Geomorphological forms of wind-eroded origin are as follows:

3.2.1 Caves of the winds

It is one of the forms resulting from the erosion process. It arises in areas of fragile clastic sandy rocks of varying hardness when exposed to wind erosion.

3.2.2 Individual hills

They are heights of disparate shape with sides of little slope that appear in various places in the study area, where there are isolated and spaced hills of little height, with a surface height ranging between (5-10 m) and in some cases it may reach (20 m) above the surrounding lands. In the Siddiqia area, however, its small size and low height made it difficult to distinguish it from aerial photos, and thus it did not appear on the geomorphological map compared to the scale of aerial photographs and the geomorphological map, but it was documented in the field through field study.

4. Earth sedimentary shapes

The terrestrial shapes resulting from the two types of sedimentation processes (hydro and aerobic) differ from one place to another, depending on the severity of the factors affecting the formation of these appearances and shapes, and these shapes vary in the study area as it dates back in its origins to the Triple Age. And it is divided into:

4.1 Wind sedimentary forms

It is represented by sand dunes, which are a sand complex whose height ranges between 30 cm - 40 m and a width between 1 m - 1 km. They arise as a result of the variation in the surface roughness so that the coarse sand is below and the fine sand is on the surface[31].

4.2 Sedimentary water forms

It can be classified into the following:

4.2.1 The flood plain

(29)River bends are Terrestrial Shapes resulting from the processes of erosion and hydrological sedimentation.

(30)Muhammad Sabry Mahsoub, Geomorphology of Earth Forms, Previous Source, pg. 118.

(31)Hassan Ramadan Salameh, The Origins of Geomorphology, previous source, p. 284.

Flood plains are characterized as having low levels and close to the level of the erosion base, if not already there. These planes were formed as a result of the accumulation of sludge sediments over the valleys' bottoms that the rivers have expanded, and these plains are characterized by the low degree of slope in them. It has multiple terrain features such as river twists, crescent lakes, swamps, and lakes irregular in their distribution, which occupy the depressions present here and there of the flood plain.

4.2.2 Earth dams

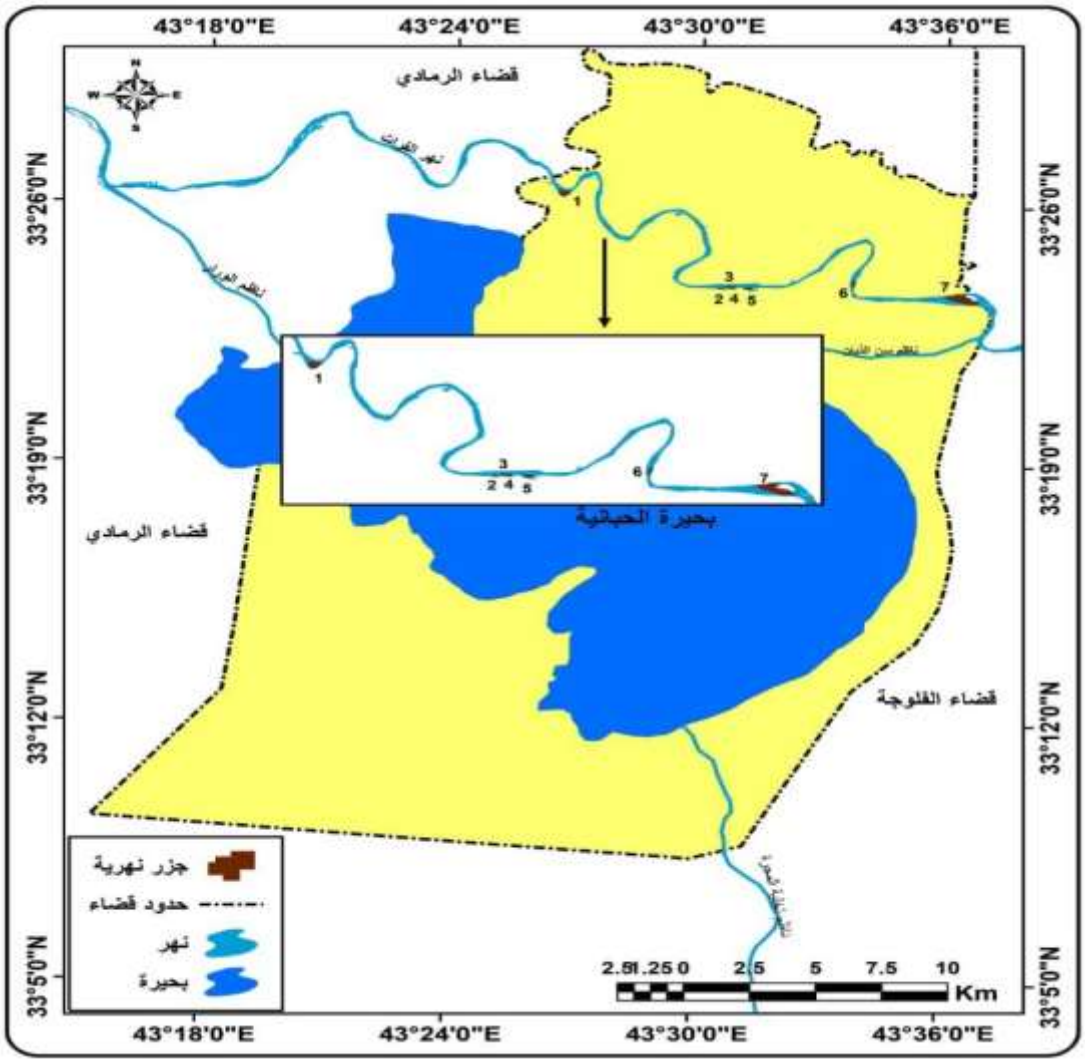
The earth dam was established for the purpose of confining the water within the riverbed and preventing it from tyranny the neighboring lands in times of floods.

4.2.3 River islands

It is one of the sedimentary earth shapes that appear in the study area. It is formed as a result of the increase in the load over the river's power, the decrease in its flow velocity, and the decrease in the drainage in an unusual way. One course, in addition to it working on braiding the river and making it stranded, which helps in easing the clogging of the sewers and changing them in appropriate directions(32). By looking at the geomorphological map of the study area, we can see the existence of (7) river islands, Table No. (2), the largest of which was a carrot. No. (7), as its area reached (233957 square meters), the smallest of which is Carrot No. (3), as its area reached (3088 square meters).

Map No. (3)

(32) Wafiq Hussain Al-Khashab, Applied Geomorphology, Part 1, 1st Edition, University of Baghdad, 1980, p. 87.



River islands in the study area

Source: Based on (Land sat + OLI 8) satellite visuals for 2020 and Arc GIS 10.4.1 program outputs.

Table No. (2)
River islands and their areas /m^2

Island No.	Area in square meters
1	55361
2	3169
3	3088
4	4689
5	13718
6	10058

Source: From the researcher's work on the basis of Map No. (3)

4.2.4 River terraces

Surfaces of relative flatness and varying capacity that occur as a result of water erosion, which is evidence of previous levels of valley bottoms and rivers in which they flowed and left after the deepening and changing of the streams, consisting of deposits of boulders, gravel, sand and silt(33).

4.2.5 Crescent lakes

The crescent lakes are known locally as Al-Sarat (meant where water collects)(34). It is considered a remnant of the changes in the course of the river, as it represents an advanced stage of the river torsions that arise and develop as a result of the variation in the processes of erosion and sedimentation. We can distinguish it through aerial photos, but it was documented in the field through the field study, which is known as Basrah Sufi, located on the right bank of the Euphrates River.

5. Evaporative earth shapes

These shapes are formed in arid and semi-arid regions, and the study area is located in areas with arid climates, as has been explained previously. These shapes appear in clay soils represented by the salty crust (sebakh), and in sandy soils represented by gypsum crust. A high percentage of salts, whether within its composition or through underground water, and the increase in temperature leads to an increase in the rate of evaporation, so these earth forms are formed, including: -

5.1 The salt crusts

They are salt formations resulting from rising underground water levels that work to dissolve the salts in the earth and raise them to the surface, or as a result of the drought or receding of the water of lakes from some areas, so the water dries up and leaves the salts, and appears similar to the plowed land tending to a dark brown color or Yellow or white(35).

5.2 Plasterboard

The gypsum is a manifestation of the succession of the rainy and dry climate, as in rainy times the rainwater dissolves the gypsum components of the region's formations, especially forming the hole, transporting them with it in the form of solutions and then depositing them in the subsurface layers. The dissolution of many of the gypsum components that were deposited in past times, and these solutions are subjected to evaporation, leaving the gypsum in the form of crusty layers on the surfaces.

(33) Khalaf Hussain Ali Al-Dulaimi, Terrain, Previous source, pg. 279.

(34) Khalaf Hussain Al-Dulaimi, Terrain, previous source, p. 26.

(35) Khalaf Hussain Al-Dulaimi, Earth shapes, a field study, previous source, p. 364.

6. Earth forms by the action of living organisms (humans, animals, plants)

Although many activities do not necessarily lead to a clear change in the geomorphological processes or the formation of new earth forms, it is not possible not to recognize some of the terrestrial shapes that resulted from the direct and indirect interference of man[(36)], the human being has a major role in the formation of the earthly shapes. Through the demolition and construction that he carries out, animals and plants also have a great influence on it.

Conclusion

The earth shapes were classified according to the processes that make up them into six classes, including: -

1. Structural earth forms - even including (plateaus, hills, mesa, houses, and rocky tracers)
2. Structural earth shapes - even, which are represented by rocky ridges.
3. Forms of a mesh earth and divided into:
    A- Forms of water-drainage earth, which include (dry valleys, secondary stream valleys, pediment, single hills and river bends).
    B - Forms of wind-washed earth, which are represented by sand dunes.
4. Sedimentary earth forms, which include: -
    A- Wind sedimentary forms
    B- Water sedimentary earth forms that include (flood plains, flood fans, earth dams, river islands, river terraces, and crescent lakes.
5. Evaporative earth forms and include (salt crust and gypsum).
6. Earth forms by the action of living organisms (humans, animals, plants).

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(36) Abdul Hamid Ahmad Kalio, Man as a Geomorphological Factor - Its Role in River Geomorphological Processes, Periodical Bulletin Concerning Geographical Research, Kuwaiti Geographical Society and Geography Department, Kuwait University, Kuwait, Issue 8, 1980, p.9.

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