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GEOMORPHOTACTONIC INDICATORS AND THEIR IMPACT ON THE POTENTIAL OF THE WATER HARVESTING USING RS–GIS AL-BAGHDADI, ANBAR, IRAQ AREA STUDY

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Abstract

This research examined the subject of geomorphotonic indicators based on the analysis and linkage of the relations between Geomorphia and the water harvesting mechanisms in the numerology semantics, and these indicators proved that they can be applied to modern digital data within their input (Dem-raster Image Satellite), As part of the digital analytics software packages and the building of the geographic base (Erdas Imagin–ArcMap). It was found that the region with the adaptive tectonic index does not suffer from tectonic changes that have a sudden effect on the region's geomorphic, but that it requires long-term geomorphological cycles, reflecting the potential Investment for water harvesting and area development, and the input of indicators and secondary semantics varies from one location to another within its geographical effect. It should be noted that these indicators are mainly based on water drainage systems.

Keyword **:** Geomorph, potential of the water, RS-GIS.

Introduction

To the importance of water and its connection to the life of creation, the mechanisms for detecting and investing water resources have become the target of researchers, especially in arid and semi-arid regions, in order to gain access to the methods of gathering and maintaining this inexhaustible fate. Thus becoming one of the methods of water detection, sources and management In accordance with the technical progress and the development of geography in particular and applied sciences in general, and the construction of databases with various natural qualifications to link to the mechanism of the layers that mimic the reality and the building of automated models to be provided to decision makers and specialists in facilitating the adoption of the appropriate decision with studies prepared Economically feasible as well as planning for sustainable development purposes. The underlying problem is the detection of placements that are intended for the purpose of water harvesting in ways that correspond to the qualifications of the same position and to the tectonic, hydomorometric and gimorphic semantics. Al-Baghdadi region has a search specificity, as it lies within the dry and volatile region, although it falls on the Euphrates River but suffers from a lack of water, depriving it of environmental development and exploitation of the water filth and abundance of old dry river networks, it varies in its extension from Plain water to the ancient Western Genesis and the formation of the hard-core, which painted the contours of the area of the geomorphic body, shows the effect of synthetic stearate in determining its present appearance. This reflected the direct impact on the selection of suitable methods for locating water harvesting.

Hypothesis: Geomorphotonic indicators reflect their potential for environmental development and sustainability according to their results of water quantities that can be collected and planned for management.

Objective: To detect the quality, type and distribution of watershed connotations, as well as to study and analyze geomorphotonic indicators and their impact on human uses in management and water planning.

Importance: Building models that simulate reality to provide an analytical vision of sustainability, investment and environmental mechanisms through the optimum utilization of natural resources, the determination of the best geographical location for the uses of the Earth, the mapping of the aquatic abundance and the determination of the method of collection according to Geomorphia of the region.

Methodology: analytical and deductive approach, which analyses the natural and human qualifications and draws relationships to the position, origin and impact of the terrestrial form and to identify the causes, using quantitative statistical methods, remote sensing, geographic information systems and Cartokavian Digital.

Location and Area

The area of the search is geographically located within the land of peptide, the northern part of the island plateau in Iraq, and its southern part of the western Iraq plateau, passing the Euphrates River in the middle of the area and forming a narrow strip of the valley. Located in Anbar province from Iraq, it is bordered by the north and north-east to the Euphrates, south and south-east by the leap and the south-west to its end and from the west to a modern district. An astronomer is located between the linear length (42.9.0-42.51.0) east, two latitude (33.45.0-34.20.0) north (Fig. 1), and its area is (1589) km2 (24.1%). From the area of the Het district (6580) km2 and (1.1%) From Anbar Province (138.579) km2 (0.3%) Of the total area of Iraq (435.052) is 2 km^2. Timely included the Duration (1984 – 2014) of climatic Data and Duration (1984 – 2016) for space data. Climate according to the classification of Vladimir Kopen falls within the desert climate (B W), the desert climate is dominated by the daily and high monthly thermal range with low humidity, low rainfall and fluctuation (Al-Shalesh, 1978).

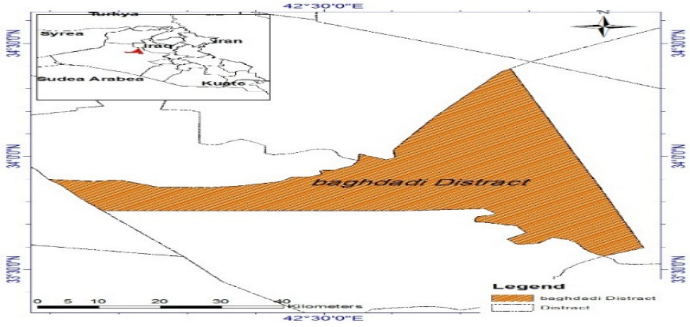

Fig. 1 : Location Area Study

Source: General Authority for surveying, Iraq map, 1100.000 scale, Baghdad, 2000 and using ARC MAP10.6. The area is part of the Arab plate inside Iraq. Iraq is part of the Arab plate, which is an extension of the African plate, both of which were separated in the late First Age and the beginning of the myosin (Lateoligocene and Earlymiocene) (Touba, 2005). Located within the stable pavement of the Nubian Arabic plate, which increases its thickness as we move away from the Arab Nubian Shield and shows the effects of the refractive blocks associated with the movement of the rocks of the al-Qaeda in the scope of the urban ladder, which is characterized by the low depth of al-Qaeda rocks, which is not more than (12) km (Albarazan & AL-Paruany, 2013). The base rocks are deep in the Akashat (9 – 12) km belt and are increasing westward, with the clearest features of the Horan, which is located to the southwest of the area (Al-Arid, 2008).

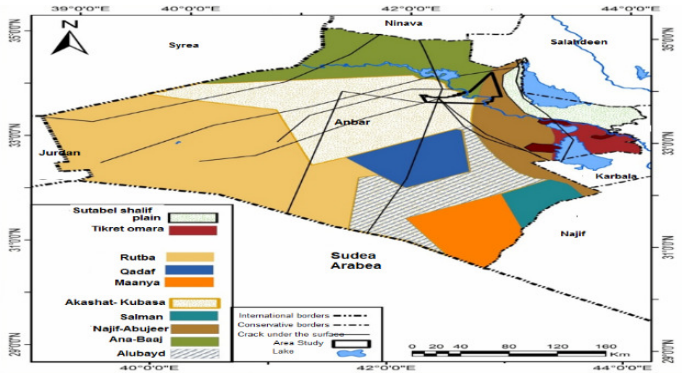

Fig. 2 : Location of the area of the main tectonic plate of the western Iraq plateau.

Source: Ministry of Industry and Minerals, Iraqi Geological Survey, Iraq structural map, 1 100.000 scale, Baghdad, 2000. And Adnan al-Niqash, Morvotectonian Plain Al Hammad the Iraqi part, Journal of Remote Sensing Society, Baghdad, Issue 1, 2002. So the researcher divided the research into three detectives as follows:

First: Linear compositions: Linea mints Structure

They are phenomena with straight or semi-straight geometric shapes with little curvature that show their effect on river valleys ' trends (Shamma, 1986). These phenomena, which are of a structural origin and can be observed on space visuals, have to do with water drainage systems by weakening the form of a plate form, which makes them ripe for weathering processes, (Alajili, 2014) and they represent geomorphological expressions that refer to linear parameters, the key in analytical studies In Metal Search. The linear characteristic of linear compositions calls for sorting between them and man-made ones, so the derivation of those compositions was relied on remote sensing data through the analysis of the area's spatial visual (Landsat LC 8) for the year 2016 using digital processing Through the use of several automated programs in accordance with the following practical procedures:

- Import visual space by means of a program (ErdasImagine8.4) and construct a color image using three specific bands. (4, 6, 7). Export the color image to the program (Geomatica, 2015), which will draw and clarify those compositions and then save them.
- Export the results of the program (Geomatica, 2015) to the ARC MAP10.6 program to build a database for those compositions, and then insert the results in tables (1 and 2) and the directions of those compositions could be determined as in (Fig. 3) and (Fig. 4).

Table 1 : Length of linear compositions and numerical repetition of the trends and ratios of compositions

Geographical orientation	Length /km	Ratio of length (%)	Repeat trend Number	Ratio (%)
North-South	16	14.2	8	13.8
Northeast-southwest	38.5	33.7	17	29.4
East-West	12.4	10.8	9	15.5
Northwest-southwest	47.3	41.3	24	41.3
Total	114	100	58	100

From the foregoing, it follows:

1. Most of the linear compositions are concentrated on the Euphrates River and the Wadi al-Asadi. The north-west-south-east trend is the most lengthy and frequent.
2. The linear compositions are the contours of the Euphrates River and the Wadi al-Asadi Valley, thus controlling the water network lines in the area.
3. Linear compositions have identified the areas of rock weakness acquired for the region and have been linked in situ by an increase in weathering and erosion activity and by an increase in the geographical density of groundwater.

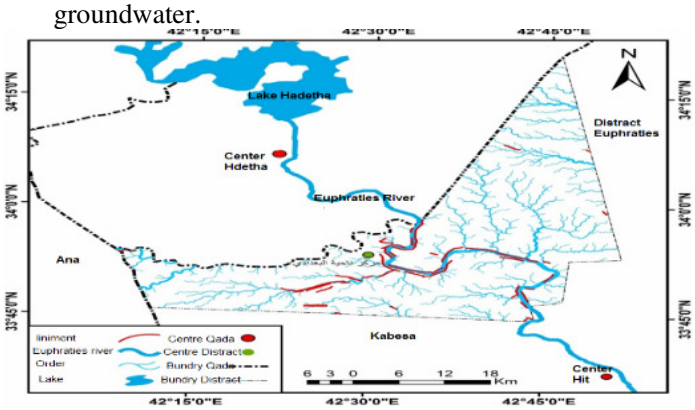

Fig. 3 : The relationship of the distribution of linear compositions to the water network.

Source: Satellite video of satellites (Land sat + Lc 8) for 2016 and outputs of the Erdasimagine 8.4 program, Geomatica 2015 and ARC map 10 program.

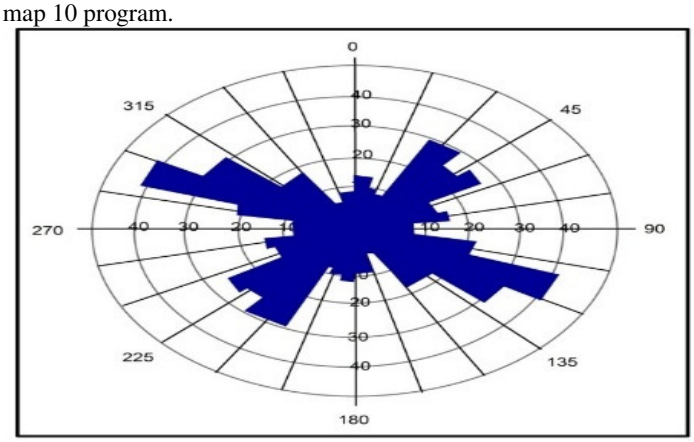

Fig. 4 : Chart of the rose linear compositions

Source: Table 1.

Many of the rock-aged-age-based detectors appear from the oldest to the newer between the lower myosin to the sediments of the 4th age. In what comes a description of these discoveries, seen (Fig. 5) and Table (2) (Geological Survey of Iraq , 2000).

Table 2 : Characteristics of dominant disclosures

	Age	Function	Thick/M	Description	Area/ km2	Ratio (%)
Ternary	Lower -Miocene	Euphrates	50.5 - 73	Gravel and limestone	149	9.40
	Middle -Miocene	Fatha	7 - 30	Clay, limestone, anhydrite, gypsum	287	18.10
Quaternary	Pleistocene	Sediment of river Terraces	1 - 10	Gravel, limestone, flint and a combination of fiery and metamorphic rocks and quartz	13	1.80
	Pleistocene - Holocene	Slope deposits	0.5 - 2	Sand, green, clay and rock pieces mixed with gypsum	71	4.50
	Pleistocene - Holocene	Old sediments	1 - 2	Sand, gravel, gypsum, green	918	57.80
	Pleistocene - Holocene	Gypsum soils	1 - 5	Gypsum mixed with grenie soils	53	3.30
	Holocene	Flood plains Deposits	3	Soft grit, sand and mud	12	0.80
	Holocene	Sediment filling Valleys	1.5 - 2	Coarse grit, fine sand, lime rock	86	5.40

Source: Vararuyan Khaajik Siakyan, Sondos Mehdi Saleh, geological report of Ramadi, Ministry of Industry and Minerals, Iraq Geological Survey, Baghdad, 1993.

Second: Morphotectonic Processes

Based on the analysis and linking of the relationships between the constructional processes and their agreed manifestations of the surface of the earth, and for the purpose of analyzing that relationship has relied on geomorphological indicators which are a modern scientific methods with significant results in clarifying the evolution of the tectonic history of any area under The study, which is based mainly on the drainage networks and from these indicators are.

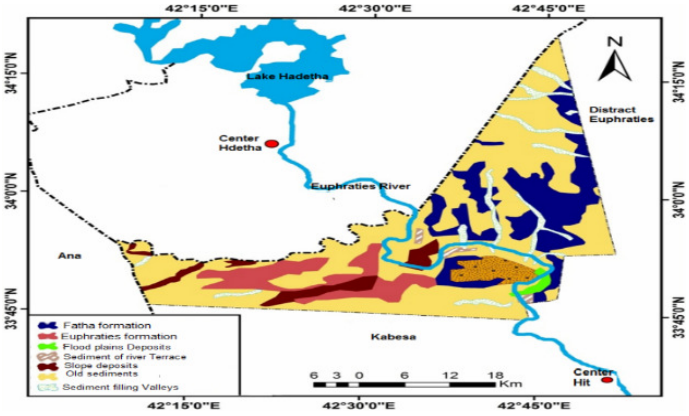

Fig. 5 : Dominant Rock detectors

Source: Ministry of Industry and Minerals, Iraqi Geological Survey, Iraq structural map, 1 100.000 scale, 2000.

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1. Asymmetry Factor Indicator: (AF)

This factor (asymmetry Factor) refers to the pelvic side slope for the main watercourse in the water basin resulting from the power and tectonic processes, the values higher than (50) indicate the exposure of the main course to the rotatable or curvature of tectonics and this has an effect on its tributaries on both sides of the urethra The main of the pelvis this has a pre-imposed any that the tributaries in the left of the stream will be shorter compared to the right side reflecting the asymmetry factor. As shown in Fig. 6 and Table (3), the value falls within three high, medium and low ranges, extracted according to the following equation:

$$AF = 100 (Ar/AT)$$

Where: AR = area of the basin on the right side of the main (km2). AT = total area of the basin (km2).

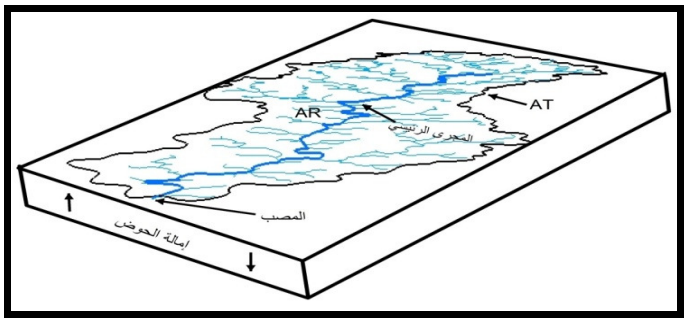

Fig. 6 : The tectonic rotation of the Almhabobe basin and the lengths of the tributaries on either side of the main conduit

Source: From the work of the researcher using the program (ARC Scene10).

Table 3 : Geomorphological index items (AF)

Description	Type	Range
High	1	65
Average	2	65- 57
Low	3	57

Source: Keller, E, A, and, Pinter, N, (2002), Active tectonics: Earthquakes, uplift, and landscape, P.P, 125.

Table 3 shows that the area falls into three categories:

- The first is a high class (1) for values greater than (65) and includes high indicators of tectonic activity, concentrated within the Valley Basin (landscape, Almhabobih).

- The second medium class (2) represents values ranging from (65 – 57), medium indicators in its tectonic activity concentrated within the valley of the landscape.
- The third low Class (3) represents values that are less than (57), reflecting low-lying tectonic activities concentrated within the basins of (al-Asadi, Baghdadi, Abu Sarwal, Jabal, on it).

Table 4 : Represents the results of measurement of the index (AF) items and grades

Basin	AR	AT	Index AF	Type	Description
Mashhad	13.4	17.4	77.1	1	High
Alasdi	141.3	255.8	55.2	3	Low
Albaghdadi	14.3	34.7	41.2	3	Low
Falj	32.1	51.5	62.3	2	Middle
Abusarawil	26.7	49.6	53.8	3	Low
Jaal	86.8	193.8	44.3	3	Low
Alea	23.4	184.1	12.7	3	Low
Almahbubya	51.7	65.1	79.4	1	High

Source: From the work of the researcher relying on the digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m, using the ARC Map 10 program.

2. Topographic parity Factor Index: (T)

This indicator (topography symmetry factor) refers to the migration of the main basin of the basin from the axis of the aquarium, the value of which ranges from (0-1) to reflect the perfect symmetry and zig, the closer to (0) becoming symmetrical and the closer to (1) becoming a vector to the asymmetry shows the condition Affected by the winding or cracking of the superficial layer this leads to the migration or displacement of the main course of the basin with the direction of the superficial cracks and as shown in table (5), and this indicator is extracted according to the following equation:

$$T = Da/Dd$$

Where: Da = distance from the center line of the basin to the center line of the Hungarian (m). Dd = distance from the main conduit to the water dividing Line (m).

Table 5 : Geomorphological index items (T)

Description	Type	Range
High	1	0.6
Average	2	0.6- 0.3
Low	3	0.3

Burbank, D.W. and Anderson, R.S (2001) tectonic ge0morphology, malden, massachusett: blackweels science, Inc.Pp574. (by husam A.M, 2008) .

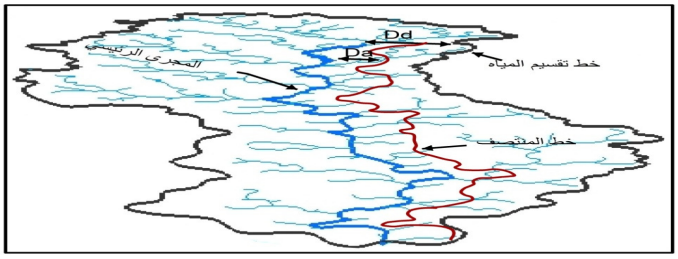

Fig. 7 : Shows how to apply the index equation (T)

Source: From the work of the researcher using the program (ARC Scene10).

Table (5) shows that the indicator (T) values in the region fall into two categories:

- The first Class (2), which tends to be similar in proportions (0.3) with medium tectonics concentrated in ponds (hemiplegia, Abou Sarul, Almhabobet).
- The second Class (3) a factor indicator represented a value of less than (0.3) reflecting a low tectonic activity concentrated in the rest of the region's basins.

Table 6 : Representing the measurement results of the index (T)

Basin	da	Dd	T	Type	Description
Mashhad	372.1	2087	0.17	3	Low
Alasdi	920.3	4598	0.2	3	Low
Albaghdadi	397.1	2549.5	0.15	3	Low
Falj	1124.2	2812.5	0.39	2	Middle
Abusarawil	566.7	1403.9	0.4	2	Middle
Jaal	392.8	2584	0.15	3	Low
Alea	942.5	2997.8	0.31	2	Middle
Almahbubya	681.3	2210	0.3	2	Middle

Source: From the work of the researcher relying on the digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m, using the ARC Map 10 program). Burbank and Anderson, 2001, Pp 574)(Husam A.M, 2008 Pp.56) .

3. Duct length and Slope index: (SL)

This indicator (Stream Length-Gradient index) is used to illustrate the degree of rock resistance to aqueous erosion and its relation to the activity of tectonic activities, which is influenced by the slope and winding of the river Valley Canal and is linked to the power of the torrent as the power of the torrent illustrates the length or the palace of the drainage canal that Linked to the flood's ability to strip, channel erosion and sediment transport, this indicator is used to diagnose the tectonic activity by performing a classification of the index values where the high value indicates the presence of solid rocks on the floor of the channel, either low indicating the opposite, and the corresponding values (SL) represent the amount of water discharge Convergent anomalies, whether rising or decreasing, are evidence of the change in the amount of drainage that reflects the influence and control of the sapper, and the high values indicate that any deposition is far from the high ground areas, i.e. at the end of the valley, which is an indicator of active tectonic effectiveness and vice versa, (Al-Kubaisi, 2002). And table 7, and extracted according to the following equation, (Keller and Pinter, 2002).

$$SL = (\Delta H/\Delta L) L$$

Whereas:

SL = path and gradient length indicator.

ΔH = the height difference in the selected downstream area.

ΔL = The length of the straight distance in the selected downstream area.

L = Total channel length from upstream to specified point at downstream.

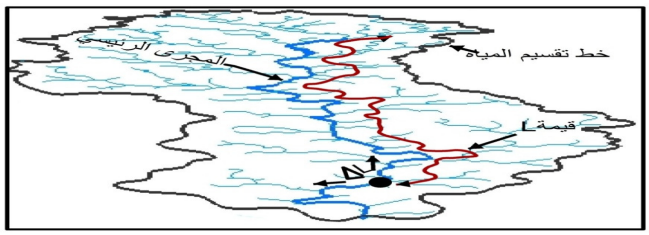

Fig. 8 : Represents a method that illustrates the measurements of a pointer (SL)

Source: From the work of the researcher using the program (ARC Scene10)

Table 8 : Geomorphological index items (SL)

Description	Type	Range
High	1	500
Average	2	500- 300
Low	3	300

Source: Keller, E.A.and, Pinter, N. (2002) Pp.125.

Table (7) shows that the values of the (SL) indicator in the region, classified according to table (8), are:

The first Class (2) represents the median values of the tectonic activity, which ranges between (300-500) and concentrated within the two basins (Abou Sarwal, on it).

The second Class (3) which represents the low values of the tectonic activity with values less than (300) and is concentrated in ponds (landscape, al-Asadi, Baghdadi, hemiplegia, Juloud, Almhabobih) .

Table 9 : Represents the results of the measurement of the index classes and grades (SL).

Basin	L	LΔ	HΔ	SL	Type	Description
Mashhad	8563	617	12	166.5	3	Low
Alasdi	38490	1845	9	187.7	3	Low
Albaghdadi	7480	620.6	6	72.3	3	Low
Falj	16818	699	6	144.3	3	Low
Abusarawil	17956	753.5	14	333.6	2	Middle
Jaal	24430	1131	8	172.8	3	Low
Alea	22646	707.9	13	415.8	2	Middle
Almahbubya	16783	716	8	187.5	3	Low

Source: From the work of the researcher relying on the digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m Using the ARC Map 10 program.

4. Ratio of valley width to Valley height: (VF)

The indicator (Ratio of valley floor width to valley height) refers to the difference between the V-shaped valley floor, which originated from the elevation of the tectonic effect of the underground rocks and between the ground of the valley, which is the character (U) resulting from the lateral erosion of the valley, which reflects the effectiveness Low tectonics and table 10 shows this, and a value has been derived according to the following equation. (Hamdouni, Irigaray, FernandesChacon, Keller. 2008):

$$VF = 2VFW/([(Eld-Esc)] + [(Erd-Esc)])$$

Whereas:
VF = indicator ratio of pelvic width to height of the valley.
VFW = width of the valley floor (m), Eld = height of the left side of the ravine (m).
Erd = height of the right side of the ravine (m).
ESC = Elevation of the valley floor from sea level (m).

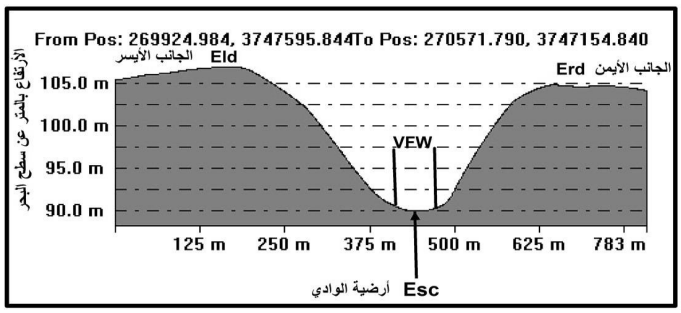

Fig. 9 : Represents how to illustrate indicator measurements (VF)

Source: From the work of the researcher using the program (ARC Scene10).

Table 10 : Geomorphological index items (VF)

Description	Type	Range
High	1	0.5
Average	2	0.5- 1
Low	3	1

Depending on the foregoing, the areas for which cross-section extraction was carried out at the downstream and a distance of (1) km from the downstream point of all the main drainage basins have been identified and classified according to the classification (Hamdouni, 2008) of the Tectonic Activity Index (10) and figure (9) are therefore categorized into machines In

- The first item (2) is the values that are located between (0.5-1) of intermediate tectonic activity and are concentrated in the ghd Valley basin.
- The second item (3) is the values that are greater than (1), which represent a low-concentration activity and are concentrated in the remaining basins

Table 11 : Represents the results of the measurement of the indicator varieties and grades (VF)

Basin	VFM	ESC	ERD	ELD	Index VF	Type	Description
Mashhad	25	84	89	91	4.1	3	Low
Alasdi	60	80	95	100	3.4	3	Low
Albaghdadi	19	82	92	94	1.7	3	Low
Falj	21.2	70	73	76	4.7	3	Low
Abusarawil	25.4	87	110	105	1.2	3	Low
Jaal	16.8	78	90	98	1	2	Middle
Alea	38	79	96	100	2	3	Low
Almahbubya	31.3	83	98.5	92.5	2.5	3	Low

Source: From the work of the researcher relying on the digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) using a program (ARC Map 10)**.**

5. Final classification of tectonic indicators: (LAT)

The collection of the results of the previous geomorphological of drainage basins in the region to give a holistic view of the impact of these indicators on the tectonic activities according to the classification (Hamdouni, 2008), which represented the tectonic classification with four categories according to schedule (12).

Table 12 : Represents the final classification of the (LAT) index

Description	Type	Range
Very High	1	1- 1.5
High	2	1.5- 2
Average	3	2- 2.5
Low	4	2.5

Source: Hamdouni, C, Irigaray, T,, Fernandes, J, Chacon, E, A, Keller. (2008); R.E

The class (1) represents the tectonic value ranging from (1-1.5) which gives a very high tectonina activity.

- Item (2) represents the tectonic value ranging from (1.5-2) which gives a high tectonics activity.
- Item (3) represents the tectonic value ranging from (2-2.5) which gives a medium tectonics value.
- Item (4) represents a larger tectonic activity of (2.5) which gives a low tectonics value.

Accordingly, the results of the items have been collected for all the equations and for all the drainage basins, and the final tectonic value of the area has been extracted and the table (13) is considered **.**

Table 13 : Representing the results of measurement of the index (LAT)

Basin	Index AF	Index T	Index SL	Index VF	LAT	S/N	Type	Description
Mashhad	77	0.17	166.5	4.1	247.7	61.9	3	Low
Alasdi	55.2	0.2	187.7	3.4	246.5	61.6	3	Low
Albaghdadi	41.2	0.15	72.3	1.7	115.3	28.8	3	Low
Falj	62.3	0.39	144.3	4.7	211.6	52.9	3	Low
Abusarawil	53.8	0.4	333.6	1.2	389	97.2	3	Low
Jaal	44.7	0.15	172.8	1	218.6	54.6	3	Low
Alea	12.7	0.31	415.8	2	430.8	107.7	3	Low
Almahbubya	79.4	0.3	187.5	2.5	269.7	67.4	3	Low

Source: From the work of the researcher relying on the digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m and using the program (ARC Map 10)**.**

Table 13 shows what follows:

After showing the natural characteristics of geology, climate and topography of the study area, the environmental characteristics of the soil, the drainage system and its natural vegetation, which are only a reflection of its natural conditions and the resulting variation in the prevailing terrestrial forms, and, based on the foregoing, the role of the Components and how they affect the activity of the human being and the possibility of exploiting it in its requirements, the person carries out his activity and trade according to the conditions available to him is either a catalyst or a determinant of what he can invest in environmental sustainability.

Third: Locating watersheds:

For the natural qualification of (tectonics, linear compositions, rock detectors, climate and morphotonic indicators) The catchment positions have been determined, and the placements have been determined after the matching of those characteristics with the ARC MAP10.6, which are found to be compatible with the conditions for determining Watershed, select a catchment as follows, see table 14 and Figure 10**:**

- The first catchment area is located in the north of the region within a basin with an area of 2.8 km^2 and (0.17%) Of the total area of the region, which is barren land of rocky nature consisting of clay and limestone whose soils are shallower at a rate of (1.2 – 3.8) mm/h, the midpoint of this position (105) has reached the sea level by parties with a height of (113 – 115) m above sea level. Given the shape of the narrow purer look (4-4) The volume of the torrent in this basin, where the catchment is located, is determined by the model Senidrepin (4.6 – 67.6) million m3 with a flow depth ranging from (4.1 – 58.8) m², the maximum capacity of the reservoir (28) MCM water requires the establishment E-Ceramics Championships (268) m.
- The second catchment area is located south of the region within the Wadi al-Asadi basin with an area of (2.3) km2 and (0.14%) Of the total area of the region, which is barren land of rocky nature consisting of solid limestone, whose soils are shallower with a leaching rate of between 3.8-7.1 mm/h, the midpoint of this position (175) m above sea level with parties ranging from (183 to 184) m from the sea level given E The shape of the narrow purer look figure (4-5) The volume of the torrent in this basin, which is located within the catchment, according to the Snyder model (7.3 – 88.3) is estimated at a depth of flow between (6.6–79.7) m², maximum capacity (20.7) MCM of water requires the construction of a high (12) m. The safety and the length of (273) m.

Table 14 : Catchment areas and the capacity of the Potter

Location	Area /km^2	Percentage of area (%)	Maximum storage capacity M m^3	Long	Latit
1	2.8	0.17	28	42.46	33.57
2	2.3	0.14	20.7	42.2	33.48
Sum	5.1	0.31	48.7	-	-

Source: From the work of the researcher based on the director of the program (ARC MAP10, 6) and the digital Elevation model (DEM) with a discriminatory accuracy of (30 × 30) m.

Catchment position (Fig. 10)

Source: Digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m using the ARC MAP10.6 program**..**

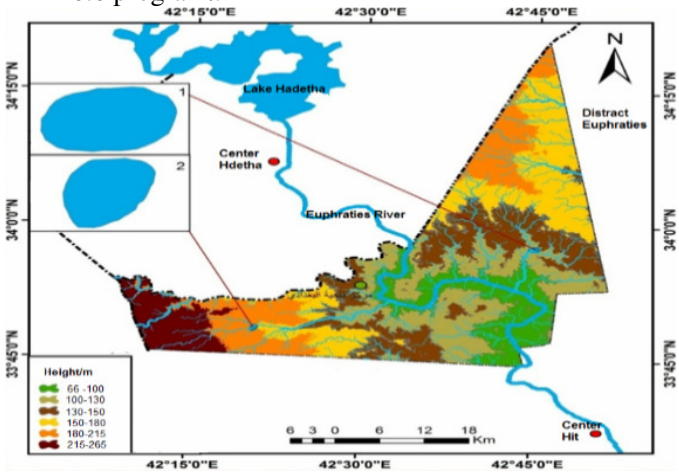

Fig. 11 : Position of the first catchment

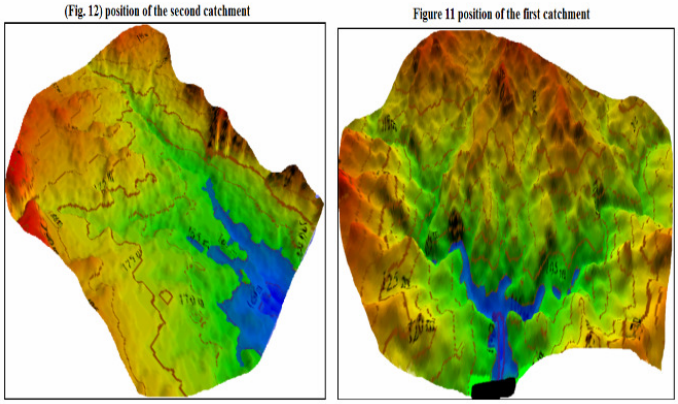

Fig. 12 : Position of the second catchment

Source: Digital elevation model (DEM) with a discriminatory accuracy of (30 × 30) m using the ARC MAP10.6 program**.**

Conclusions

- The area extends within the geological-stable range of the Arab plate**.**
- The region comprises a series of linear combinations of a total of 114 linear structures dominated by the West-south-east, which controlled the waterways of the water network**.**
- There is a correlation between slopes and rock detectors**.**
- Rainwater harvesting is available within the region**.**

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