Evaluating morphotectonic karst sinks in Parav - Bistoun mass using DEM

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Extended abstract
1- Introduction

Fractures are one of the most important factors in capability of carbonate rocks permeability. System of fractures and joints bring about penetration and access of water into the deeper layers. Therefore, karstic processes can developed along them and result in variety of karst morphology. In mountainous massif of Parav - Bistoun, Various forms of the karst landscapes such as karrens, uvalas, dolines, caves and soon have emerged due to specific lithology and tectonic. The Depressions are interesting because of great influence of fractures on them and their dimensions. Thus, in this study, morphotectonic consideration of depressions an important part of karstic studies has been marked.

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Besides, the study of karst morphology in the region, the morphotectonic recognition of depressions has proceeded in combined with results of fieldwork and processing of DEM.

2- Methodology

In this study, accurate location and orientation of depressions and joints were provided using GPS and compass data collected during fieldwork. In addition, orientations of faults were recognized using a 1/100000 scaled geologic map of the study area and in the next step were digitized. This collected information was processed in Rock Work software and their rose diagrams provided. By processing of digital elevation models in GIS software, depressions location was recognized and drainage density index of the area was surveyed. At the end, after collecting all these data, relation between karstification process and tectonic was attended and karstification rate and its conditions in the area were studied.

Analysis of joints and faults system and its effect on the area:

High brittleness and low flexibility in the thick limestone formations has

followed the increase of stress effect resulted in creation of various faults with different directions and orthogonal (tensile) - shear in the relief.

The creation of orthogonal faults and crashing in their direction have important role in further permeability of water and create further contact level with bed. It caused the development of karstification process and created of various depressions with bigger dimensions in direction of faults. Therefore, in order to survey relationship between faults & joints and depressions, in addition to tracing rose diagram of depressions resulted from digital elevation models and field work, was traced rose diagram of fault lines that had been divided from 1/100000 scale geologic map and field works.

3- Discussion

According to these results, the orientation of tensions in Parav - Bistoun mass is approximately Northern – Southern and faults show Azimuth angles of 45, 75 and 315 degrees.

Joints and fractures with a similar trend show up that the azimuth orientation 45 and 325 degrees in area. Tracing of lengthwise across of depressions shows trend of NW-SE. Thus, the longitudinal axis of the depressions with azimuth angle of 320-330 degrees are consistent with trend of maximum faults and their maximum different with faults of area is 10 degrees.

Therefore, this study shows the development of karstic depressions and development of karst has been fundamentally affected from tectonic situation and tectonic activity in the area.

-Morphology of karst in the study area.

The study of different forms of exokarstic in Parav - Bistoun indicated that, in the result of the dissolution process at different levels, the karsts create a specific landscape and topography with a variety of forms. The most significant karst forms in the area are sinkholes, dolines, Karens, caves, uvalas and so on. This form indicated differences in dimensions and local dispersal in relationship to suitable circumstances for karstification.

According to the geomorphological evidence of the region (Parav cave with a depth of 751 m and local erosion levels such as great fields of karst in surfaces of low relief) the thickness of Bistoun limestone together with high purity that have potential for dissolution, Depressions of the area lie within dissolution - break down class from sextet categories that introduced by Ford &Williams (2007, p. 341).

The area has various depressions with different dimentions. The biggest depression has depth of 115 m and diameter of 180 m. It shows azimuth angle of 30 degrees. Other karstic forms of area are caves, which recognized as the deepest cave in the whole Middle East and have depth and length of about 751 and 1361m, respectively.

On the basis of studies that has performed by the Ministry of Energy of I.R.Iran

General trend of the cave is according to the main Zagros thrust fault trace.

Uvalas are others form from karst of area that have shaped as a result of great karst development and unifying contiguous depressions. Sometimes, these shapes have created in the realm of depressions development with unevenness bed and sometimes have shaped in downwards of big depressions with evenness bed, as a result of dissolution processes in beneath the earth's surface and have relationship with

infiltrated waters into higher elevations depressions.

Identify of depressions and big karst fields:

Studies have been focusing on more the recognition of exokarstic types in terms of depressions & uvalas using of digital data. In this study, we have surveyed hydrological methods related to depressions and uvalas of the area. Automatic extraction of network and watershed properties from a DEM represents a convenient and rapid way to parameterize a watershed (Garbrecht and Campbell, 1997, 205 p).

With the help of digital hydrological model, the locations that have convergent drainage (without distinict outlet) and frequently have main shaft (without distinct drainage and without cell data) have been extracted as depression. By applying 50 meters resolution DEM, about 20 depressions and karst fields were identified (table 4 and fig.12). Trend of depressions is according to fractures rose diagram that shows development of karst is effective from tension and tectonic activity in the region. Processing of DEM with resolution of 10 m and extract of Figure 13 helps to evoke a more vivid portrayal of karst big field wich indicated in figure 12.

Figure 13 shows depressions with zero cells ratio and blue color. This figure denotes relationship between depressions and faults.

Finally, proceeded toward trace of depressions profile in the area that have great area and depth shows karst field of depressions and identification were impossible because of low spatial resolution of DEM.

4- Conclusion

Due to the specific tectonic & lithologic conditions of Parav - Bistoun mass the development of dissolution has morphologically existed in surface and depth.

- existence of thick stratum of limestone with high purity has provided development of karst processes.

- raptures that are resultant of fault activities, has provided development of dissolution processes in depth and create depressions according to joints and fractures and also create vaults and columns.

- existence of caves (Parav cave that has depth of about 751) and uvalas that have created in different elevation surfaces and have role of local erosion bases shows that development of karst is extensive in the region.

- the major depressions extracted from 10 meters resolution DEM shows that trend of depressions is linear and is in relationship with lineaments and faults of the region.

Key word: Parav-Bistoun, sinkhole, morphotectonic, digital elevation models

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