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FRACTAL DISTRIBUTION OF EARTHQUAKE EPICENTER AND FAULTING IN THE SEPIDAR ANTICLINE, SW ZAGROS

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Fractal analysis (Mandelbrot, 1982) is one of the most appropriate methods for determining the quantitative level of tectonic activity, structural maturity and degree of heterogeneity of seismicity (Naimi-Ghasabian, 2017). In this paper, the fractal dimension (D) obtained by the box-counting method as the most general approach for calculating D (Turcott, 1989). According to this method, the study area was initially superimposed on a square grid size r_1. The unit square (r) of area was divided into small squares of linear size $r_1/2$, $r_1/4$ and $r_1/8$, sequentially. The geometry of fractals is calculated by power-law distribution and the potential D, is represented by the fractal dimension:

$$Ni=C/r_i^{Df} \quad (1)$$

where Ni is the number of objects, characterized by the linear dimension *r*, C; proportionality constant and D_f fractal dimension, which is calculated by Turcotte (1992):

$$Df = \frac{Log(\frac{Ni+1}{Ni})}{Log(\frac{ri}{ri+1})} \quad (2)$$

At simplest form of Equation 2, the fractal dimension was determined from the slope of the log $N(r_i)$ versus log $(1/r_i)$ plot.

$$Log(N)= a + K \log(1/ri) \quad (3)$$

Sepidar anticline in southwest of the Zagros, located in a tectonically active area, is delineated by the Sepidar, Sabzpoushan, Khafr and other active faults. This area has experienced destructive earthquakes like Zanjiran events with Mw=5.9 (20/6/1994) and the maximum peak acceleration of 1g (https://ismn.bhrc.ac.ir/en). Calculation of fractal dimension (D_f) by using the active faults map, reveals that D_f values varies from 0.9 to 1.73 from southeast to northwest part of the Sepidar anticline. In addition, the spatial distribution of the earthquake epicenters analyzed from the data base on earthquakes of *Mw*>3 which occurred from 1900 to 2018 (Figure 1). The computed fractal dimension of

earthquake epicenters (D_s) values show ranging from 0.3 to 1.06. The maximum D_s values belong to the regions 8, 14, 15, 20, and 21 in the northwest, whereas the minimum values belong to the regions 3, 6, 9 and 25 (Figure 1). These results (D_s values) suggest that the earthquake epicenters are distributed on the northwest part of study area. The variation pattern of the fractal dimension for the spatial distribution of the earthquake epicenters (D_s) and the faults (D_f) are similar. However, D_f are higher than D_s values, with the difference of absolute values being larger in the northwest part than that in the southeast part of the Sepidar anticline. This result indicates that the potential of the fault network has not been completely released by the seismic activities yet (e.g. Sherman and Gladkov, 1999). Thus, the seismicity may increase with time as more faults become reactivated in the Sepidar anticline, so that both processes come to a balanced state ($D_s \rightarrow D_f$).

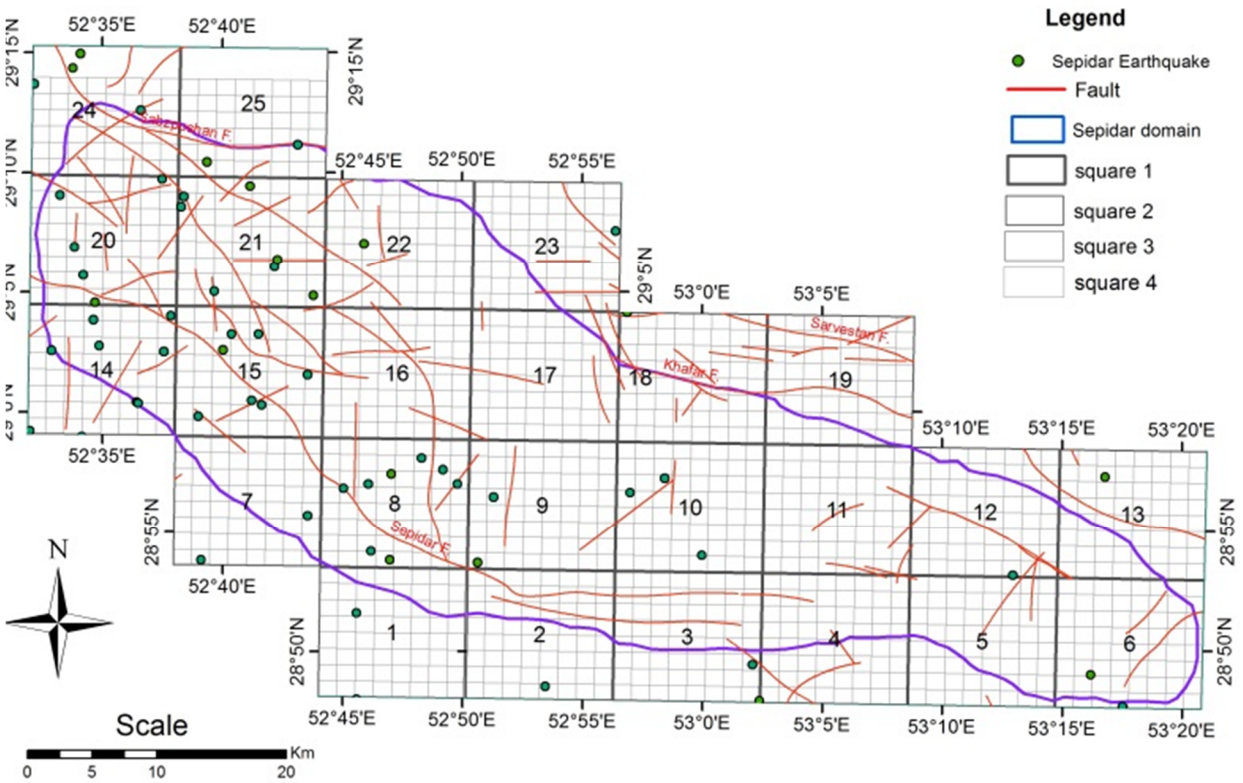

Figure 1. Scheme of the fault network, earthquake distribution and equal squares grid in the Sepidar anticline.

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