



SEISMICITY AND SEISMOTECTONIC STUDY FOR ALTUNKOPRI DAM SITE NORTH IRAQ

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Abstract

A seismicity and seismotectonic study for a dam site located on latitude (35°:48' – 35°:50') degree North and longitude (44°:20') degree East was carried out. The surrounding area within a circular area of radius 100 km was also included to determine the seismic activity.

It is found that the area was subjected to 10 historical events prior 1900 year with an intensity ranges (V - IX) degree and the area exposed to about 163 recent earthquakes with $M_s=1.1 - 5.9$.

The maps of epicentral locations, tectonic features and lineaments of the study area were compiled and drawn. Matching was carried out for these three maps and it is found that most of earthquake epicenters coincide with the main structural and tectonic phenomena at the dam site.

ISO – intensity map for the dam site was also drawn. It is found that the dam site was located between (5 -6) degree earthquake intensity on MMI Scale

دراسة زلزالية تكتونية لموقع سد التون كوبري شمال العراق

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الخلاصة

تم اجراء دراسة زلزالية لموقع سد التون كوبري والمناطق المحيطة به بنصف قطر مقداره 100 كم لغرض تحديد مستوى النشاط الزلزالي في المنطقة . لقد تعرضت المنطقة الى 10 هزات تاريخية وبشدة تتراوح ما بين (IX-V) وتعرضت الى حوالي 163 هزة حديثة بمقدار زلزالي يتراوح بين 0.9-1.1 . تم رسم خارطة مواقع البؤر الزلزالية لمنطقة الدراسة ، الخارطة التكتونية وخارطة الظواهر الخطية ومن مطابقة الخرائط وجد ان هنالك معظم مواقع الهزات الارضية يتطابق مع الاتجاه العام لمحاور الطيات ومع الصدوع في منطقة الدراسة . تم رسم خارطة تساوي الشدة الزلزالية لمنطقة الدراسة ووجد ان منطقة السد تقع ما بين الشدتين (5-6) درجة حسب مقياس ميركالي المعدل.

1. Introduction

Earthquakes represent the most severe loading some dams will experience. Strong ground shaking can result in instability of the dam itself, strength loss of the foundation, instability of the natural reservoir rim, and release of the reservoir [1,2].

Active faults within the foundation of the dam have the potential to cause damaging

displacement of the structure. To prevent catastrophic release of water from the reservoir , appropriate design measure must be employed to resist earthquake imposed loads [3,4].

To provide a high degree of protection from earthquake related dam failure, identification of the seismic sources that could affect a project is needed [5] Seismotectonic investigation , often involving detailed studies to determine faults

activity and magnitude of Paleoseismic earthquake is an important part of a site investigation for dams [6].

2. Geotectonic situation

The investigated area is located in the northeastern part of Iraq (Fig. 1) between latitude 35°:50' N and longitude 44°:20' E. The topography of the area is closely controlled by its geological structure, lithological character and the degree of erosion. The rocks exposed to the surface are generally pebbly sandstones and conglomerates alternating with fine siltstones and marls of the

upper Al-Fatha and Bakhtiari beds of upper Miocene – Pliocene age. Alongside that outcrops lie the alluvial, river graded and scree deposits of Pliocene – Recent age, (Fig 2) [7].

The seismic distribution is firmly related to the tectonic nature of the area. Therefore it is necessary to know the tectonic and structural units to give a complete seismotectonic picture of the area [8,9]. (Fig 3) show a flowchart of tectonic division of Iraq. (Fig 4) shows tectonic map of the studied area[10].

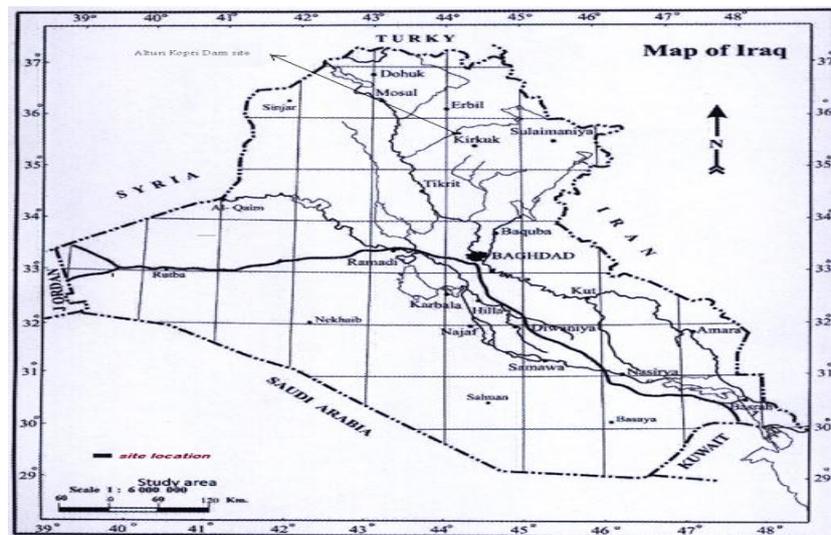


Figure 1: Location map

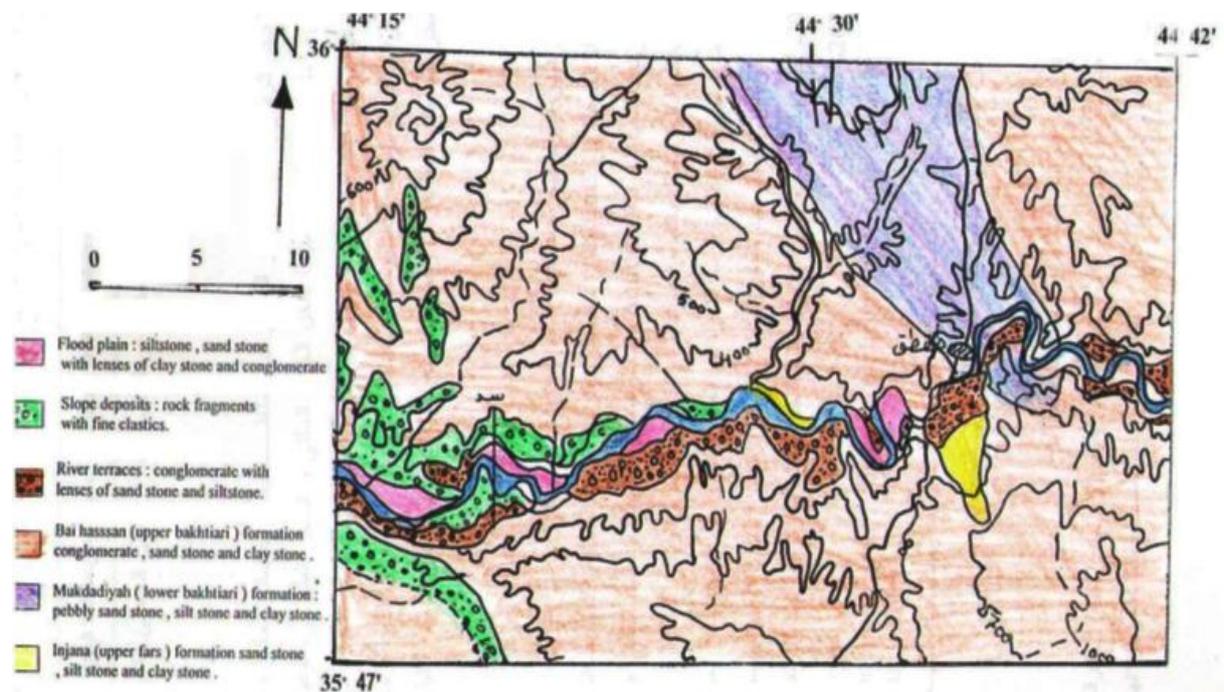


Figure 2: Geological map of site

3. Seismicity

The tectonic positioning of Iraq between the fringes of the Alp-Himalayan belt and the African –Arabian plate has generated a rather unique seismotectonic framework which is considered the principal cause of earthquakes occurrence [11].

This is particularly true for the relatively high seismic risk in the epicentral appear to be directly associated with the Zagros-Tauros mobile zone [12].

The seismicity of the area can be presented qualitatively by showing the locations of earthquake epicenters on a map which indicates different ranges of magnitudes (Fig 5). The figure shows two types of earthquakes:-

- Historical earthquakes, the studied area subjected to about (10) earthquakes with intensity (V - IX)[13].
- Recent earthquakes, the area exposed to (163) events within circular area of 100 km about dam site with magnitude range of $M_s=1.1 - 5.9$ [14]. (Fig 6) shows the distribution of earthquakes magnitude .
- The reoccurrence relationships was plotted as shown in (figure 7). The b value was found (1.1578) which means a high seismic activity.

4. Lineaments features

(Figure 8) show the lineaments through the studied area(15). The trend of the most lineaments is N45E which are parallel to the lesser zab and Anna-Fatha-QalatDiza fault.

There is another trend N45W which is perpendicular to the main strain which affect the region.

The lineaments of N85W and E-W trending result from the anticlockwise movement of Arabian Peninsula in NE and E trend appear in the studied area.

5. Seismotectonic settings

The results of comparison of three maps (seismicity map, tectonic map and lineament map) , are as follows:

1. A good matching between Traifawi-Hatar-Bakham and Annah-Fatha-Dizah fault is found with the epicentral locations which indicates reactivation of these faults.
2. Another matching was distinguished between the existing faults and the extracted lineaments of trending N45E with a series of earthquakes occurred in the Lesser Zab area.
3. There are good matching among anticline axes which extend NW-SE with the epicentral location and lineaments trend of N45W.
4. Matching was found between earthquakes location and lineaments in Arbil, Tagtag, west of Altunkopri and Kirkuk. The intense seismicity of the region indicates that tectonic deformations are still in progress.

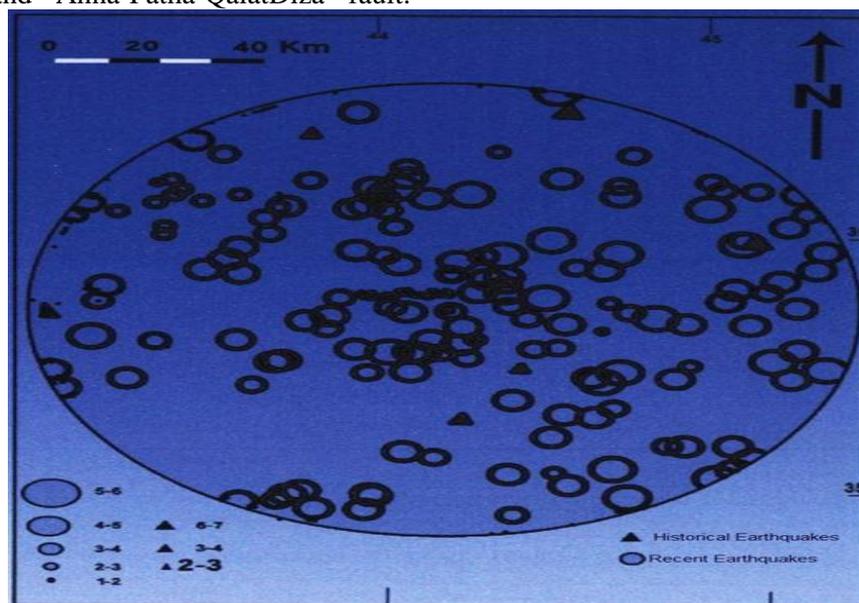


Figure 5: Seismicity map of studied area.

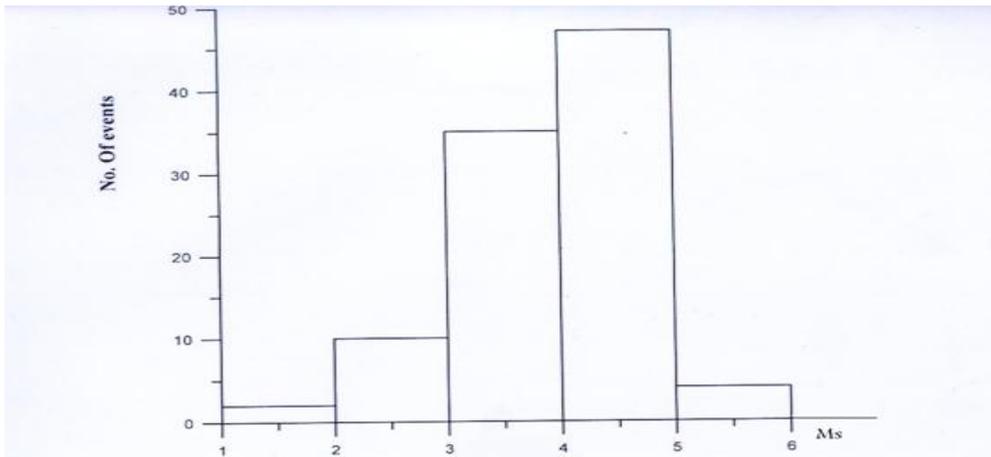


Figure 6: Show the distribution of Magnitude.

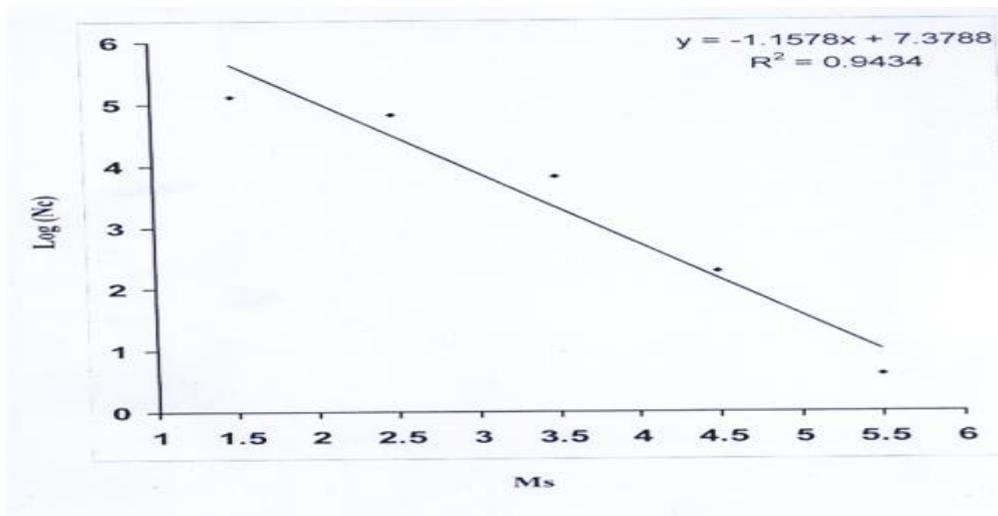


Figure 7: Show Frequency –Magnitude Relation.

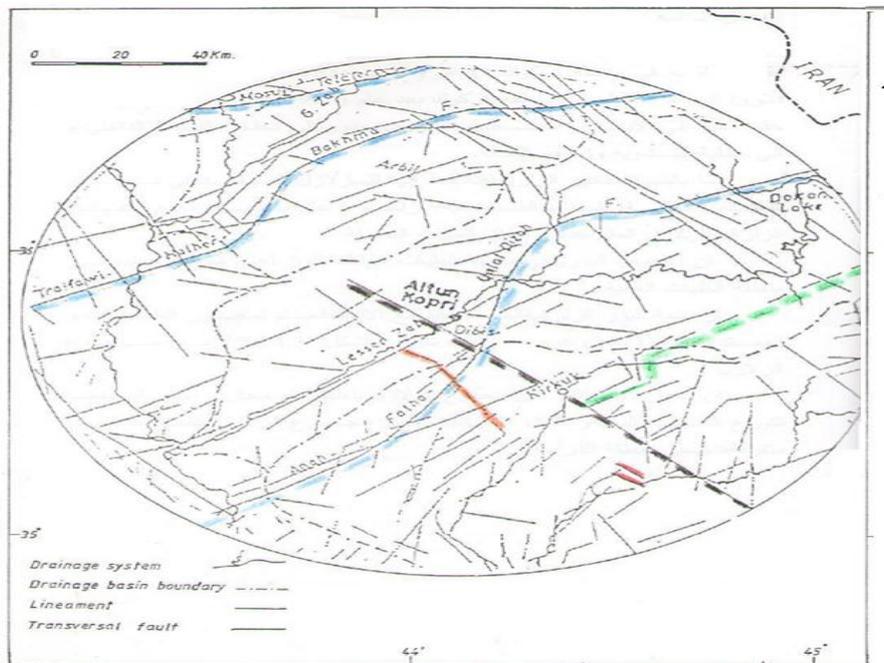


Figure 8: Lineaments map of studied area (Al-Kubaisy,2000)

6. Intensity zoning map

Isoseismic map has been constructed on the basis of available seismic information. The constructed map reflects the distribution of

tectonic activity and gives the probable maximum earthquakes intensity which is important in the seismic design of structure (Fig. 9).

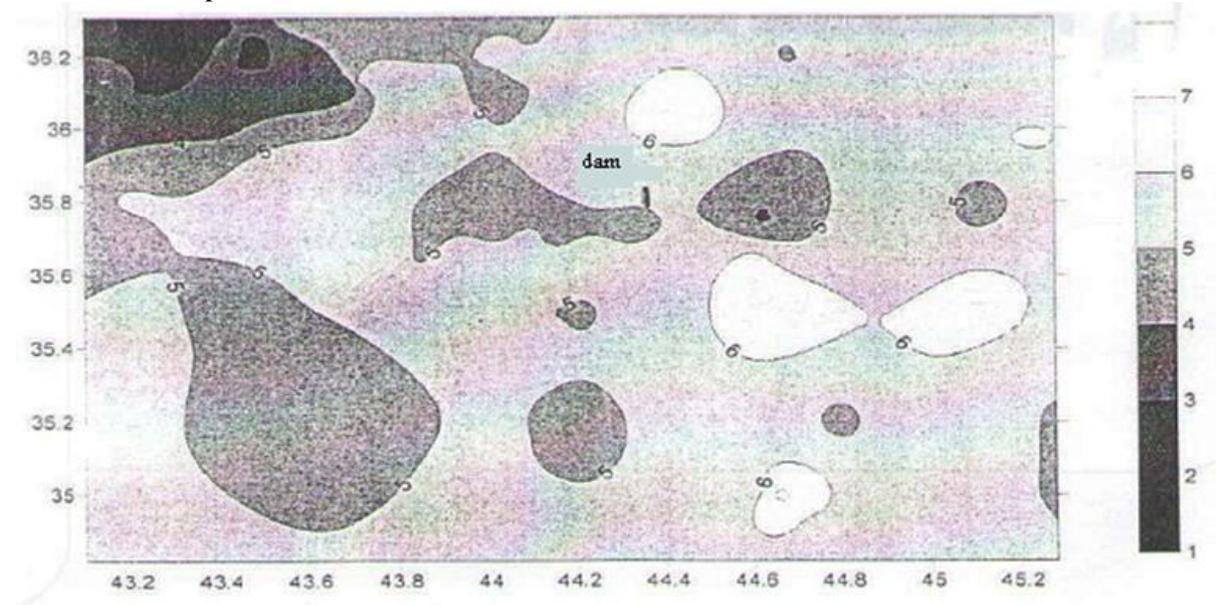


Figure 9: Isoseismicity map of studied area.

7. Conclusions

Based on the comparative analysis and discussion the following conclusions may be drawn:

1. The seismicity of an area within a radius of 100km has been studied. It is found that the area subjected to 163 events, in addition to 10 historical earthquakes.
2. The seismicity of the area is due to the forces resulting from movements of the Arabian plate to the north and northeast causing reactivation of the faults.
3. The forces which formed the geological structures along the plate boundaries are still active causing strain accumulation and deformation.
4. It was found that the trend of the faults planes are parallel to the trend of the structure of Zagros-Tauros belt and the pressure axes are approximately perpendicular to the axes of the major structures.
5. The dam site lies between (5 - 6) degree of MMI scale.

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