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# Iraq Earthquake Contour Maps

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## ABSTRACT

A magnitude 7.3 earthquake struck the northern Iranian- Iraq border region, it was 350 km north of Baghdad at a depth of 33.9 km. The earthquake was felt as far away as Turkey and Kuwait. Until that moment the Iraqi researchers did not focus on the hazardous of Earthquakes. This research provides national seismic contour maps of Iraq. The use of values on the maps as design coefficients, replacing site-specific studies, is not generally considered best practice. The values are intended to give a general indication of the expected hazard level. Three maps are provided, with return periods of 20 years, 10 years and ne year, whole showing the depth and magnitude. Values were computed over an area bounded by 29 o - 39o N and 39o W - 49o E. The computations were made for points distributed on a grid at approximately 15 km intervals in both directions, and this defines the spatial resolution of the maps.

**Keywords:** Baghdad, Iraq, Earthquake, Contour Maps

## I. INTRODUCTION

Earthquakes typically occur large-scale vibrational ground movements, caused by a number of phenomena including tectonic earth movements, volcanoes, landslides, rock deposits and human explosions. From these various causes, tectonic-related earthquakes are the largest and most important. The reason for this is to break the rocks and slide them along the faults inside the earth's crust. Error is the area of the earth's crust that the sides have moved - errors may be hundreds of miles long, from 1 to more than 100 miles deep, not easily visible on the Earth's surface. Earthquakes trigger a number of phenomena or factors called seismic hazards that can cause significant damage to the built environment. These include rupture, rupture, vibrational ground motion (immersion), immersion (eg tsunamis, cych, damfilor) (Such as liquefaction), fire or hazardous materials. For an earthquake, any particular hazards can be controlled, each of which has historically caused serious damage and significant loss of life in specific earthquakes. The expected damage that is given a specific value for the risk parameter is called "vulnerability" and the resulting risk and vulnerability (ie, expected damage) is called seismic hazard [1].

## II. EARTHQUAKES

Globally, tectonic earthquakes produce movement between a number of large plates consisting of the earth's crust or rock cover (about 15 in total). These paintings are driven by the movement of material in the mantle of the earth, which in turn is driven by the heat generated at the earth's core. The motion of the relative plate in the friction interface is restricted to friction and / or aspartites (tangled areas due to protrusions in the fault surfaces). However, the strain energy accumulates in the plates, eventually overcoming any resistance, causing slip between the

sides of the error. This sudden slide releases large amounts of energy, which constitutes the earthquake. The initial radiation site of the seismic waves (ie, the first location of the dynamic rupture) is called the hypocenter center, whereas the projection on the surface directly above the epicenter of the epicenter [1].

## III. MEASUREMENT OF EARTHQUAKES

The Seismic waves are the vibrations of earthquakes that travel across the Earth. Earthquakes are complex multidimensional phenomena, scientific analysis that requires measurement, and are recorded on instruments called seismographs. The measurement of earthquakes qualitatively in terms of impact or severity, which vary from point to point. The time, location and size of the earthquake can be determined by data recorded by seismic stations. These measures remain the most widely used earthquake measures, and a number of different measures have been developed for each, which is sometimes confused. However, engineering design requires measuring earthquakes in units such as force or displacement.

## IV. THE RICHTER SCALE

Numerical measurement is used to describe the power of earthquakes. It was invented by Charles Francis Richter in 1935. Measured Earthquakes between 4.5 or more on a scale can be measured by instruments all over the world table I.

TABLE I

THE RICHTER SCALE

| Richter scale | Description | The impact of the earthquake | Average frequency of occurrence |
|---|---|---|---|
| Less than 2.0 | Micro | earthquakes can only be felt by animals | About 8,000 a day |
| 2.0-2.9 | Minor I&II | is too small to feel by human but instruments observe it | About 1,000 a day |
| 3.0-3.9 | Minor III&IV | Felt by human beings, but rarely cause harm. | About 49,000 per year |
| 4.0-4.9 | Light | Humans feel a jolt with things moving and the sound of an earthquake. But it does not cause harm | About 6,200 per year |
| 5.0-5.9 | Moderate | Poor buildings may be severely damaged but strong buildings are not severely damaged | About 800 per year |
| 6.0-6.9 | Strong | Can cause great damage up to 160 km from the point of occurrence. | 120 per year |
| 7.0-7.9 | Large | can cause significant damage to a large area. | 18 per year |
| 8.0-8.9 | Major | can cause great damage even hundreds of miles from the point of occurrence. | 1 per year |
| 9.0.9.9 | Great | can cause significant | Once every 20 years |

| | | | |
|---|---|---|---|
| | | damage up to thousands of miles from the point of occurrence | |
| 10.0+ | Supernatural | has not happened yet. | Rare (Unknown) |

## V. MAGNITUDE

An individual earthquake is a unique release of strain energy. Quantification of this energy has formed the basis for measuring the earthquake event.

Richter's original magnitude scale was extended to observations of earthquakes of any distance and of focal depths ranging between 0 and 700 km. Because earthquakes excite both body waves, which travel into and through the Earth, and surface waves, which are constrained to follow the natural wave guide of the Earth's uppermost layers [2].

## VI. INTENSITY

In general, seismic intensity is a measure of the effect, or the strength, of an earthquake hazard at a specific location. While the termcan be applied generically to engineering measures such as peak ground acceleration, it is usually reserved for qualitative measures of location-specific earthquake effects, based on observed human behavior and structural damage [3].

## VII. DETERMINING THE DEPTH OF AN EARTHQUAKE

Earthquakes can occur anywhere between the Earth's surface and about 700 kilometers below the surface. For scientific purposes, this earthquake depth range of 0 - 700 km is divided into three zones: shallow, intermediate, and deep.

Shallow earthquakes are between 0 and 70 km deep; intermediate earthquakes, 70 - 300 km deep; and deep earthquakes, 300 - 700 km deep. In general, the term "deep-focus earthquakes" is applied to earthquakes deeper than 70 km. All earthquakes deeper than 70 km are localized within great slabs of shallow lithosphere that are sinking into the Earth's mantle [2].

## VIII. TECTONICS OF THE IRAQ

Iraq is located in the north-western sector of the Arabian plate, attached with two plate boundaries.

The two closest boundaries are the Africa and Eurasia. It is an intraplate area and as such, levels of seismicity are characteristically low (see Figure 1).

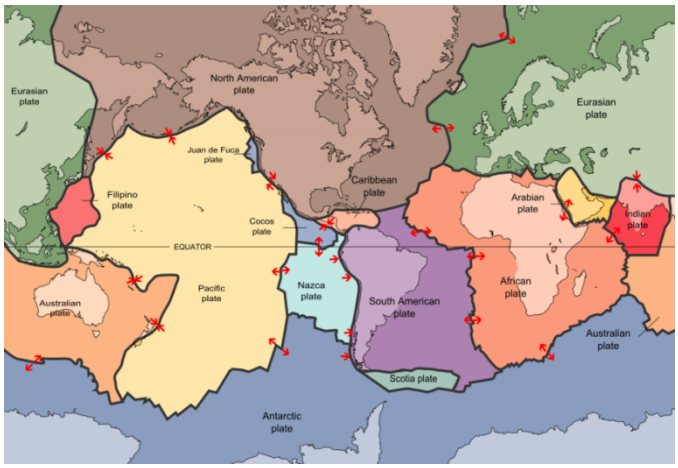


Figure 1: World tectonic plates [3].

## IX. PURPOSE AND OBJECTIVES

Over the past few decades, a substantial body of new data on the location and activity rates of faults in Iraq region has become available. The present maps are a direct reflection of these new data but also reflect a somewhat different approach to how seismic hazards are defined and how data are incorporated into the evaluation.

This research describes the methods and results of a year-long research project to evaluate seismic hazards in Iraq and to produce a seismic contour map to be used in the studying the hazards of earthquakes on Iraq [4].

## X. SCOPE OF WORK

Although most of the information available was collected early in the investigation, data collection, refinement, and analysis are ongoing throughout the entire project. Trusted investigators evaluated of most of the data collected and the most reliable data were used throughout the project. Some of the collected data were sufficient as they existed but more data is needed for several aspects.

## XI. DATA COLLECTION

The main type of information required for this study was the data on faults and earthquakes. A literature base containing the need the information was great and varied. To track a large amount of data, the information was collected in two forms: 1) data sheets and 2) maps.

## XII. EARTHQUAKE CONTOUR MAP IRAQ

The seismic contour maps shows the latest earthquake sites 924 with size (M)> 5 in the surrounding area of the Arabian Peninsula - Eurasian.

The M7.3 earthquake is located within a wide area of earthquakes along the Zagros Mountains and the Betelis stitch which forms the border plate. Note that the depths of the earthquake are often less than 70 km, indicating that most of these events are on the shell faults (see Figures II-7) [5].

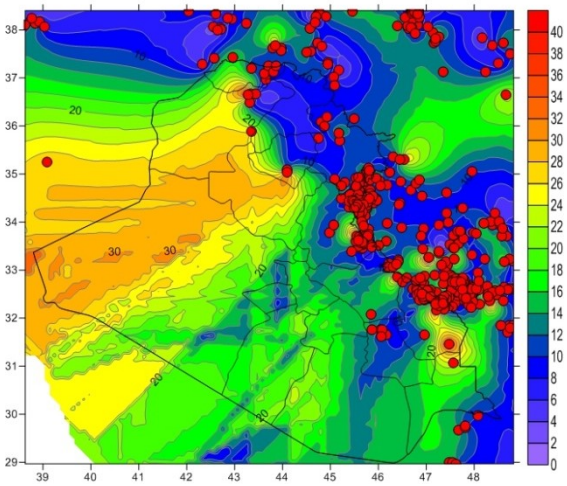

Figure 2: 10 years depth contours.

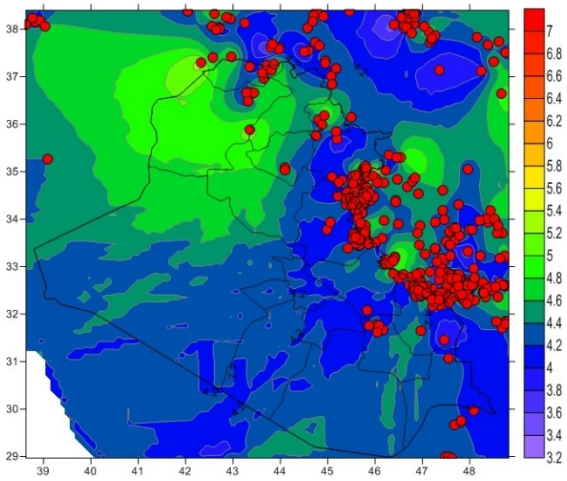

Figure 3: 10 years magnitude contour.

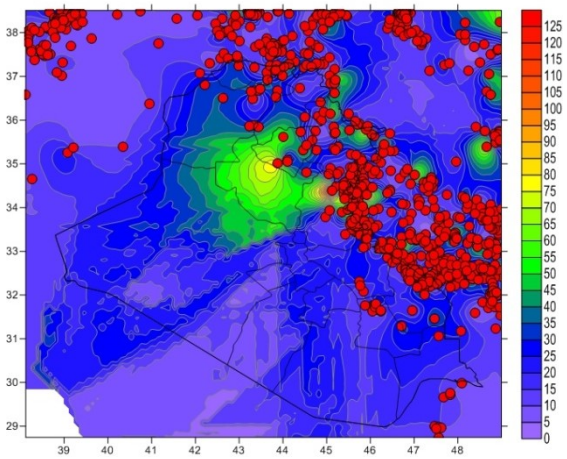

Figure 4: 20 years depth contours.

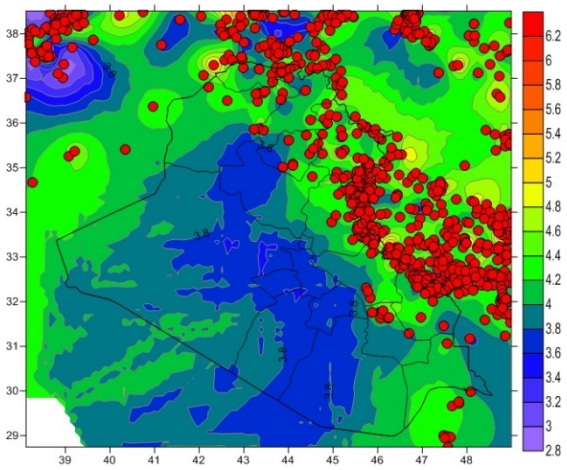

Figure 5: 20 years magnitude contours

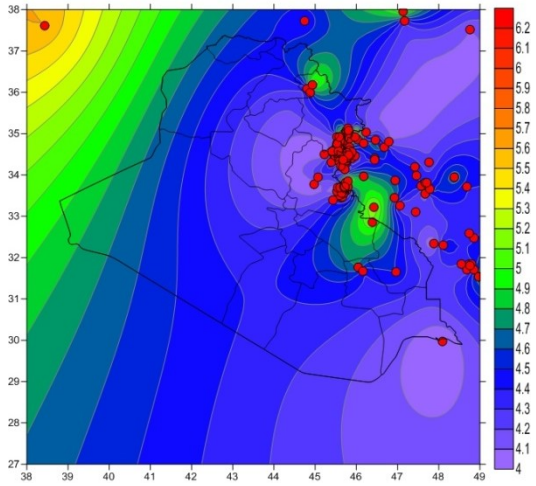

Figure 6: one year magnitude contour map.

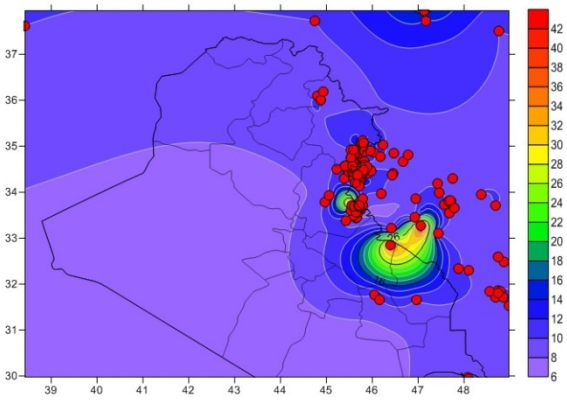

Figure 7: one year depth contour.

## XIII. ACCURACY OF DEVELOPED MAPS

Since a lot of information on the basic map and others project data (including accelerometers) were moved by or that are created as computer files, the resulting maps must be accurate to degree allowed by hardware equipment or more susceptible, limited by the accuracy of the original sources used to create the data. The errors that may arise in the process may come from the following sources:

o Incompatibility of map projection schemes
o Distortion of original map reproduction
o Reduction of electronic scanning device.

## XIV. CONCLUSIONS

In contrast to previous studies that are largely based on relatively historical earthquake data incomplete, we have worked tremendously depends on both earthquakes and geological data in the region. Specialty difference between the map of the magnitude contour and the map depth.

## XV. RECOMMENDATIONS

Given the ongoing developments by the Iraqi Government for the maps, several areas for future development for the seismic maps will be studed, this study may be useful in the future work.

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