

*National Board of Scientific Research
Libyan Center for Remote Sensing
and Space Science*

Seismological Observatory Office

*Explanatory Booklet for Seismicity
and Seismotectonic Maps of Libya
(1965 – 1999)*

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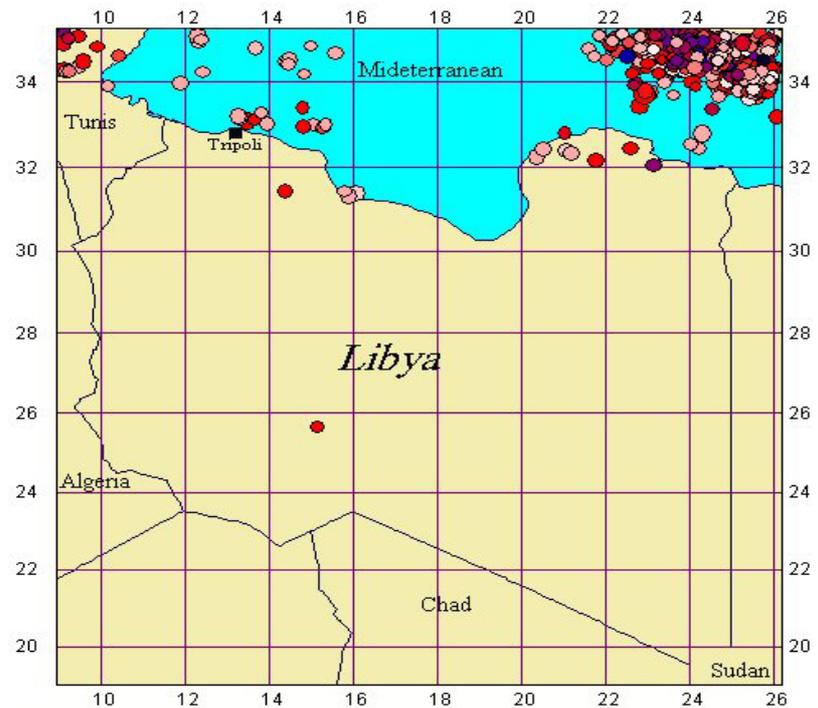
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Introduction

Libya is not considered a highly active seismic region (Gutenberg and Richter, 1965); however, several earthquakes of magnitude >6.0 have occurred within the last century, causing large of total damage, e.g. a series of large earthquakes occurred in Hun Graben area between 1935 and 1939, Al Marj earthquake of 1963, (Kebeasy1980; Suleiman and Doser, 1994).

Libya situated on the Mediterranean foreland of the Africa shield, has largely been affected by the regional tectonic and geologic history of the North African carton. It extends over platform of cratonic basins.

No seismological stations, in operation, are available in Libya at the present time, except two temporary stations in Gharyan (Ghar) and Al Marj (Marj) installed in March 2000.

The Libyan Center for Remote Sensing and Space Science has adopted the idea of establishing the Libyan Seismological Network (LSN) to record the local, regional and distant seismic activity, for many purposes, among which the assessing of seismic risk. Now, this idea is under executive and preparation stage (achievement of the civil works for some of the proposed station, training the staff ... etc.). In addition to the main acquisition and processing center in Tripoli, the seismic network will include 15 permanent Broadband stations, 16 portable stations and strong motion array of 30 stations.

Upon completion the Libyan Seismological Network, local and regional monitoring capability in Libya, Mediterranean region and in Africa will be improved by observing and characterizing the propagation of regional phases across the regions mentioned above.

The purpose of this project is the compilation of maps (at large scale) for Seismicity and seismotectonic of Libya, depending upon the available data.

Earthquake Database of The Seismicity Map of Libya

For the purposes of compilation of Seismicity map, making long-term earthquake prediction and hazard evaluation, provision of accurate Seismicity information in the for of earthquake data catalogues remains an essential prerequisite.

Nearly all earthquake catalogues document temporal changes in the rare of activity with particular magnitude ranges. This change could be due to variations in global network coverage and to seismographic station practice, which can systematically affect magnitudes. In order to construct a consistent and reliable earthquake database, the catalogue of Libya earthquake database has been compiled from different sources and served as the primary source from the instrumental Seismicity (1965 – 1999) in Libya and conterminous regions ($18^{\circ} - 35^{\circ} \text{ N}$; $9^{\circ} - 26^{\circ} \text{ E}$). Indeed only after the establishment of the World Wide Standard Seismograph Network (WWSSN) in 1963, did reasonable accurate earthquake locations and magnitude determinations become available for this region, we chose the period 1965-1999 for our catalogue.

Entries in the Libya earthquake catalogue for compilation the maps were crosschecked and additions made from various sources of earthquake records to ensure that repetitions are not included in this analysis. Searches were made in a number of seismological catalogues and bulletins including those of the International Seismological Centers (ISC), National Earthquake Information Center (NEIC), and European Mediterranean Seismological Center (EMSC).

Since the available earthquake sources contained events that were repeated more than once, it was necessary to eliminate the repetitions. The events were considered duplicate if they had time difference of 10 seconds or less, and space origin difference of 50 km or less. In a given set of duplicate events, an event, which had a magnitude and ISC source, was retained as the record of the event.

All earthquake catalogues are biased against small earthquakes. In other words, they are so-called incomplete data sources in the low magnitude range, because of the limited availability of seismographic network or in-earlier records-due to spares population densities. The common approach for treatment of this incompleteness is to employ earthquake detection and reporting probabilities. These probabilities are allowed to vary in time-span and with the size of the earthquake. The numbers of events for a specific magnitude range are adjusted to reflect the probability of detection and reporting. Using stepp's (1973) model an analysis of completes for our catalogue is performed. It is observed that the catalogue is complete for 4.4 mb and greater over the whole 35-years sample of data.

The basic information of ISC source contained for each earthquake is: date, time of occurrence (GMT), location (latitude, longitude), depth and the body wave magnitude (mb).

Seismicity map of Libya

Seismicity is a temporal and spatial distribution of the earthquakes. To compile a Seismicity map, we need the location (latitude, longitude) and magnitude of the event. To compile a Seismicity map of Libya, we classified the earthquake according to mb into seven categories: $3.0 \leq mb < 3.5$, $3.5 \leq mb < 4.0$, $4.0 \leq mb < 4.5$, $4.5 \leq mb < 5.0$, $5.0 \leq mb < 5.5$, $5.5 \leq mb < 6.0$, $6.0 \leq mb < 6.5$.

Each category has a symbol. We projected the earthquakes on a base map based on geologic map of Libya (*Industrial Research Center, 1985*) using symbols of the categories, (Fig. 1).

Our map show that most of the earthquake activity is concentrated mainly in the coastal region of the northeastern part of Libya in Al Jabal Al Akhdar region. The southern part of Libya can be considered as aseismic region.

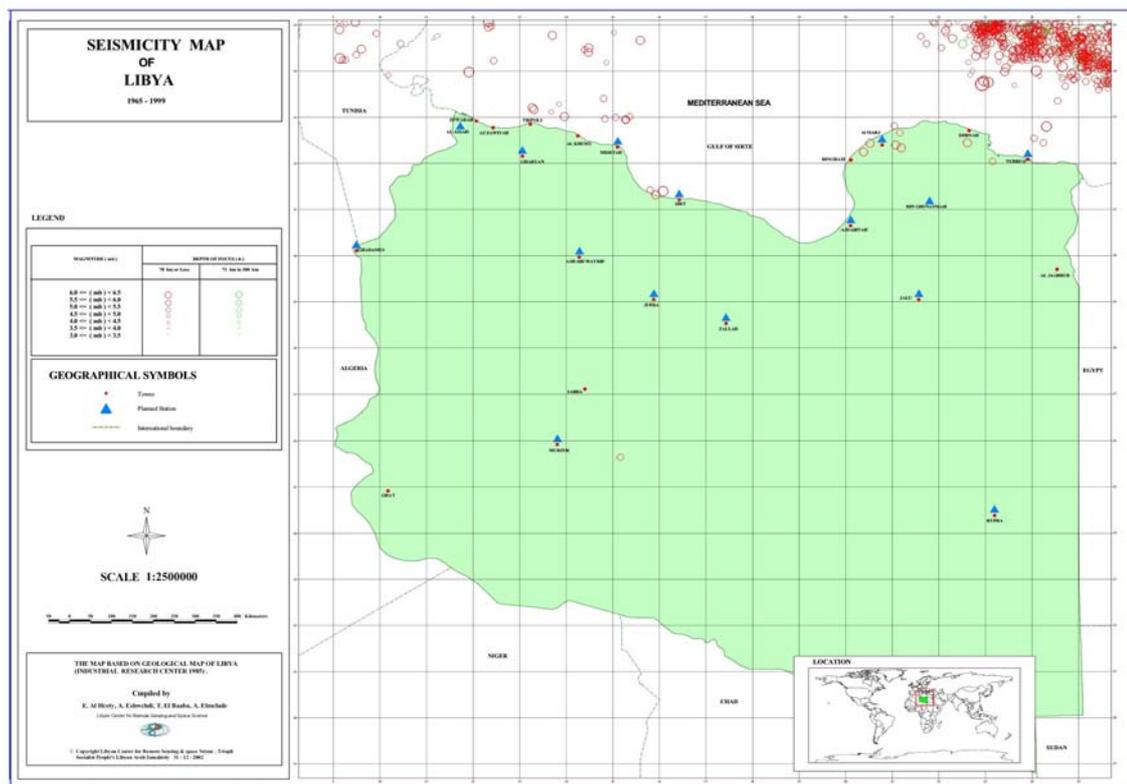


Fig. (1)

Seismotectonic Map of Libya

Seismotectonic is the relationship between distribution of the epicenters and the tectonic elements. We compiled a tectonic map of Libya based on geologic map of Libya (*Industrial Research Center, 1985*).

We projected the epicenters on the tectonic map of Libya (Fig. 2). The map shows that the distribution of epicenters agrees with distribution of the major tectonic features.

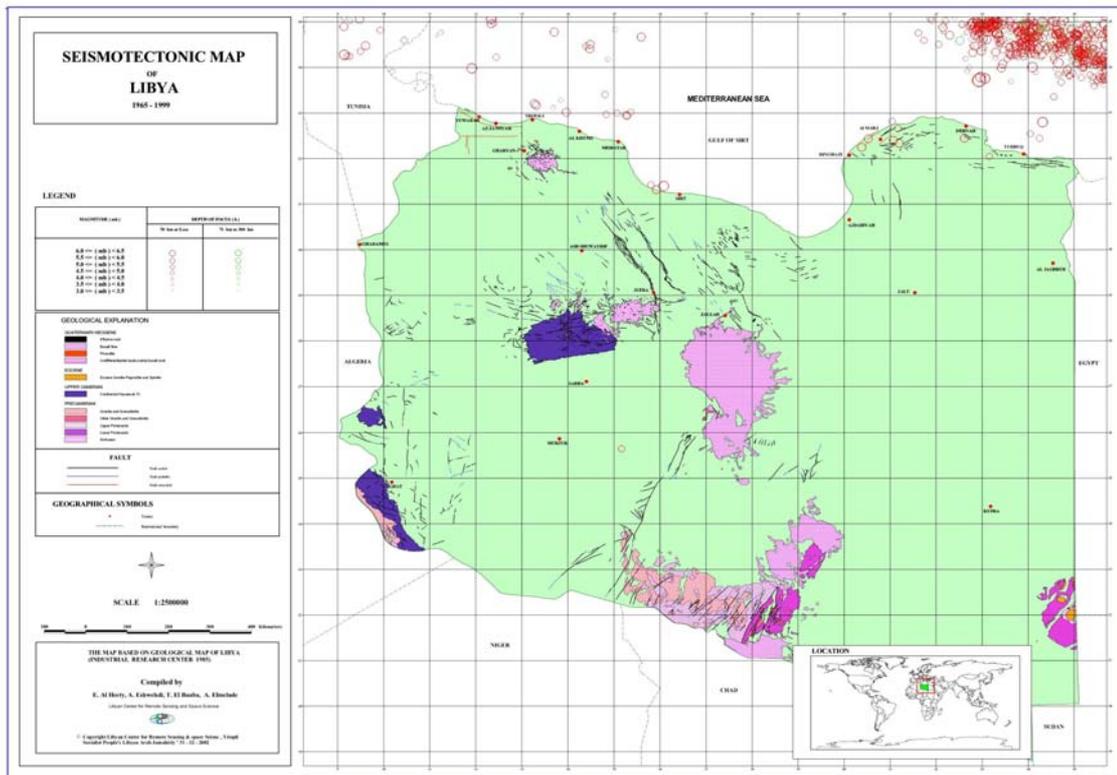


Fig. (2)

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