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# Significant Earthquakes Affected Egypt for the Last Decade and the Development of the Egyptian National Seismic Network

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Egypt is situated in the north-eastern corner of the African Plate, interacting with the Arabian and Eurasian plates through divergent and convergent plate boundaries, respectively. Also, Egypt is affected by the opening of the Red Sea (Mid Oceanic System) and its two branches (the Gulf of Suez and the Gulf of Aqaba-Dead Sea transform system). The relative motion along these plates creates areas of high seismicity in Egypt. In the last century, Egypt has been shaken by some severe earthquakes (Ms =5.8-7.3). These earthquakes caused a considerable damage in both historical and recent constructions. The most recent severe damage was caused by the 1955 (Alexandria) and 1992 (Southwest Cairo) earthquakes. Damage reports for such earthquakes reveal that the death caused by earthquakes exceeds the sum of victims caused by other natural hazards. Moreover, Faro, Romanic and Islamic constructions have been suffered from damages. Damages were concentrated mainly in Cairo as well as in cities located within the Nile Delta and the Nile Valley.

There are many destructive historical and recent earthquakes, reported in Egypt (see Table 1). The total reported damage depends mainly on the size of the earthquake, local geology and location with respect to populated areas. Comparing the earthquake size with the associated damage shows that even small local or large distant earthquakes could cause severe damage in different areas in Egypt, e.g., Cairo, the Nile Delta and the Nile Valley.

**Table 1. Destructive earthquakes in Egypt. Io is the maximum observed intensity in MSK scale.**

| Date | | | Lat N | Long E | Io | mb |
|---|---|---|---|---|---|---|
| Yr. | Mn. | Dy | | | | |
| 1955 | 09 | 12 | 32.2 | 29.6 | VII | 6.0 |
| 1969 | 03 | 31 | 27.6 | 32.9 | IX | 6.1 |
| 1981 | 11 | 14 | 23.6 | 32.6 | VII | 5.6 |
| 1992 | 10 | 12 | 29.9 | 31.0 | VIII | 5.4 |
| 1995 | 11 | 22 | 28.76 | 34.66 | VII | 5.9 |
| 1998 | 05 | 28 | 31.8 | 25.7 | VII | 5.9 |

The observation of seismicity can help us understand much about the sources of activities. However, many parts of the country had not been well covered with seismic stations, and the need of having a new system of monitoring with new technology covering almost all the territory had been a national demand specially after the Dahshour earthquake 1992. This new national network has to be technologically sophisticated system and fundamentally adequate to meet important needs for public safety and emergency management, quantification of hazard and risk associated with both natural and man-made earthquake, and engineering applications related to this, as well as basic research.

The Egyptian National Seismic Network (ENSN) now consists of different types of seismic sensors such as, short period, very broadband, borehole, strong motion, portable digital seismographs, mobile arrays and shallow seismic refraction sets. Due to the intense number of stations and its very well azimuth distribution, monitoring of micro-earthquake activities were remarkably increased and new seismic sources have been detected. Nowadays the Egyptian National Seismological Network consists of the Cairo, Hurghada, Burg al Arab, Kharga, Aswan and Toshka sub networks that include more than 55 seismic stations with vast communications between sub-arrays and the central sites (HLW at Helwan). In addition to these seismograph stations, ENSN has 24 mobile seismograph stations and 24 strong- motion accelerographs. By these dense stations, it is possible to record most of on going seismic activity in Egypt.

The main conclusions from this study can be summarized as:

1) The tectonic setting of Egypt is complicated. Active zones have developed from plate margin activity and imply that the seismic hazard is high for parts of the country.
2) The highly populated area of the Nile Valley and Nile Delta are highly deformed and tectonically connected with the northern Red Sea, Crete and Turkey. The fault systems connecting the areas are geologically verified and coincide with areas of high energy release.
3) The current seismic activity is concentrated to faults Oligocene-Miocene in age. This supports the idea of recent reactivation of the Oligocene-Miocene stress cycle. The seismicity pattern has been similar for at least many centuries.
4) Site effect (amplification) of the Nile Delta.
5) Microzonation studies should be carried out in detail around the greater Cairo and other investment areas around the Gulf of Aqaba, Mediterranean coast.
6) Special concern should be considered for the seismic activity around the High Dam region.