



REVIEW ARTICLE

Shallow subsurface structures and geotechnical characteristics of Tal El-Amarna area, middle Egypt

Mostafa Toni ^{a,*}, Ahmed Hosny ^{a,c}, Mohsen M. Attia ^b, Awad Hassoup ^a,
Amr El-Sharkawy ^a

^a Seismology Dept., National Research Institute of Astronomy and Geophysics, Helwan, Cairo, Egypt

^b Geology Dept., Faculty of Science, Sohag University, Egypt

^c ICTP North Africa Group for Earthquake and Tsunami Studies (NAGET), Egypt

Received 10 February 2013; revised 13 June 2013; accepted 31 October 2013

Available online 8 December 2013

KEYWORDS

Seismic refraction;
Noise array;
Frequency–wavenumber;
Dispersion curves;
Geotechnical;
Site classification

Abstract The shallow seismic refraction profiling was carried out at 18 sites in Tal El-Amarna, which is a flat area on the eastern bank of the Nile River, 50 km south of El Minia Governorate, middle Egypt. The collected data are used to estimate the P-wave velocity and to delineate the near-surface ground model beneath the study area. This study is supported by the National Research Institute of Astronomy and Geophysics due to the historical interest of the Tal El-Amarna area as a famous tourist place where there exist many Pharaoh temples and tombs. This area is low seismically active, but it is probably of high vulnerability due to the influence of the local geological conditions on earthquake ground motion, as well as the presence of poor constructions in the absence of various issues such as building designs, quality of building materials, etc.

Another dataset at the study area is obtained by multi-channel passive source (microtremor) measurements, which have been recorded at four arrays. The frequency–wavenumber ($f-k$) method was used to derive the dispersion curves from the raw signals at each array. The resulted dispersion curves were inverted using the neighborhood algorithm to obtain the shear and P-wave velocity models.

The concluded V_s and V_p values provide a preliminary estimation of the geotechnical parameters and site classification for the shallow soil as they are of great interest in civil engineering applications.

© 2013 Production and hosting by Elsevier B.V. on behalf of National Research Institute of Astronomy and Geophysics.

* Corresponding author. Tel.: +20 1111425645; fax: +20 225548020.

E-mail address: m_toni@nriag.sci.eg (M. Toni).

Peer review under responsibility of National Research Institute of Astronomy and Geophysics.



Production and hosting by Elsevier

Contents

1. Introduction	213
2. Field survey	215
3. Data processing	215
3.1. Shallow seismic refraction data	215
3.2. Noise array data	216
4. Results and interpretations	217
5. Conclusions	220
Acknowledgments	221
References	221

1. Introduction

Tal El-Amarna area is located at the central part of Egypt, southeast of El-Minia Governorate (Fig. 1). It is built on the eastern bank of the Nile River. It was historically known as Akhetaten, which means the horizon of the solar disk. It is very similar to the meaning of Amun Dwelt at Thebes, Ptah at Memphis and other gods at their favored places. Recently, local living people (Bedouins) called this area Tal El-Amarna village. The area is a plain field, separated from the Nile Valley by a strip of palm trees. It is covered mostly by sand and outlined by ruins of temples, palaces and houses that archeologists discovered or are trying to find. Some tourists consider it as the most romantic place they have ever seen, because of the silence and the peaceful beauty that the area has gained through the centuries. Assessment of seismic hazard at this area is therefore interesting for mitigation of the earthquake risk and is here obtained based on estimation of the shallow seismic velocity structures, as well as the site characterization.

In general, El-Minia district is essentially covered with sedimentary rocks, which range in age from Early Eocene to Recent. Recent and Pleistocene sediments appear around the cultivated plain of the Nile valley. The Nile sediments are limited to the Nile valley at the western side of the Tal Al-Amarna village. Tal El-Amarna is located within the Nile basin, which

is generally a part of a rocky platform covered mostly by Quaternary deposits. These formations are mainly represented by sand, gravels and recent Nile deposits. However, different types of rock materials having different ages cover most of the area. The Eocene limestone and Quaternary alluvial deposits are also present (Fig. 1). The study area lies between the limestone scarps on the eastern bank and the Nile flood plains on the western side. Different Eocene limestone represents the structural plateau which has irregular outcrops. It is represented by sectors of mountain blocks, which run in NW–SE and NE–SW directions, approximately parallel to the Gulf of Suez and Gulf of Aqaba trends (Yallouze and Knetsch, 1954). Said (1962) described the tectonics of Egypt as a persistent Arabo-Nubia nucleus, of massive rocks, surrounded by stable and unstable shelves. On the basis of his classification, the study area is located in the stable shelf that is composed of rigid foundation of the Pre-Cretaceous rocks; Faulting is common, as a number of horsts and grabens cross this shelf. Also, he stated that most of the stable shelf folds are structures that do not show any lateral loss of the area. These structures are better termed as domes even though some of them may be many times longer than width. The dome's structures are probably due to the uparching of the rigid basement. Therefore, the previously mentioned folds and fault systems are represented in the studied area. Tal El-Amarna area has no fault traces

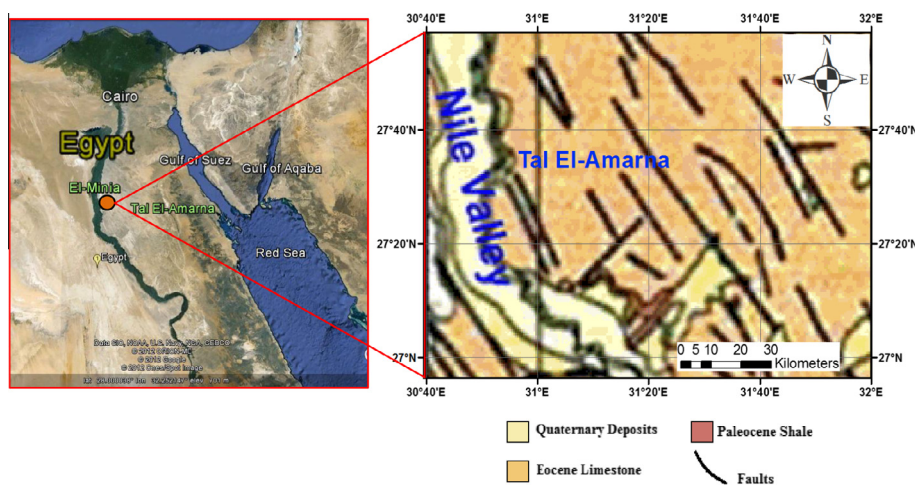


Figure 1 Left: Location of the Tal El-Amarna area. Right: Geologic map of the Tal El-Amarna from the geologic map of Egypt (EGSMA, 1981).

Download English Version:

<https://daneshyari.com/en/article/1780700>

Download Persian Version:

<https://daneshyari.com/article/1780700>

[Daneshyari.com](https://daneshyari.com)