

## Structural Analysis of Archaeoseismic Records Linked to the 5 July 408 - 410 AD Utica Strong Earthquake (NE Tunisia)

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**Abstract :** The archaeological monument of Utica, located in north-eastern Tunisia, was founded (8th century BC) By the Phoenicians as a port installed on the trade route connecting Phoenicia and the Straits of Gibraltar in the Mediterranean Sea. The flourishing of this city as an important settlement during the Roman period was followed by a sudden abandonment, disuse and progressive oblivion in the first half of the fifth century AD. This decadence can be attributed to the destructive earthquake of 5 July 408 - 410 AD, affecting this historic city as documented in 1906 by the seismologist Fernand De Montessus De Ballore. The magnitude of the Utica earthquake was estimated at 6.8 by the Tunisian National Institute of Meteorology (INM). In order to highlight the damage caused by this earthquake, a field survey was carried out at the Utica ruins to detect and analyse the earthquake archaeological effects (EAEs) using structural geology methods. This approach allowed us to highlight several structural damages, including: (1) folded mortar pavements, (2) cracks affecting the mosaic and walls of a water basin in the "House of the Grand Oecus", (3) displaced columns, (4) block extrusion in masonry walls, (5) undulations in mosaic pavements, (6) tilted walls. The structural analysis of these EAEs and data measurements reveal a seismic cause for all evidence of deformation in the Utica monument. The maximum horizontal strain of the ground (e.g. SHmax) inferred from the building oriented damage in Utica shows a NNW-SSE direction under a compressive tectonic regime. For the seismogenic source of this earthquake, we propose the active E-W to NE-SW trending Utique - Ghar El Melh reverse fault, passing through the Utica Monument and extending towards the Ghar El Melh Lake, as the causative tectonic structure. The active fault trace is well supported by instrumental seismicity, geophysical data (e.g., gravity, seismic profiles) and geomorphological analyses. In summary, we find that the archaeoseismic records detected at Utica are similar to those observed at many other archaeological sites affected by destructive ancient earthquakes around the world. Furthermore, the calculated orientation of the average maximum horizontal stress (SHmax) closely match the state of the actual stress field, as highlighted by some earthquake focal mechanisms in this region.

**Keywords :** Tunisia, utica, seimogenic fault, archaeological earthquake effects

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