

Climate Monitoring and Damage Assessment Model: A Case Study from the Praetorium at Umm El-Jimal Archaeological Site, Jordan

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Abstract

Umm el-Jimal is a Byzantine- Nabatean archeological site located on the edge of the southern Hawran plain. The site is notable among Jordan's premier archaeological sites for its wealth of Late Antique ruins. The architectural forms are illustrated in the ruins of the site by ground plans, the construction of the super structures of the buildings, their ornament, the girder arch, the corbel courses, and roofing slabs. There are principal details and constructive principles developed in the purely lithic architecture in basalt at Umm el-Jimal and these are not common in the architecture of Hawran.

The objective of this study is to carry out a detailed microclimate monitoring program in order to provide reliable information on the measurement and characteristics of the stone decay problem at Umm el-Jimal. Relative humidity, temperature, and the level of pollution (CO₂) will be measured for a limited period of time.

This study is focused on the Praetorium – one of the structures at Umm el-Jimal which enables us to determine elements that accelerate destruction. The Praetorium gives a glance at the damage to the stone in Umm el-Jimal, which is affected by microclimate. Climate changes such as the rise in the percentage of relative humidity during winter and humidity decline during summer, and vice versa with temperature all result in damages to the site. Both relative humidity and temperature appear in different types of mechanical, alteration, and solution decay forms at the site. In addition, it is notable that Umm el-Jimal suffers from high levels of CO₂, which contributes to the increasing growth of micro-organisms on stone surface, which accelerates many types of damage to the stone. Therefore, it is necessary to have a comprehensive conservation plan for the preservation of the site from loss and destruction in addition to the need for removing the damaged or deteriorated crust by using non-destructive methods as much as possible.

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1. Introduction

1.1. General Introduction

Umm el-Jimal is a large settlement near the northern border of Jordan and is located in the semiarid region of north Jordan – on the edge of the basalt plain. It was created by prehistoric volcanic eruptions from the slopes of the Jebel Druze (De Vries, 1990). The ruins of Umm el-Jimal are

situated at twenty kilometers from Mafraq, where the pipeline and road from Iraq cut the Hijaz railway on the way to Haifa city on the Mediterranean Sea (Horsfield, 1937).

Umm el-Jimal is situated in semi-arid steppe, 25km south of Busra and 40km southwest of Salkhad. This is the point where the southern Hawran plain meets al-harra, the formidable basalt plateau of north-eastern Transjordan. This remote lava city is interspersed with pockets of soil and vegetation. Today, the city hosts a few villages including Sabha and Umm al-Quttayn, which were built-up around the Late Antique ruins as local Bedouins settled, and as a result of the scattering of Druze families (Brown, 2009).



Figure 1. Umm el-Jimal location (Google Earth, 2016).

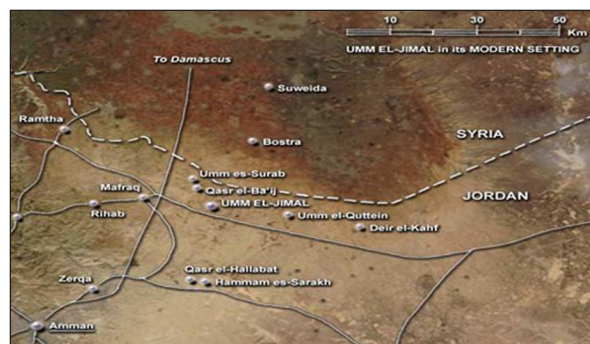


Figure 2. Umm el-Jimal location (Umm el-Jimal Project, 2016)

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Umm el-Jimal ranks second after Petra and Jerash in the state of preservation among Jordan's archaeological sites (De Vries, 1981). The city is considered as a substantial town compared with many of its neighboring towns (Kennedy, 2013).

In the Roman, Byzantine, and Umayyad periods, the desert population of Northern Jordan created a comfortable human habitat in the apparently hostile environment of the basaltic frontier. Umm el-Jimal formed more fertile parts of the basaltic regions where sparse agricultural resources were exploited and distributed along the Roman-Byzantine Arabic region. This also formed a secure buffer to prevent nomadic and military incursions into Syria and Palestine (De Vries, 1985).

Umm el-Jimal was occupied for 700 years from the 1st Century AD to the 8th Century AD. It was, then, completely abandoned and after that was occupied during the 20th century (De Vries, 1990). Umm el-Jimal has undergone several occupations in the Late Nabataean Roman, Byzantine and Umayyad periods (De Vries, 1995). It was finally reoccupied by the Druze who expanded their territories beyond their mountain to the North, and found Umm el-Jimal an attractive place to remodel (De Vries, 1990).

The landscape of the town resembles a rough parallelogram from south to north (Horsfield, 1937), with 800 meters in length and 500 meters in width. The site encompassed more than 150 buildings grouped into three irregular clusters (Whitcomb, 1996). However, some of the buildings had been destroyed for different reasons, while other structures still exist.

People who lived at Umm el-Jimal built a town of laboriously chiseled basalt ashlar and long beams (Brown, 2009). The town of Umm el-Jimal encompassed doorways and alleys that lead from room to room, and from building to building, reaching up to three or four stories high (Al-Kurdi, 2014). The town was surrounded by walls from four directions and five gates. These held within them praetorians, churches, houses, several reservoirs, a channel system, civil buildings, stairways, barracks, and a number of other features. All of these features were scattered throughout the town, which contravened a late antiquity pattern (Obeidat, 2002).

Umm el-Jimal has many inscriptions found throughout the rubble of the buildings, churches and graves. The inscriptions are linguistically diverse including Nabataean, Latin, Greek, Sabaean, and Arabic inscriptions written on basalt rocks. The inclusion of the various inscriptions facilitates the determination of the history of the site. Furthermore, the multilingual inscriptions allow the absolute dates of some of the structures at the site to be detected. Also, the inscriptions facilitate the understanding of the development of the Arabic language and provide information on who settled at this site (Obeidat, 2002).

1.2. Architecture of Umm el-Jimal

Since the Late Roman, Byzantine and Umayyad periods, Umm el-Jimal has had dozens of prosperous rural towns and villages scattered on the plains between Dera'a to the west and Deir el-Kahf to the east (De Vries, 1990).

The architecture of Umm el-Jimal has given it a unique

stability through the one-hundred and eight of the town's structures which once stood three stories in height (Brown, 2009). Moreover, there were fifteen churches, a water system and barracks distributed at the site (Obeidat, 2002). These were grouped in compact masses, in the east, west and north, and a scattered group was found down the middle of the structure of the city (Horsfield, 1937). Further walls of structures run every direction without plan or order (Al-Kurdi, 2014).

Umm el-Jimal is built completely from basalt. Basalt exhibits a high structural resistance against erosion, climate and time (Al-Kurdi, 2014). People who occupied the site used special techniques to support the buildings and give more space to the structures, such as corbelling, the cantilevered stairway rough wall finish, the building quality, doorway and window treatment, and lintel relieving illustrated by the circular window relief and double lintel relief (Obeidat, 2002).

Umm el-Jimal, has none of the formal lay-out or architecture which distinguished Syrian Graeco-Roman cities of the 2nd and 3rd centuries A.D. Although contiguous and contemporary with them (Horsfield, 1937), Umm el-Jimal is a non-grid town. The place is planned without frills or carving on any kind of its buildings. The churches present a far greater variety of ground plans and superstructure than can be found in any part of the surrounding area (Butler, 1913).

The houses of Umm el-Jimal consist of a single or more than one room, which overlooks a courtyard; some houses share walls (Obeidat, 2002). The houses are of two large arched stories at the front, but houses with four stories of narrow chambers are also common throughout the ruins (Al-Kurdi, 2014). Some of the houses were covered internally and externally with coatings of stucco, finished with a polished surface on walls. It should be noted that doors and window shutters were made of basalt (Horsfield, 1937), but unfortunately, people who reoccupied the site during the Umayyad period robbed and badly damaged some portions of the Byzantine buildings, such as the walls of the rooms (De Vries, 1995).

Churches of Umm el-Jimal appear in various types. Some of the churches can be identified by inscriptions upon the surface of the structure, like that of Numerianos. Others may be distinct through the observation of their architectural form, such as the cathedral church, of a basilica type built in 557 A.D. Furthermore, churches that include multiple arcades in their structure can also be found, such as the Chapel of the Barracks. The last type of churches to be found at Umm el-Jimal is known as the "hall type". This type is demonstrated by the churches of Julianos, built in 345 A.D., and of the Maeschos. The halls of these churches include roofs with black basaltic long beams and girder arches to carry the flat roofs. The largest church at Umm el-Jimal is known as the "cathedral church". The cathedral church is 23 meters in length and 25 meters in width. On the other hand, the smallest church is referred to as the "southeast church" which is 10 meters in length and 8 meters in width. In general, the churches of Umm el-Jimal are distinct in that they lack excessive decorations, while only a few are found