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The Roman City and Stone Quarry of *Sufetula* (Tunisia)

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Abstract

Sufetula is a Roman city located in central Tunisia. It was built exclusively out of limestone raw materials recovered from a neighboring Roman quarry. The quarry is dug in the Turonian-Coniacian limestone on the SE flank of Jebel M'rhila. The petrographic and diagenetic properties of the limestone used in the construction of the Sufetula city have made them resistant against weathering. In addition to this Roman city which is a geotouristic site the Roman quarry could also be an attractive geosite if promoted as such.

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Introduction

Tunisia has many interesting touristic sites. With its long and illustrious history, Tunisia is a country with particularly notable archaeological wonders [1]. The archaeological site of Sufetula located close to the modern city of Sbeitla has well preserved Roman ruins (Figure 1). *Sufetula* has played a major role in the history of North Africa. The archaeological site of *Sufetula* and its modern counterpart, Sbeitla are located in central Tunisia, ~ 40 km east of the Algerian-Tunisian border (Figure 2). The city shows in particular old Roman forum and amphitheater. The Roman city of *Sufetula* was likely built with limestone rocks extracted from the neighboring Roman quarry located in Jebel M'rhila. The Roman origin of this quarry is already mentioned on the geological map of Jebel M'rhila . The limestones are here described based on a detailed field survey of outcrops, particularly at and around the quarry, and on petrographic study. The field study complemented by microscopic observation of rock thin sections allow us examinating the petrographic and petrophysic proportises of these rocks.

Regional Setting

The study region is part of the Tunisian central Atlas (9°08'28.1"E), characterized by NESW oriented folds which are associated to several E-W to NW-SE major faults (Figure 2). The outcropping geological series are mainly Cretaceous and Cenozoic in age. The Roman quarry was dug in at the foot of the SE flank of the Jebel M'rhila near the southern anticlinal closure (Figure 3). In Jebel M'rhila the Turonian-Coniacian limestone succession called Douleb Formation [2] shows a conspicuous cliff in which the Roman quarry was dug in. The quarry is located about 2 Km at the East of the Sufetula city located at the next.

Sufetula Geosite

The Sufetula city is thought to have been founded by the Romans of North Africa during the 1st century AD under the reign of Emperor Vespasian [3]. Because of the discovery of a number of stelae written in Punic, it appears that it was built upon an even older Carthaginian settlement [4,5]. Sufetula was originally a military settlement, but it quickly became very wealthy because of its rich agricultural hinterland [5]. Sufetula was a city of some 5,000 inhabitants [6] in the interior of the country and it was almost at the border of the Roman Empire. The various buildings of the city (temples, amphitheater, thermal baths, and inhabitants) are made of limestone.

The ruins of three contiguous temples, whose several roofs, porticoes, and facades broken down, but the rest of the fabric, with its respective columns, Roman marquee, pediments and entablatures preserved, are the major landmarks of the ancient city (Figure 4A and Figure 4B) [6,7] . The Sufetula city is crossed by many well preserved pavements (Figure 1).

Roman Quarry

It is an arc shape quarry with about 150 m in width and more than 20 m in height. The quarry is dug in a bedded limestone succession (Figure 1)

According to thorough field examination, the limestone of the quarry is visibly very similar in color, petrography, texture and fossil content to those by which the Sufetula was built (Figure 6). A paleontological examination shows that the fossils recovered from limestone in both quarry and Sufetula buildings are similar. Geologically, a 20 m exposure at the quarry shows succession of 0.1 to 1m thick limestone beds. It consists of bioclastic and oolithic packstone and grainstone with various benthic microfossils (ostracods, green algae) and debris of fossils (gastropods, corals) (Figure 5D, Figure 5A and Figure 5B). The petrographic properties and diagenetic features as shown by thin sections of the considered stones refer to the hardness and the resistance of this limestone. Indeed, the limestone shows well developed carbonate rim cements that resulted from early cementation [2]. The cement developed around bioclasts and ooids and within solution voids and fractures (Figure 6C and Figure 6D). In addition, the compaction during burial diagenesis should have also provided some resistance to these limestones. Such properties should have provided good geotechnical proprieties to those limestones, which justify their usage for building first by the Roman (146 BC - 431 A D) and then by byzantine (534 A D) inhabitants (Figure 5).

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Figure 1: A: Capitolium of Sufetula ; B: Panoramic view of Sufetula city; C: Diocletian's Arch; D: The amphitheater of Sufetula.

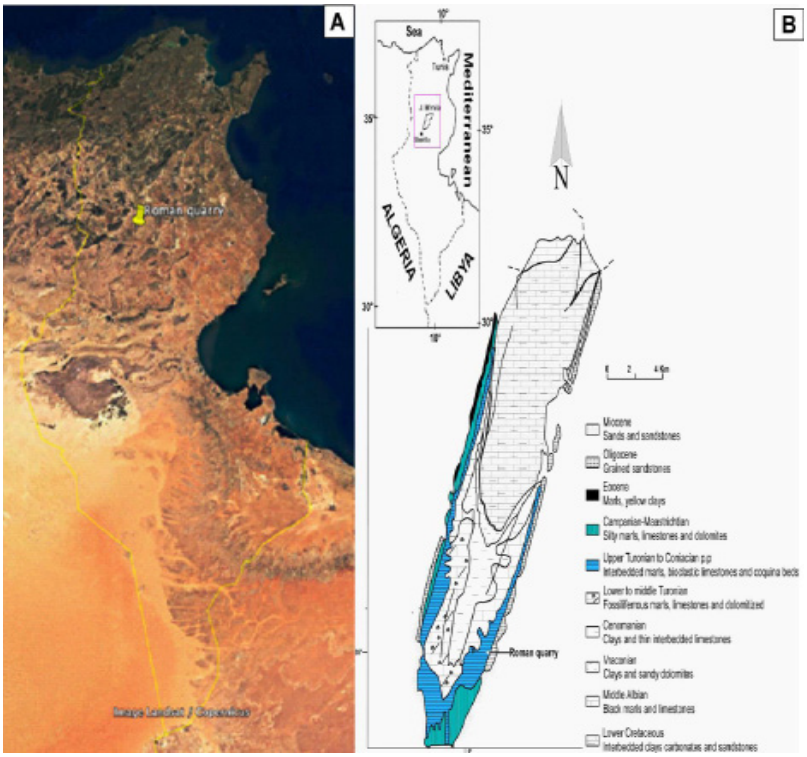

Figure 2: A: Location of the roman quarry B: Geological map of Jebel M'rhila and location of the studied section [].

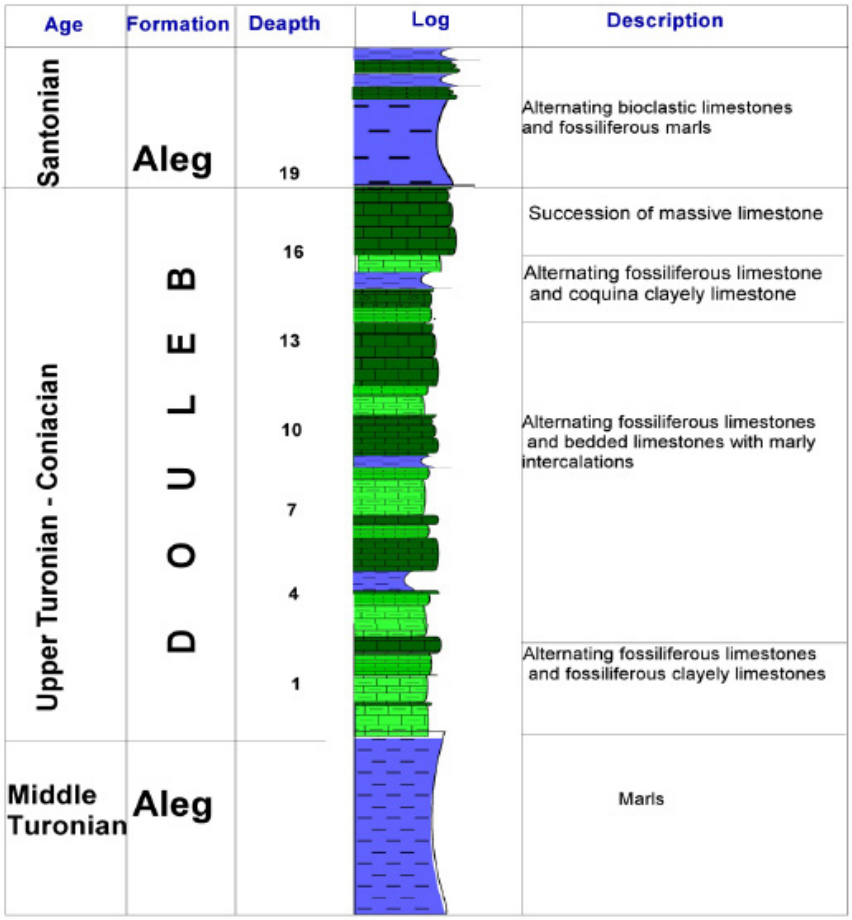

Figure 3: Lithostratigraphy of Douleb Formation (Roman quarry).

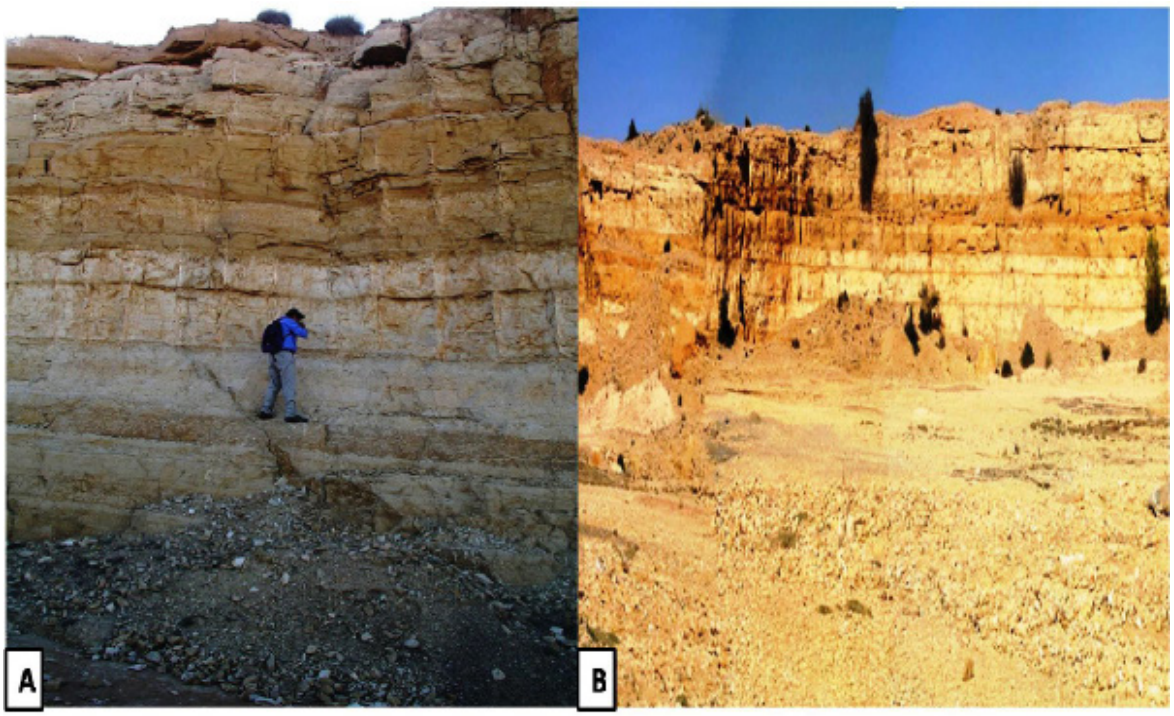

Figure 4: A: Douleb Formation bedded limestones; B: The Roman quarry

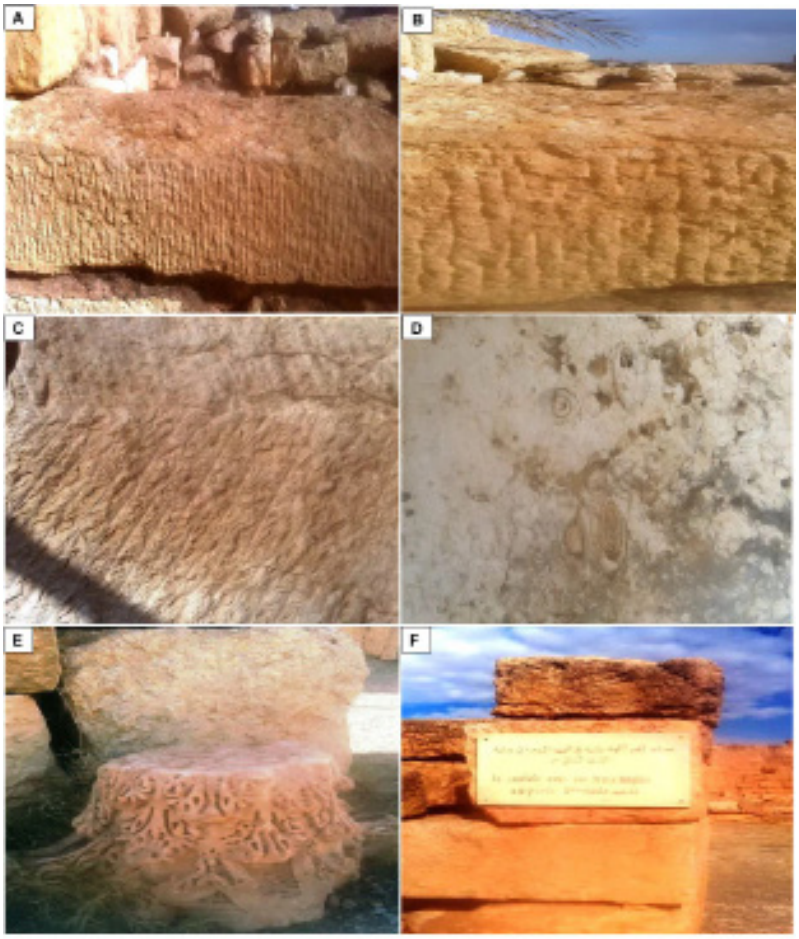

Figure 5: A and B: Hammer marks on a limestone bed; C: Hammer marks following oblique directions; D: fossiliferous bioclastic limestone showing gastropod moulds; E: Byzantine marquee cut out from Turonian limestone; F: Sign board indicating the Sufetula city building was achieved during the 2nd century J.C.

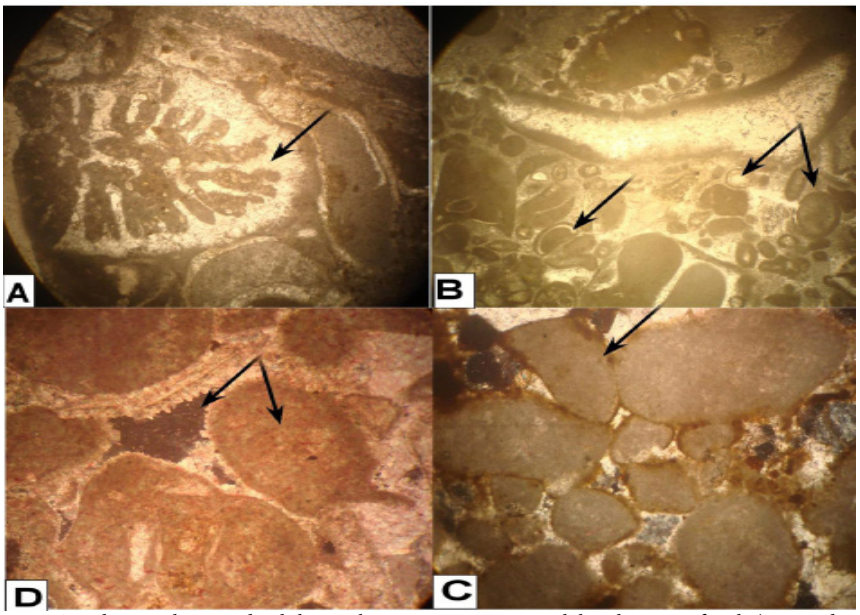

Figure 6: A and B: Bioclastic and oolithic packstone to grainstone with benthic microfossils (ostracods, green algae) and debris of fossils (gastropods, corals) (arrows); C and D: Isopach and anisopach carbonate rim cements around bioclasts and ooliths and within solution voids and fractures (arrows).

It is worth noting that such petrographic and petrophysic and paleontologic attributes of the studied limestone are typically characteristic of the Turonian-Coniacian limestone in the study region. This is another argument for origin of the *Sufetula* city building stones. In addition, some Roman quarrying methods features like as vertical hammer marks (Figure 5A, Figure 5B and Figure 5C) are still preserved. On another hand, it appears that the quarry was abandoned for a long time as may be suggested by the weathering of the surface of the exposed rocks in the quarry.

Seeing that the city is located at only about only 2 Km at the west of the quarry, a roman road should have existed and used to carry stones from the quarry to the city. This road should have been buried under abundant alluvium and soils.

Conclusion

Considering its significant and particular history and its spectacular and wonderful landscape, this roman quarry can be valorized and developed as a geological and geotouristic site. The well preservation of the Roman city of Sufetula is inevitably related to the petrographic and geotechnical proprieties of the Turonian-Coniacian limestone of the roman quarry. Through the present work we solicit the attention of the national authorities to consider this quarry as a heritage that necessitates care and protection.

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Competing Interests

The authors declare that they have no competing interests.

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