

Sedimentological description of Oued Lahouar's Maastrichtian section

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Abstract- The Maastrichtian section within Oued Lahouar offers a unique opportunity to investigate sedimentological characteristics and depositional processes in this stratigraphic unit. This study presents a comprehensive sedimentological description of the Maastrichtian section in Oued Lahouar, focusing on lithology, sedimentary structures, and depositional environments. Field observations, sedimentological analysis, and petrographic examinations were conducted to unravel the sedimentary history of the formation. The study emphasizes different fossils, trace fossils and carbonate nodules identification. Sedimentary structures such as cross-bedding, ripple marks, and bioturbation provide insights into the depositional dynamics and paleoenvironmental conditions. Interpretations suggest deposition in a shallow marine setting characterized by fluctuating energy conditions. Additionally, the presence of fossil assemblages aids in paleoenvironmental reconstructions and correlation with regional stratigraphy. This sedimentological study contributes to a better understanding of the Maastrichtian sedimentary processes and paleoenvironments in the Oued Lahouar area, shedding light on the geological evolution of the region during the Late Cretaceous period.

Keywords: Sedimentology, Paleoenvironment, Maastrichtian, Oued Lahouar, Morocco.

I. INTRODUCTION

The southwestern flank of the Western High Atlas, commonly referred to as the "Souss-Ouarzazate Gulf" (as shown in Figure 1), exhibits a distinct geological profile attributed to the uplift of the High Atlas Range. This area undergoes a gradual transition from marine to lagoonal and ultimately continental sedimentary environments along a west-to-east gradient (Algouti et al., 1998, 2015, and 2022; Hadach et al., 2015 and 2017). Examination of the Maastrichtian strata in the Western High Atlas has yielded significant insights into biostratigraphy, lithostratigraphy, and paleogeography. Paleontological investigations have primarily focused on the identification of Echinoderms and ostracods. Notable species

include (*Bythocypris gohrbandti*, Wesker 1968, *Ovocytheridea cf. producta*, *Cytherella aff. gambiensis* Apostolescu 1963, and *Paracyris sp.*) among ostracods, and (*Petalobrissus subsetifensis*, Péron and Gauthier) among Echinoderms, which serve as characteristic indicators of the Maastrichtian period. The study area of this study encompasses the Agadir basin.

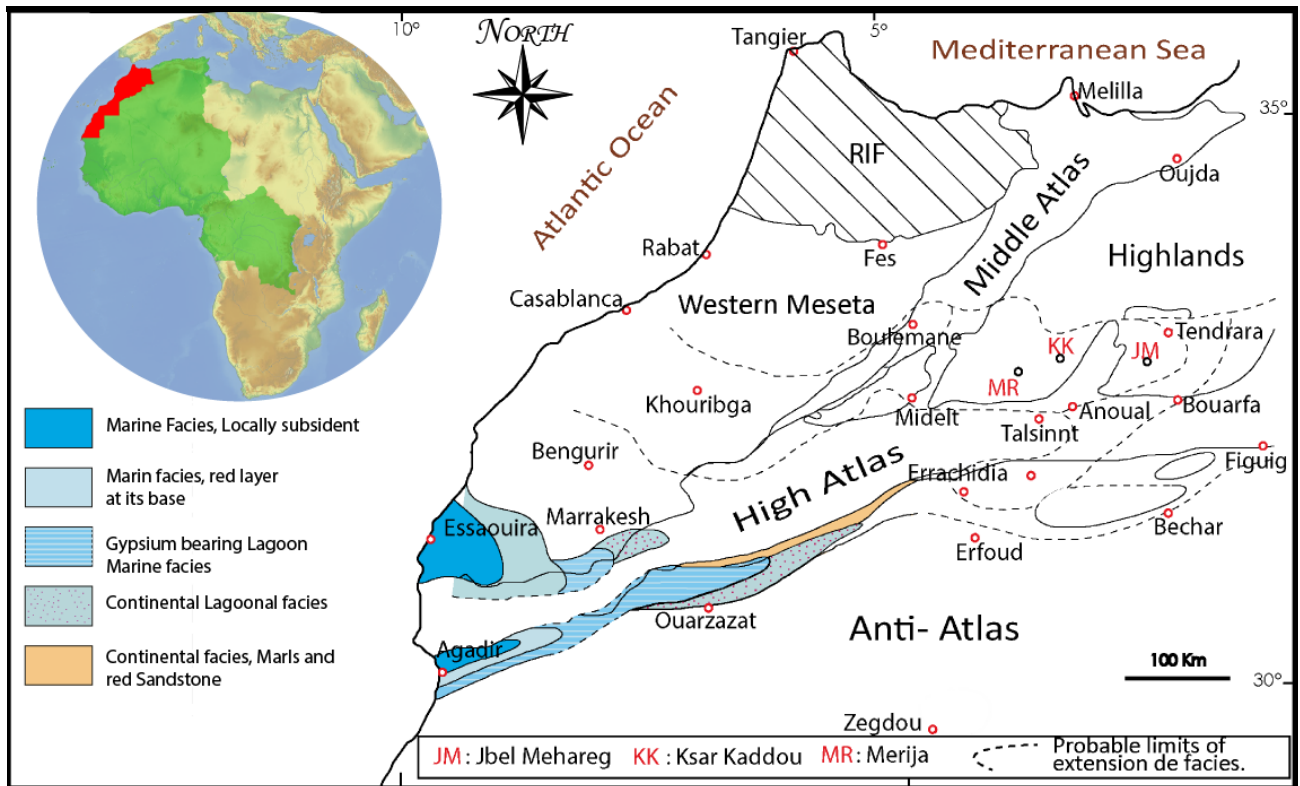


Figure 1: A schematic map illustrating the distinct facies within the study sector. (Modified after Choubert and Faure-Muret 1960-62)

II. MATERIAL AND METHOD

The facies analysis hinges on a detailed examination of in-situ geological outcrops, which entails constructing high-resolution stratigraphic profiles layer by layer, complemented by extensive laboratory analyses. Fieldwork necessitates a meticulous evaluation of sedimentary structures, alongside the collection of rock samples for thin section preparation at the "CAC of Semailia University". Sequential analysis involves identifying elementary sequences and unconformities. Subsequently, petrographic and micropaleontological analyses are carried out in the "2GRNT" laboratory.

III. OUED LAHOUAR'S SECTION

This section is located approximately less than 5 Km east of Agadir, near the village of Aït Ahmed. It comprises:

This series is bounded by 2 discontinuities and comprises 3 units:

Unit 1:

Subunit 1: (21m) Displaying a strato-increasing aspect, this subunit begins with an 8m-thick carbonate bar. It consists of lumachelic beds with lamellibranchs and gastropods, showing cross-stratification and small centimeter-scale lenses of silicified lumachella at the top. The microfacies is a wackestone biomicrite with silicified bivalves. The rest of the subunit alternates between marls and lumachelic carbonates with oblique laminae. At the top of this subunit, a bioturbated surface is observed, perforated with flint nodules.

Subunit 2: (61m) At its base, it comprises a 30m marly sequence interbedded with 5 to 10m thick limestone sandstone beds, occasionally containing mega-ripples. At the top, there is a 2m-thick interbedding of lumachelic limestone. The marls contain a biophase consisting of gastropods, lamellibranchs, sea urchin spines, foraminifera, rare bryozoans, and ostracods. Towards the top, it consists of 30m of alternating centimeter-scale sandy carbonate flakes and millimeter-scale silicified, azoic marl levels. Under the microscope, the carbonate beds exhibit a mudstone dolomicrite with very few small grains of quartz.

Unit 2:

Subunit 1: (10m) Comprising 2 lenticular bars, each 5m thick, consisting of silty dolomicrite becoming bioturbated and fossiliferous at the top.

Subunit 2: (38m) Consists of an alternation of mudstone dolomicrite flakes and limestone sandstones, and silicified azoic silts.

Unit 3:

Subunit 1: (162m) At the base, it comprises 12m of alternating marly levels, 3 to 8m thick, and fine-grained sandy levels. Above, there is a 70m thick sequence of bioturbated, fossiliferous sandy limestone or sandstone. This unit terminates with 80m of fossiliferous marls containing fish teeth, sometimes containing metric carbonate nodules, with a microfacies of silty mudstone micrite with calcispheres, iron oxides, and small angular quartz grains.

Subunit 2: (10m) Consists of 10m of alternating centimeter-scale limestone beds, more or less oxidized, and marly levels with azoic tendencies. The microfacies of the carbonate beds is silty mudstone micrite with small angular quartz grains and iron oxides. It is overlain by an unconformity of Oligocene conglomerates (Ambroggi, 1963).

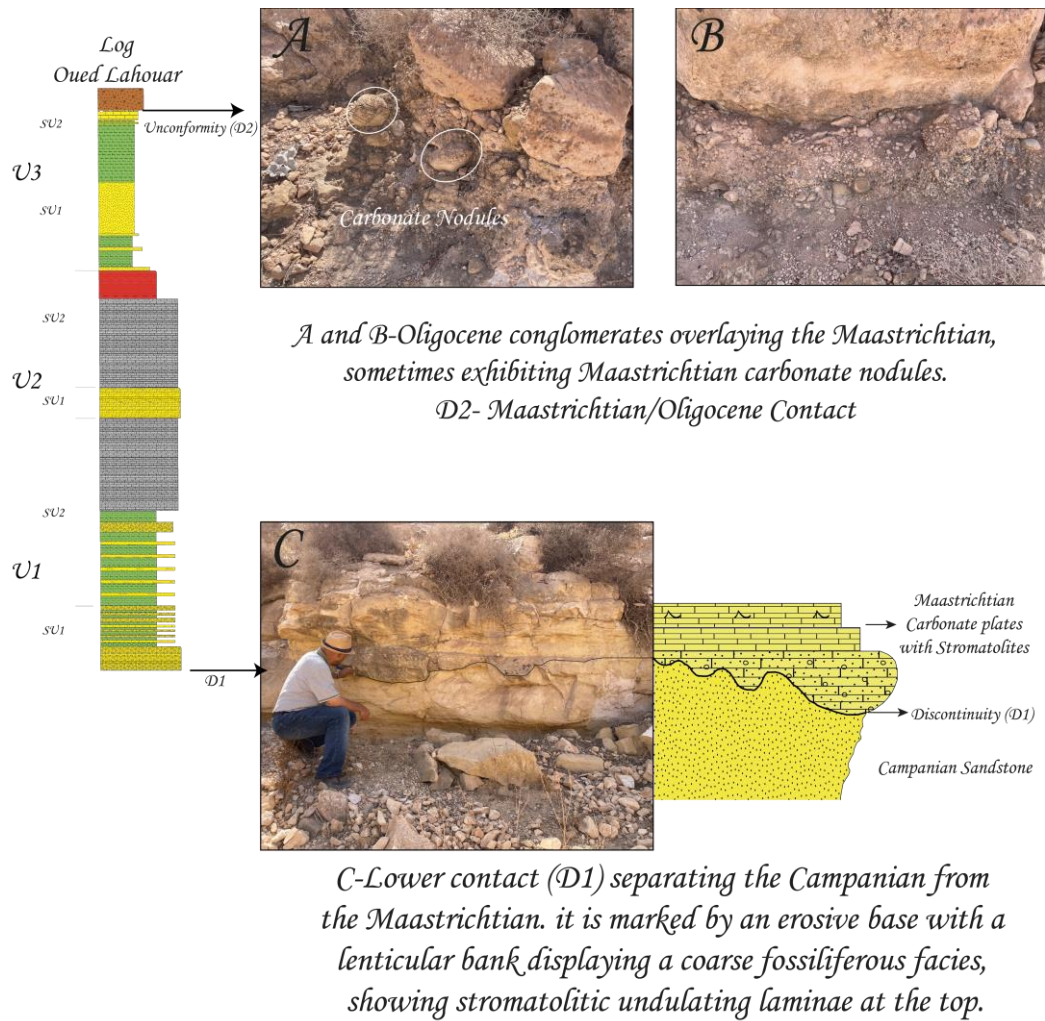


Figure: Basal and summital boundaries of the Maastrichtian from the Oued Lahouar section.

Figure 2: Basal and summital boundaries of the Maastrichtian from the Oued Lahouar section

IV. DISCUSSION

The sedimentological analysis of the Oued Lahouar's Maastrichtian formation reveals distinct environmental transitions and depositional settings within its various units. In the first Subunit of Unit 1, the presence of lumachelic levels with complete shells suggests deposition in nearshore environments within protected mudflat zones. In contrast, Subunit 2 indicates a shift towards shallower environments influenced by confinement and low hydrodynamic energy.

Unit 2 demonstrates a vertical facies evolution from tidal-flat environments to tidal channels, culminating in a calm, relatively confined supralittoral setting.

Lastly, in the first Subunit of Unit 3, sedimentation reflects a deepening environment characterized by an influx of sandy terrigenous material diluted by carbonate phases, evidenced by the appearance of planktonic fauna. Subunit 2 of Unit 3 signifies shallow mediolittoral to supralittoral conditions, marked by the absence of fauna and the presence of oxidation. This comprehensive analysis provides valuable insights into the sedimentological dynamics and paleoenvironmental variations within the Oued Lahouar's Maastrichtian formation.

V. CONCLUSION

The sedimentological investigation of the Oued Lahouar's Maastrichtian formation provides a detailed understanding of the depositional environments and paleoenvironmental changes that occurred during the Late Cretaceous period. The distinct lithological characteristics and fossil assemblages observed across the various units highlight the dynamic nature of sedimentation in this region. The transition from nearshore to shallow environments, as well as the evolution towards deeper settings, underscores the complex interplay of factors such as sea level fluctuations, tectonic activity, and sediment supply. These findings contribute to broader discussions on paleogeography, basin evolution, and paleoenvironmental reconstructions during the Maastrichtian epoch.

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