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Quantitative Analysis and Paleoasociations of the Aptian Urgonian Complex in the Ouenza Area (NE Algeria)

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Abstract: The Aptian deposits of the easternmost part of the saharian Atlas, are represented by shallow carbonate platform limestones and the outer platform marly sediments. The application of statistical methods to the analysis of the microfacies by the factorial analysis of correspondances and the classification by the dynamic cluster method allows us to visualize the ecosequential evolution and the various biological associations.

Key words: FCA, ouenza, aptian, urgonian, classe, paleoenvironments

INTRODUCTION

During the Upper Aptian, the Ouenza area exhibits an important change of the sedimentation; that permit the development of a flat carbonate platform.

The object of this article is to present the main results of a paleoecological analysis of the carbonate complex of the Ouenza formation. The presented data permit to understand the spatio-temporal organization of the different ecozones.

The Ouenza area is situated in the northern part of the Mellegue Mountains. The sedimentary formations correspond to an anticline with a NE-W diretion. This structure is pierced by a diapiric structure (Fig. 1). Around the diapiric extrusion, is formed a carbonate complex of urgonian facies.

The Aptian series consists of five lithological units (Fig. 2): A marly series (Mesloula formation), limestones with ostreids, limestone with corals, limestones with rudists and benthic foraminefera and (bioclastic limestones. The last four units constitute the Ouenza formation.

The unit 1 age is lower Gargasian and it is formed by marl with ostreids and orbitolinids.

The unit 2 serie is very rich of planctonic forams (*Hedbergella infracretacea*) and ostreids (Exogyra latissimaLAMARCK), This facies is surmounted by coral buildups.

The unit 3 is characterised by setting of skeletal bars, which evolved into corals build-ups.

The unit 4 forms the major part of the calcareous crest. It is formed of a biomicrite rudists and benthic forams: *Quinquiloculina* sp., *Triloculina* sp., *Cuneolina scarselli*, *Cuneolina laurenti*, *Ovalveolina reicheli, Textularia* sp., *Pseudocyclammina* sp., *Dictyoconus* sp. and *Nazzazata* sp.

The unit 5 covers the limestones with rudists and benthic forams. It is characterized by a massive bars of biosparites with orbitolinids, corals, bryozoans, échinids, rudists and ostreids (*Liostrea* sp).

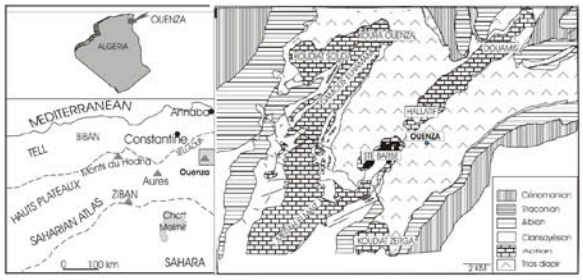

Fig. 1: Location map and geology of the studied area

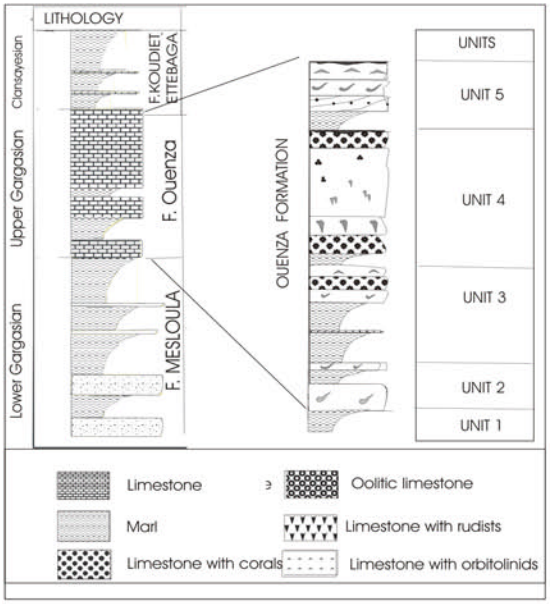

Fig. 2: Lithostratigraphy of the Aptian set of the Ouenza region

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MATERIALS AND METHODS

In this study, we used two methods to the analysis of the microfacies: The factorial analysis of correspondances and the classification by the dynamic cluster method allows us to individualize coenotical affinity-clusters and to propose a palaeoecological distribution-diagram of the principal organisms of the Ouenza urgonian limestones.

The Factorial Analysis of Correspondances (F.A.C) (Benzacri and L'analyse, 1973) that permits to visualize the proximities between the statistical units and the variables (paleontological describers).

The dynamic cluster method (Diday, 1971) that permit to achieve a classification from a set of data. We used this method in complement of the Factorial analysis in order to define the clusters affinity between describers.

The quantification of the absolute number of the organisms per sample was estimated using about more of hundred samples coming from the different sectors of Ouenza area, but only the slides containing fossils have been kept. The representation of the groups of organisms in the space of the two axes (Fig. 3) shows the opposition to the axis 1 between the associations corresponding to the external platform and their border with the groups that the characters indicates a deposit in internal platform.

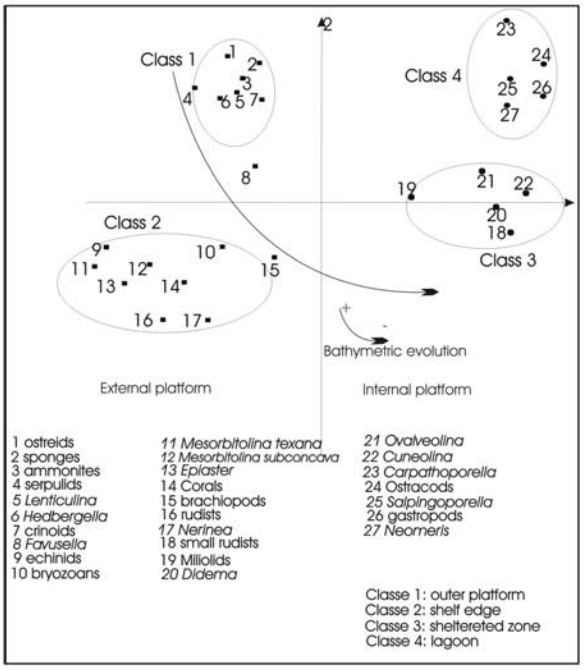

Fig. 3: Factorial analysis of correspondances and representatation of the paleoecological characters within the two factors space

In order to confirm this interpretation, we calculated the coefficient of biserial interrelationship r bis, we found a value = 0.79, the relation is good.

RESULTS AND DISCUSSION

Four classes of organism's assemblage are identified:

- Classe 1: Sponges, *Lenticulina, Colomiella, Mesorbitolina, Exogyra. spatanguids, ammonites, Favusella, Hedbergella*,
- Classe 2: Echinids, bryozoans, *Mesorbitolina*, *corals*, *Nerinea*, *Archaeolithothamnium*, *Polystrata*, *Marinella*, *rudists. brachiopods.*
- Classe 3: rudists with small size, miliolids, textulariids, *Ovalveolina*, *Sabaudia*, *Pseudocyclammina*, *green algaes.*
- Classe 4: Ostracods, miliolids, *Cuneolina,* valvulinids., green algae, naticids.

The class 1 represents a population of the external platform, represented by micrites with sponges and planctonic forams.

The class 2 corresponds to the organisms of the shelf edge and its external zone. The organisms of this association are represented by coral buildups. The class 3 regroups the organisms that characterize the sheltereted zone of the barrier reef. The class 4 regroups the organisms living in the shelf lagoon, in the internal zone of the platform. The population is represented by miliolids and agglutinated foraminifera, associated with the green algaes.

The set of all these observations and interpretations allow us to propose a paleoecological distribution-diagram of the main organisms (Fig. 4).

DISCUSSION

The analysis of the Aptian deposits of the Ouenza area permit to recognize the principal factors

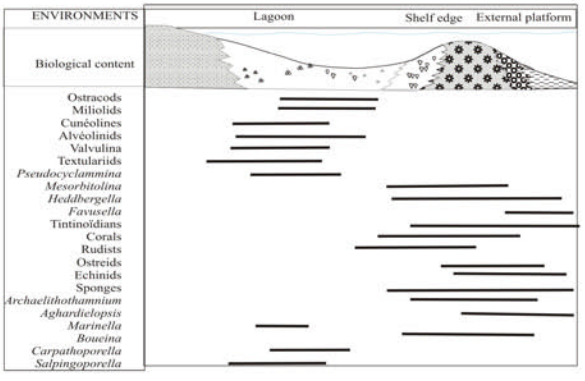

Fig. 4: Distribution of the main organisms in the biotopes of the Ouenza platform

controlling the Urgonian development. These factors are: sea level changes; climate and tectonic.

Global sea level changes: The correlation of third order cycle observed in the Ouenza area with the LZB4.2 cycle of the chart of sea level changes (Haq *et al.*, 1987) is, en general, good.

The regressive episode announced to the summit of the Gargasian between LZB4.2 and UZA1.1 would have permitted the installation of the Urgonian facies in Ouenza (Fig. 5).

Climatic variations: The climate is the main condition that permits the development of the Urgonians facies of the Mellègue. The development of carbonate facies requires a hot climate (the importance of the carbonate deposits, corals and algaes are bound to strict enough thermal parameters.

Masse (1976) reports on a card the situation of the continental and oceanic masses to the lower Cretaceous (Fig. 6) One sees that the urgonian deposits are located in the mesogean domain, essentially in the northern hemisphere.

Local tectonics: During Aptian times, the tectono-sedimentary evolution of the Mellegue area was governed by diapiric movements. The development of Aptian urgonian complex is clearly related in diapiric

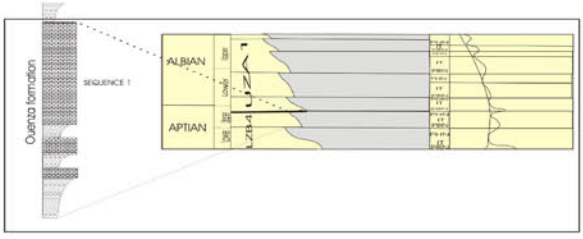

Fig. 5: Sequential interrelationship design of the Aptian Ouenza with the eustatic chart of thee sea level changes

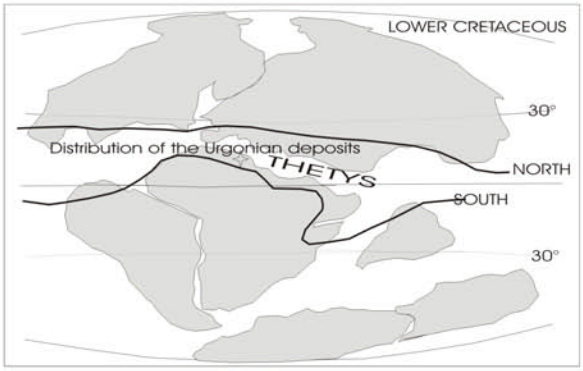

Fig. 6: Distribution of the Urgonian deposits during Cretaceous lower (Masse, 1976).

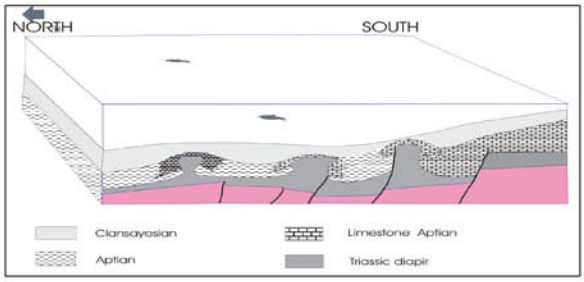

Fig. 7: Influence of the diapiric activity on the Aptian deposits

activity. The piercing stage of the diapir during Aptian times is characterized by rapid changes of facies (Fig. 7).

CONCLUSION

The Aptian deposits of the Ouenza area are formed in a platform under the increasing dependence of the diapiric activity. The biological content reveals abundant and varied populations, the bottom is formed of corals and rudists build-ups, surrounded with bioclastic deposits. The populations are varied: corals, rudists, bryozoans, echinids, sponges, ostreids, gastropods, agglutined foraminifera and algaes. This association implies a perfect colonization. At the Aptian, the development of the urgonian complex and its ecological diversity imply the very favorable conditions attested by the development of carbonates and bioconstructions.

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