



How was Like the Paleoenvironment During the Cenomanian Age in the Northeastern Algeria?

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Introduction

Decipher what the Earth's ancient environment was like thousands, may be millions of years ago became one of the most objectives of paleontology and Archaeology. Nevertheless, the significant fluctuations of the microfauna contents and the dominance phases of alternation between benthic and planktonic foraminifera reveal changes as well in the depositional environment. The results of this study indicate that the supposed depositional environment is a calm and relatively deep environment which can be located around the middle to the external platform, where the depth of waters exceeds 200 m. These waters are characterized by a poor percentage in oxygen (Figure 1a).

Palaeoenvironments reconstruction

Lower cenomanian

The lower Cenomanian has a low percentage of planktonic foraminifera with a markedly low specific diversity. Radiolarians are rare, often even completely absent. Some common mineral elements, such as gypsum and pyrite; rare fossils like: ammonites but are often pyritic, not to mention the main dark color of marls and clayey marls facies. Poor oxygenation of the bottom waters has prevented normal development of benthic organisms. The rare present species are for many authors such as cited by [1] as oxygen deficiency tolerant forms. Finally, the frequent pyritization of tests and shells as well as the presence of pyrite is an additional indication of poor oxygenation [2], because this mineral requires an anoxic environment for its formation. It is also necessary to consider the presence of gypsum throughout the studied section and which is never in form of a layer, on the contrary mixed within the levels. This element could probably be regarded as a secondary

element, resulting from the transformation of pyrite. During the Cenomanian, the depth of deposits seems to be lower and corresponds to calm and relatively deep environment, which can be located around the middle to the external platform (Figure 1b).

Lower to middle cenomanian

Compared to the previous period, the middle - upper Cenomanian is therefore marked by a dominance of planktonic foraminifera (mainly globular), a more developed benthic microfauna but the specific diversity is still relatively low. The most common species include, in particular, some agglutinated, often dominant (*Textularia* sp., *Thomasinella punica*) and small calcareous forms (*Gavelinella*). Overall, the levels concerned are characterized by a renewal and a greater diversification of benthic microfauna. Oysters levels are sometimes numerous and rich in ostreids. The presented micro-faunistic associations always indicate a deep and calm environment, of external platform type, although a change in the environment is noticeable. Indeed, greater occurrence and diversity of benthic organisms suggest either a slight decrease in depositional depth or an improvement in bottom oxygenation conditions. Both hypotheses are also likely; in addition, a total absence of pyrite is noticed. Furthermore, near the upper part of lower Cenomanian, within Fahdene Formation and at the end of *Mantelliceras dixoni* Zone, no ammonites were found at this level in one hand. On the other hand, the Formation of Fahdene at this zone is marked by a distinct break (the Trough) in sedimentation by a sudden regression of sea level shown by a thin bed of beige color limestone topped by an oyster and bioturbated surface (Figure 1c). It is succeeded by transgressive clayey brown marl with *Cuinningtoniceras inerme* ammonite which is equivalent

of the Thatcher Limestone: orange-brown clay with carbonates concretions containing a *C. tarrantense* fauna found in Texas [3]. In the Anglo-Paris basin Robaszynski et al, 1999, they recognized: "The presence of an important fall in sea-level represented on the basin margins by a marked break at the lower-middle Cenomanian boundary" they place this trough within the Zone of *Mantelliceras dixonii*, which is quiet matched with our area.

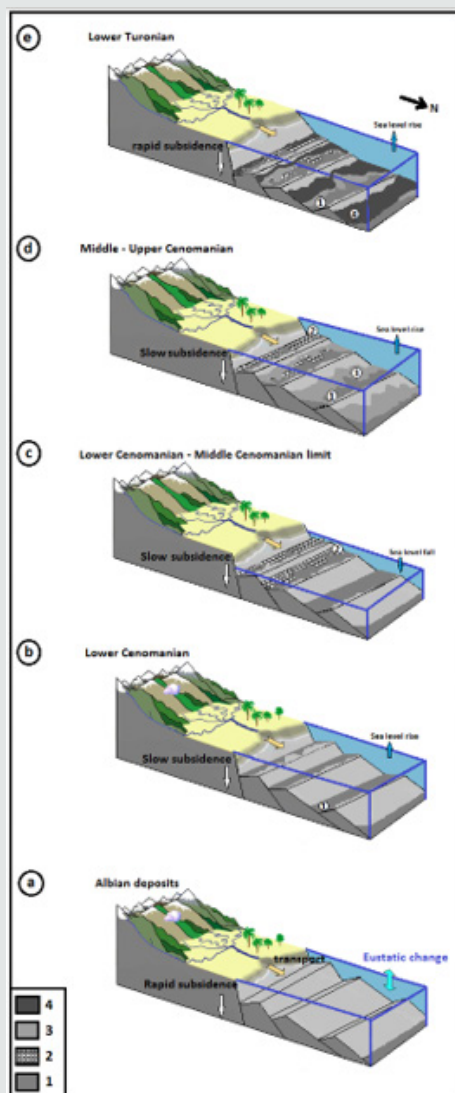


Figure 1: Palaeoenvironment reconstructing model of Nouader site.

- Albian deposits model.
- Lower Cenomanian high level marine prism with marls and rare interval of limestone facies of the lower part of Fahdene formation 1.
- Lower Cenomanian to middle Cenomanian boundary showing the break of sedimentation (Trough), which is a regressive interval with limestone facies topped by an oyster surface 2.
- Middle to upper Cenomanian presenting a transgressive interval with limestone and marl-limestone facies of the upper part of Fahdene formation 3.

Upper cenomanian

The end of the Cenomanian of Nouader site carries the print of the C/T crisis. It is characterized by marly limestone facies known as black shales, the famous Bahloul levels described at many places (Tunisia, northeaster Algeria); these black color laminated appearance levels are rich in organic carbon. (TOC value is about 4.5%). Other characteristic of this level is the dominance of globular planktonic foraminifera (*Hedbergella* sp., *Heterohelix* sp., *Heterohelix globulosa*, *Globigerinelloides* sp., *Whiteinella* sp., *Whiteinella baltica*, *Whiteinella brotonensis*, *W. prae-helvetica*, and *W. archaeocretacea*). The presented benthic species are globally very little diversified, such as *Nodosaridae*, *Textularia* and *Lenticulina rotulata*, whereas the oyster's levels are absent. Some dispersion of filaments with the presence of glauconite was well noticed especially in sample 117. In addition, the phenomenon of ferruginization is very important. Tolerant forms of minimum oxygen (such as: *Heterohelix*) indicate relative anoxia corresponding to a minimum oxygen zone (the beginning of the transgressive interval from here) developed during the Late Cenomanian to lower Turonian according to the work of [4&5]. All these characteristics provide information about the circalittoral area (external platform-type) environment (Figure 1d).

Lower turonian

This interval is marked by an abundance of the genera *Whiteinella* and *Heterohelix*, especially the species *Whiteinella baltica* and *Heterohelix globulosa*. Also, the microfaunistic associations composed of the species *Whiteinella archaeocretacea*, *W. baltica*, *W. brittonensis*, *Heterohelix moremani*, *H. globulosa*, *Hedbergella simplex*, *H. delrioensis*, and *H. planispira*, allow to attribute a Turonian age to this interval. The appearance of the elongated test forms (endofauna) represented by *Nodosaria*, reflects a decrease of the oxygen level and which would explain this decrease of the planktonic population [6,7]. In addition, the appearance of keeled forms (*Dicarinella*) reflects a relatively deep environment Hart & Bailey, 1980 [8]. All these data evoke an external platform-type repository environment (Figure 1e).

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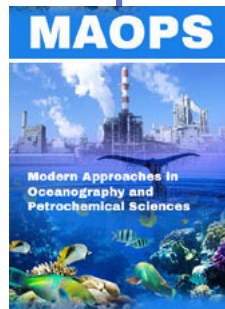
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