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RESEARCH ARTICLE

SEDIMENTOLOGICAL AND PALYNOSTRATIGRAPHIC STUDY OF THE CENOMANIAN TO TURONIAN DEPOSITS OF THE BENO-3X WELL, EAST OF THE CÔTE D'IVOIRE SEDIMENTARY BASIN.

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ABSTRACT

With a view to establishing a reliable palynostratigraphic scale of the Cenomanian and the Turonian in the eastern margin of the Ivory Coast basin, around 20 drill cuttings samples from the BENO-3X well were studied. The lithological study of these excavations revealed an alternation of gray marl with whitish laminations, massive gray clays to subfissile, friable sandstones with calcareous cement, fine to coarse sands, a small proportion of friable and sandy limestones. These cuttings have undergone a classical palynological treatment using strong acids (37% hydrochloric acid and 70% fluoridric acid) to make thin sections. The blend made up of palynomorphs; *Classopollis classoides, Ephedripites barghoornii, Classopollis spp, Classopollis triangulatus, Classopollis jardinei, Ephedripites barghoornii, Pemphixipollenites inequiexinus, Tricolporopollenites* sp S. 152, *Cretaceisporites polygonalis, Cretaceisporien* sp., made it possible to highlight the Frankish Cenomanian. This study also revealed the presence of *Galeacornea clavis* that Jardiné and Magloire (1965) could not find in the sediments of the Ivory Coast during the years 1965. As for the Turonian reworked following the great Turonian regression, it was brought to light thanks to the palynomorphs; *Droseridites senonicus, Droseridites baculatus, Tricolporopollenites* sp. SCI 141, *Tricolpites giganteus, Tricolpites microstriatus* sp. SCI 107, *Tricolporopollenites* sp. SCI 428, *Tricolpites* sp SCI 427, *Tricolpites* sp SCI 348-155, *Tricolpites* sp. SCI 13.

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INTRODUCTION

Sedimentary basins are of undeniable interest in oil research. Since the discovery of bitumen seeps in 1896, in Eboinda, in the southeast of Côte d'Ivoire near its border with Ghana, oil exploration has boomed in Côte d'Ivoire and particularly in recent decades (Affian, 1986 et 2003; Digbéhi, 1987; Mondé, 1997; Sombo, 2002). This research has allowed us to accumulate a number of data on the stratigraphy, tectonics and deposit environments of the various compartments of the basin. (PETROCI, 1990 ; Digbéhi *et al*., 2011a& b ; Yao, 2012 ; Assale et *al*, 2012 ; Assale., 2013 ; Bié, 2012 ; Gbangbot, 2012 ; Yao, 2014 ; Guédé, 2016 ; Ouattara, 2018).

Many biostratigraphic researchers have been able to subdivide the Paleocene and Late Cretaceous into foraminiferous biozones and provide details on the deposition environments. This is the case of: Goua (1993), Digbehi *et al*. (1996),Digbehi *et al*. (1997), Saint-Marc & N'Da (1997), Goua (1997), Yao (2012). Concerning palynology, there are few works. Since the work of Jardiné and Magloire in 1965, who studied the Senegal basin and that of Côte d'Ivoire, Bié *et al.* (2012)recent work have been able to classify Tertiary palynomorphs. Likewise, the palynological studies initiated by Guédé (2009; 2016), Digbehi *et al.,* (2011 a & b) Guédé *et al.,* (2019) nevertheless carried out the Cretaceous period with few details. These palynological data on the Cretaceous of the Ivorian basin are therefore still insufficient, the present study proposes to establish a palynostratigraphic scale in order to delimit the formations of the Cenomanian and those of the Turonian thus proposing a finer local palynostratographic scale. The BENO-3X well (5 ° 7'3.94'N and 4 ° 2'21.27"W) whose sediments were used for this study is located in the eastern margin of the Ivory Coast basin (figure 1).

MATERIAL AND ANALYTICAL METHOD

- The lithological analysis consisted in describing the sediments (clay, sand, sandstone, limestone, etc.) with a binocular magnifying glass in relation to the following description criteria: the color, appearance, hardness, presence or absence of limestone and silt for clayscolor, hardness, appearance, mineralogical composition and texture for limestones.
- Mineralogical analysis consists of identifying with a binocular magnifying glass, the accessory minerals present in the sediments. The minerals concerned are glauconite, pyrite and carbonaceous debris. By virtue of their specific characteristics, these minerals provide information on the different deposit environments.
- For calcimetry, equipped with a Bernard Calcimeter, we measured the volume of carbon dioxide released after cold attack on the rock with 10% hydrochloric acid (HCl)

The palynological treatment carried out in this work involves 21 cuttings samples from the 1675m to 2225m interval of the BENO-3X well. It aims to eliminate all the mineral matter contained in the sediments using the classic method of extracting organic microfossils, in particular: (i) 20g are taken from the clayey-silty, marly or carbonate sediments, the hard facies of which will be crushed; treatment by attack with strong acids (cold 37% HCl to decarbonize the sediments and 70% HF to remove silicates; a second hot HCl attack to dissolve the fluorosilicates formed).

The residues obtained were concentrated on a 10 µm cloth, then two drops of the sporopollinic material obtained were deposited between slide and coverslip glued with a special Loctite 358 resin. Finally, the analysis of the thin palynological slides using a MOTIC BA 310 transmitted light optical microscope equipped with a camera and a screen made it possible to observe and take pictures of the palynomorphs. The taxonomic determination of these was based on the morphographic classification of Potonie (1974) and Jardiné & Magloire (1964) for spores and pollen grains and DINOFLAJ3 (Williams et al., 2017), for dinoflagellate cysts.

RESULTS AND INTERPRETATIONS

SEDIMENTOLOGY

Lithology: Two lithological intervals could be distinguished between the heights of 1771 m and 2245 m (Figure 1):

Interval 1 has a thickness of 120 m (2250-2130 m) has two lithological units. Unit 1 (2250 m - 2180 m) is mainly made up of argillite and very little sandstone and limestone. Dark gray to brownish argillite is silty, micro micaceous slightly calcareous flaky to subfissile and locally very fossiliferous. The sandstone is light gray with fine to very fine grains. The gray, microcrystalline, slightly clayey limestone contains calcispheres (oligosteginids). Unit 2 is 50 m powerful (2180 m -2130 m) and is mainly made up of gray silty marl with whitish laminasions sometimes subfissile and micro micaceous. The limestones in small proportion are slightly clayey, microcrystalline with rare carbonaceous debris. Interval 2 (2120 m -1680 m) consists of two lithological units (Figure 2): Unit 1 (2120 m- 1850 m) consists of argillite and sandstone. Argillite is gray flaky to subfissile, silty and locally very fossiliferous, micro micaceous. The sandstones are whitish, and crumbly in appearance. The grains are subangular to sub-rounded, very fine to medium, bound only by a calcareous cement. They are poor in carbonaceous debris. The accessory elements seen here are made up entirely of carbonaceous debris. Unit 2 (1850 m - 1680 m) four sedimentary facies which are in order of abundance: argillite (gray, silty sandstone (very weakly represented) and limestone (pyritic).

Calcimetry

The evolution of the carbonate content of the sediments (Figure 1) allows us to distinguish three large intervals:

- Interval 1 (2200 m -2020 m) at high carbonate content with three respective peaks of 45% at 2180 m from 50% at 2120 m and about 60% at 2060 m. This is explained by the lithology made up of marls and limestones rich in foraminifera tests.
- -In interval 2 (2020 m -1840 m), the carbonate content drops and oscillates between 10% and 20% in argillites with fine sand and sandstone layers corresponding in places to weak carbonate peaks.
- -Interval 3 (1840 m- 1675 m) shows an almost zero calcium carbonate content with three peaks of about 15% at heights 1800 m, 1690 m, 1610 m in layers of dark gray argillites not to weakly limestones and thin sandstone banks with limestone cement where the peaks are expressed.
- The vertical distribution of carbonaceous debris, glauconite and pyrite is relatively variable in the two intervals studied (figure 2).

BENO-3X WELL PALYNOLOGY

Palynological analysis

Interval I: Interval I (2220 m to 1870 m) of the borehole yielded 2220 miospores (96%), palynomorphs, 96 dinocysts (4%) (Figure 2) and 58 chitinoid basal debris from foraminifers. Pteridophyte spores represent 6% (Figure 3) 19 species. They are dominated by *Deltoidospora, Cicatricosisporites* and *Dictyophilidites* (2.6%), to which are added the wart genera *Verrucosisporites* and the periporous forms like *Crybelosporites*. Angiosperms represent 4% of miospores with Triorites and Tricolpites (2.9%). The others include *Pemphixipollenites, Proteacidites, Monosulcites, Polyadopollenites, Tricolporopollenites, Retimonocolpites, Monocolpopollenites* and represent 1.17% of the population, or 28% of angiosperms. The most abundant are gymnosperm pollens with 12 genera, 21 species and 90% of miospores. Sporo-pollen spectra of the interval are largely dominated by *Classopollis* (82%), followed by Ephedroid pollens (5.49%) represented by *Ephedripites, Gnetaceapollenites* and

Steevesipollenites. The other gymnosperms *Araucariacites, Longapertites, Cycadopites* and *Inaperturopollenites* represent 1.36% of the population. Elater spores and bissacate pollens represent 0.42% and 0.06% respectively, while those with 2 balloons are represented by *Alisosporites* at 1960 m level.

The elater spores *Galeacornea, Elateroplicites* and *Elaterosporites* occur sporadically in the interval. Dinocysts, although representing 4% of palynomorphs, are well diversified with 17 genera and 22 species. The most common genera are *Spiniferites* and *Hafniasphaera* (up to 45.83%), followed by *Operculodinium* (12.5%). Their distribution is relatively continuous in the interval except for the known *Hafniasphaera* at the top of the interval. Other species are found sporadically such as *Fibrocysta, Florentinia, Hystrichodinium, Cyclonephelium, Exochosphaeridium, Glaphyrocysta, Diphyes, Spinidinium, Trichodinium* and some forms of peridinoids classified as fallout with regard to their global stratigraphic distribution: *Cerodinium andalusiella* and *Senegalinium.* An acritarch is reported at the 1940 m elevation. Scytinascias are well represented and are sometimes more abundant than dinocysts in some samples.

Interval II: The palynoflora in this interval (1870 to 1690 m) is dominated by continental forms. However, the proportion of spores and pollen decreases (90% to 57%) while that of dinocysts increases (4% to 43%) (Figure 5). A total of 17 genera and 25 species have been identified. The sporomorphs diversify specifically (18 to 20), the number of genera remaining unchanged. The proportion of spores increases (4% to 28%) (Figure 6) but with a constant number of genera. Extinctions of the genera *Schizeasporites, Verrucosisporites, Appendicisporites, Crybelosporites, Laevigatosporites* and the fungal spores *Pluricellosporites* are observed. These disappearances are compensated by appearances of the genera *Triporoletes, Lycopodiumsporites, Interrulobites, Ariadnaesporites, Cyathidites, Neoraistrickia*. The dominant genera are *Deltoidospora* and *Dictyophillidites* (32.96% of spores).

New appearances leading to species diversification are observed in angiosperms which, from 15 species (4%) in interval I, increase to 22 species (22.14%) in interval II. As for gymnosperms, they are in marked decline and go from 21 species for 89.5% to 15 which represent only 50%. This regression follows the extinctions of certain species of *Classopollis* (*Classopollis triangulus* and *Classopollis* spp) and of *Ephedroides* pollen (*Ephedripites barghoornii, E. torosus, E. jansonii* and *Gnetaceapollenites* spp). Within interval II, the dominant gymnosperms are the pollen grains without apertures namely *Inaperturopollenites* and *Araucariacites* which represent 45.7% of gymnosperms and 22% of miospores. They are followed by *Ephedripites* which, after the extinction of some of their species (*Ephedripites barghoornii, E. torosus, E. jansonii*), continue their development with species such as *E. multicostatus* and *E. ambiguus* in proportion 25% of gymnosperms and 12% of spores and pollen grains. There is also an almost total extinction of elater forms which are represented by only one form of the genus *Elateroplicites africaensis*. The balloon pollen grains (bissacates) have disappeared. The rate of dinocysts increased from 4% in Interval I to 43% in Interval II as genera such as *Xenascus* diversify. The population of *Cyclonephelium* increases from 6.12% in Interval I to 11.28% in Section II. New species have emerged.

These are *Batiacasphaera* spp, *Spiniferites mambranacea, Dinogymnium longicornis, Achomosphaera* spp, *Oligosphaeridium complex, Odontochitinia porifera, Exochosphaeridium* spp. Along with these, some species appear with high populations (*Xenascus* (up to 43.08%) followed by *Circulodinium* (17%)). Some forms observed within interval I have also disappeared, namely *Glaphyrocysta, Diphyes, Spinidinium, Trichodinium*. A total of 25 species have been described, divided into 17 genera.

Palynostratigraphy

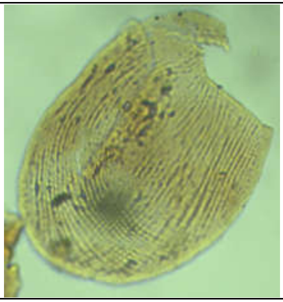
The Cenomanian: From 2220 m, the appearance of the species *Classopollis classoides, Ephedripites barghoornii, Classopollis* spp, *Classopollis triangulatus, Crybelosporites pannuceus, Ephedripites jansonii, Tricolporopollenites* sp S. 152, *Cretaceisporites polygonalis, Cretaceisporites* sp, *Classopollis jardinei, Quadricolpites reticulates*. the age is confirmed by the presence of other species such as, *Pemphixipollenites inequiexinus* and the elater species *Elaterosporites protensus, Elateroplicites sp, Elateroplicites africaensis.*

The Cenomanian wall is set at 2240 m based on the appearance of the Albian type markers and the exceptional *Classopollis* peak. The roof of the Frankish Cenomanian is set at 1870 m on the last occurrence of *Ephedripites barghoornii* and *Pemphixipollenites inequiexinus*, associated with the species *Classopollis jardinei, Classopollis classoides* and *C. brasiliensis.* From 2220 m to 1980 m, the presence of *Elaterosporites protensus, Elateroplicites* sp, *Elateroplicites africaensis* species associated with the genus *Classopollis* confers a lower to medium Cenomanian age, although the presence of *Elaterosporites protensus* (only one form) would indicate Albian. From 1980 m to 1870 m, the species *Pemphixipollenites inequiexinus* and *Galeacornea clavis* and *Triorites africaensis* indicate a Cenomanian age greater than this interval.

The reworked Turonian: In the range 1870 m to 1690 m, *Droseridites senonicus, Droseridites baculatus, Triorites africaensis, Classopollis jardinei, Tricolporopollenites* sp. SCI 141, *Tricolpites giganteus, Tricolpites microstriatus* sp. SCI 107, *Steevesipollenites binodosus, Tricolporopollenites* sp. SCI 428, *Steevesipollenites cupiliformis, Tricolpites* sp SCI 427, *Tricolpites* sp SCI 348-155*, Cretaceisporites polygonalis, Cretaceisporites sp, Classopollis classoides, Classopollis brasiliensis, Tricolpites* sp.SCI 13. Some of these palynomorphs date from the Cenomanian (Plate I), others from the Turonian (Plate II). This simultaneous presence indicates a rework between 1870 m and 1690 m. These spores and pollen grains are associated with the dinocysts *Odontochitinia costata, Oligosphaeridium complex, Hystrichodinium pulchrum* which make their last appearance at 1720 m, which indicates an age not exceeding the Lower Senonian. *Florentinia* sp., (LAD at 1690 m) and *Florentinia radiculata* characterize the Turonian at 1780 m.

Passage from Cenomanian to Turonian: The passage from Cenomanian to Turonian is set at 1870 m, between 1900 m and 1820 m. Palynomorphs are dominated by continental flora (82%) to the detriment of marine microflora (18%).

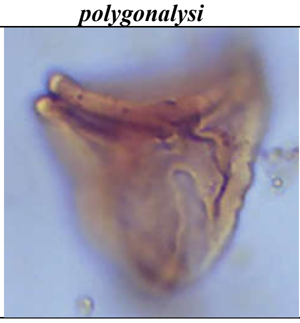


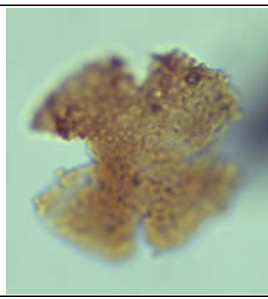



1. ***Classopollisclassoides*** **2.** ***Classopollisjardinei*** **3.** ***Classopollisbrasiliensis*** **4.** ***Classopolis brasiliensis***

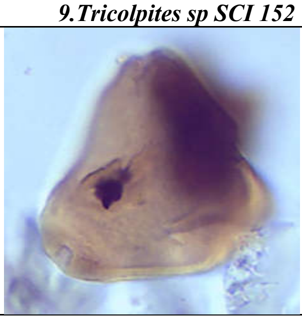



5. ***Cretaceisporites polygonalysi*** **6.** ***Cretaceisporites mulleri*** **7.** ***Galeacorne clavis*** **8.** ***Elaterosporites protensus***



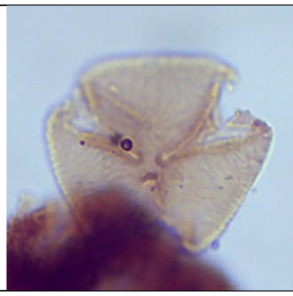
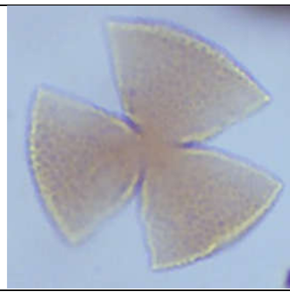



9.Tricolpites sp SCI 152 ***10. Ephedripites jansonii*** ***11. Quadricolpites reticulates*** ***12. Ephedripites barghoornii***



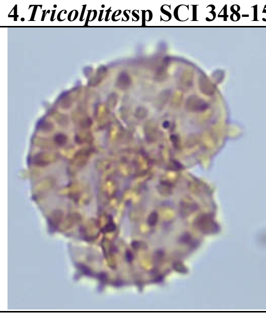
1,2. Tricolpites microstriatus ***3. Tricoplites sp SCI 107*** ***4. Tricolpites sp SCI 348-155***



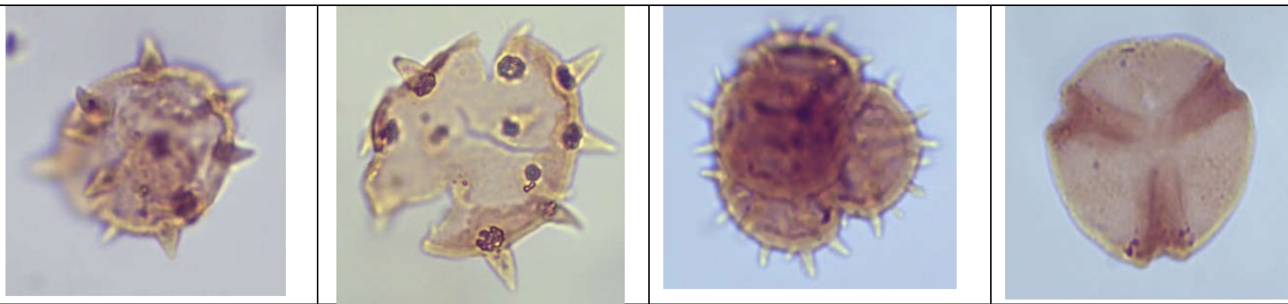
1, 2. ***Tricolpitesmicrostriatus*** **3.*Tricolpitessp* SCI 107** **4.*Tricolpitessp* SCI 348-155**



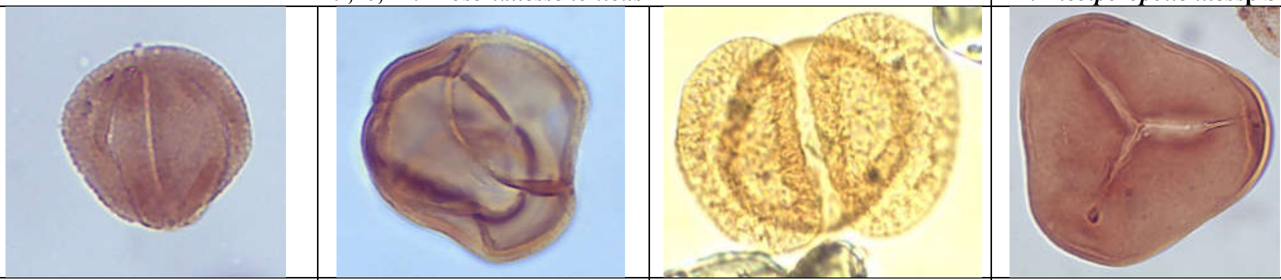



5,. ***Tricolpitesgiganteus*** **6.*Tricolpitessp* SCI** **7.** ***Droseriditesbaculatus***

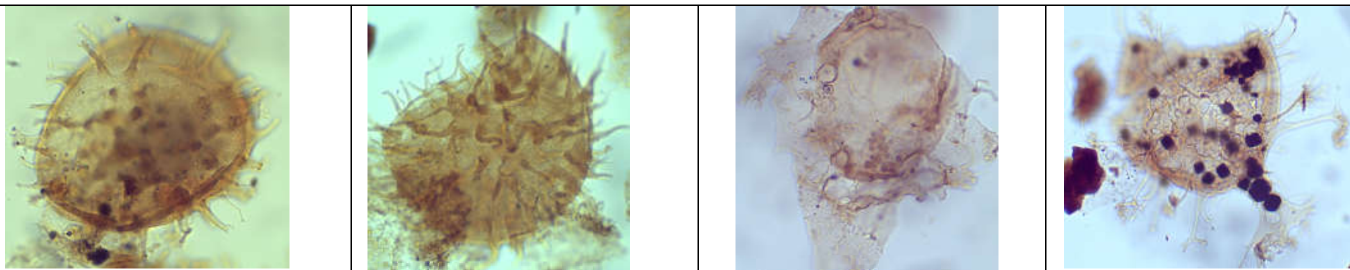
Continue ….



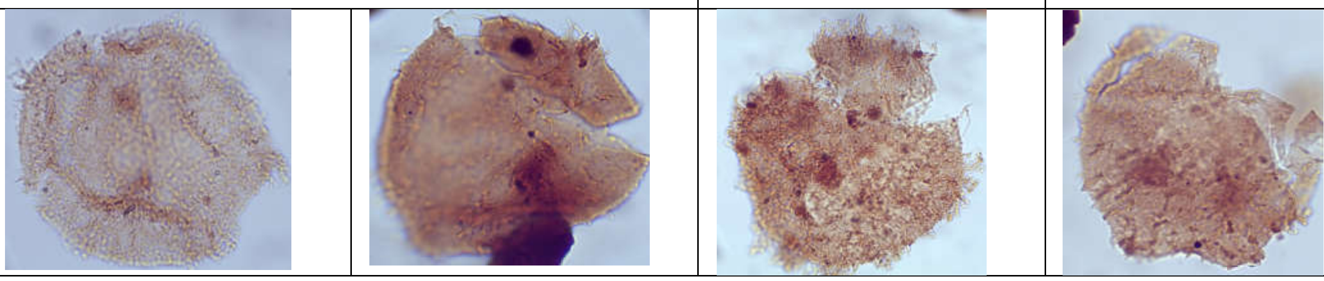
9,10, 11. *Droseriditessenonicus* 12.*Tricolporopollenites*sp SCI 428



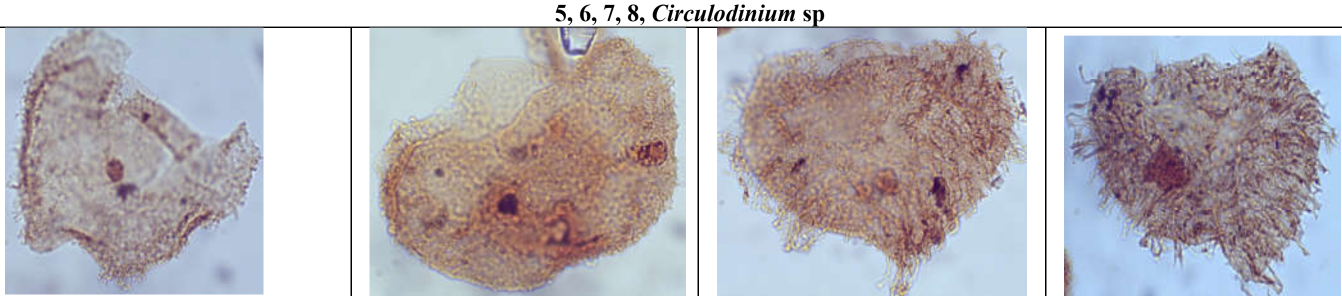
13. *Tricolpites*sp 14. *Tricolpites*sp SCI 141 15. *Alisosporites*sp *16. Deltoidospora*sp



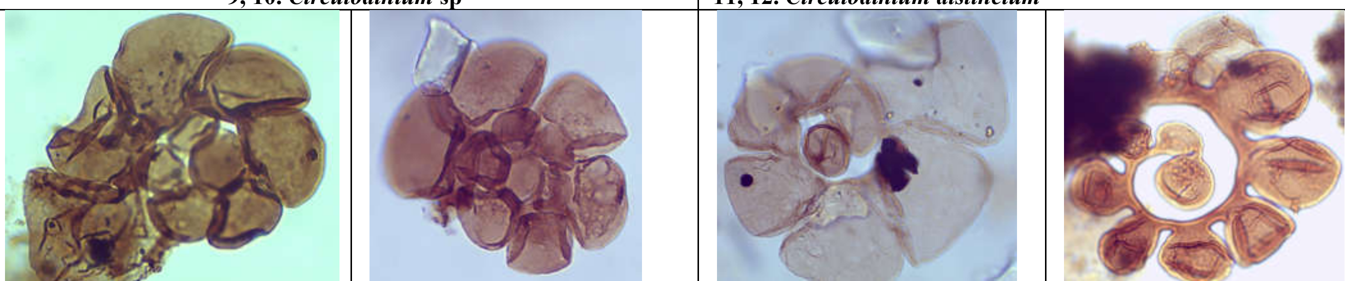
1,2. *Exochosphaeridium* sp 3. *Xenascusceratiodes* 4. *Xenascus* sp



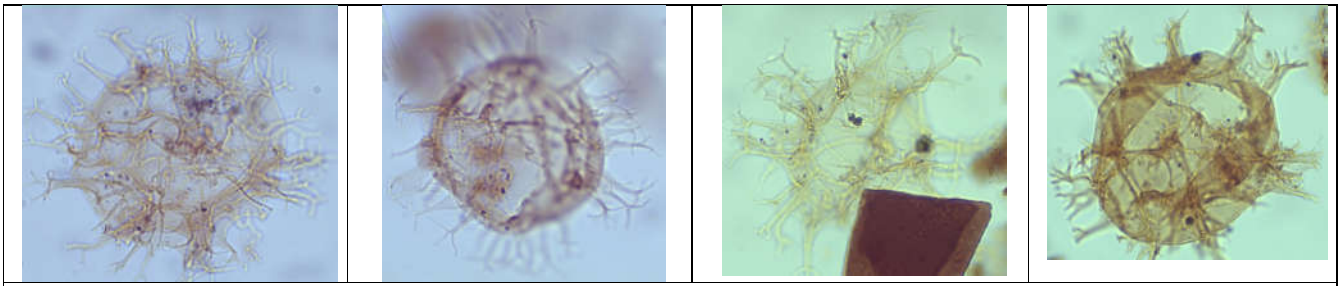
5, 6, 7, 8, *Circulodinium* sp



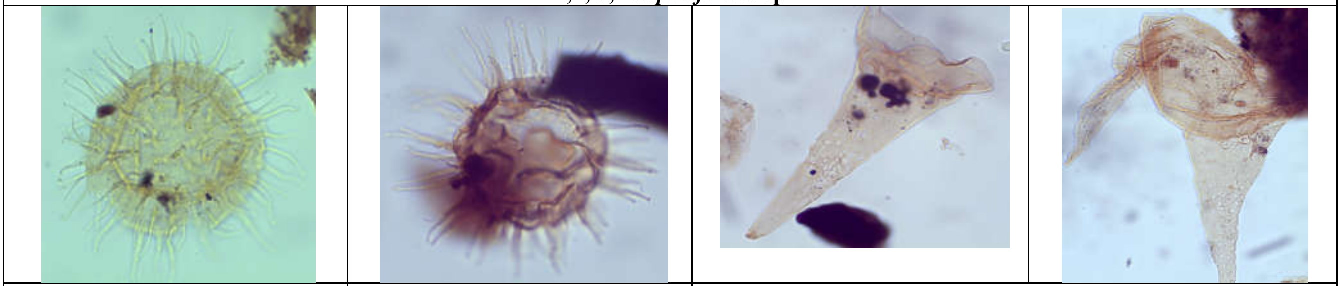
9, 10. *Circulodinium* sp 11, 12. *Circulodinium distinctum*



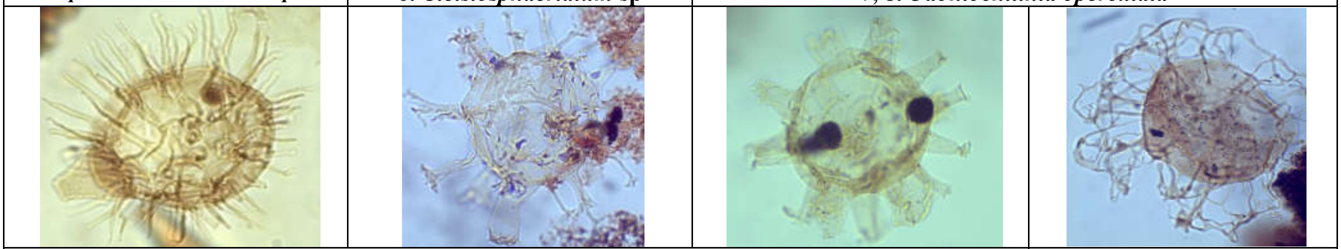
13, 14, 15. *Rhodonascia*cf. *bontei* 16. *Trochiliascia*cf. *cuvillieri*



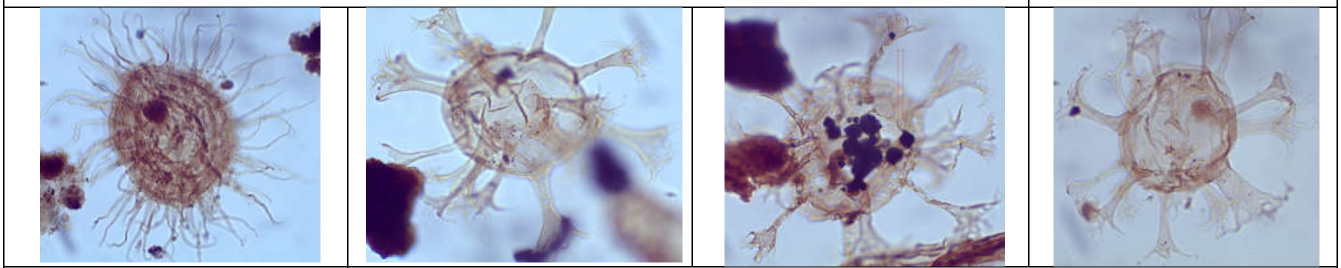
1,2, 3, 4. ***Spiniferites* sp**



5. .*Operculodiniumcentrocarpum* **6. *Cleistosphaeridium* sp** **7, 8. *Odontochitinia operculata***



9,10 11. *Florentinia* sp **12. *Glaphyrocysta*sp**



13. *Hystrichodinium*sp **14, 15, 16. *Oligosphaeridium*sp**

DISCUSSION

The genus *Classopollis*, very abundant in the study interval, has been used by many authors to characterize the Cenomanian. Indeed, the appearance of the species *Classopollis brasiliensis* characterizes the Cenomanian in North Africa and West Africa according to Jardiné and Magloire (1965). The C. jardinei species is known to belong to the Upper and Middle Cenomanian in Senegal. Also, *Classopollis* sp is used by Mohamed (2009) to highlight the Cenomanian in the Egyptian basin. This same species is very abundant in the Cenomanian formations of the Ivory Coast basin, Kouassi (2014), Ouattara (2017). Jardiné & Magloire (1965) described *Galeacornea clavis* in the Cenomanian in Senegal but they have not encountered any in any equivalent formation in the Ivory Coast. It was highlighted in this study and allows confirmation of the Cenomanian age. The present work reveals the presence of this palynomorph in sediments where it is always associated with *Classopollis,* which suggests that they both characterize the Cenomanian. Also according to Lawal (1982), Lawal & Moulade (1986) this form belongs to the Upper Cenomanian in Nigeria. *Tricolporopollenites* sp S. 152 in Senegal dates the sediments of Middle to Upper Cenomanian age (Jardiné & Magloire, 1965; Lawal & Moullade, 1986). *Triorites africaensis* characterizes the Upper to Middle Cenomanian in Senegal. For various authors (Herngreen, 1973 and 1975; Regali *et al*., (1974 a & b); Lawal, 1982 and 1986) this form actually belongs to the Upper Cenomanian. These forms are rare in Côte d'Ivoire, Jardiné & Magloire (1965) observed some species in the extreme top of *Classopollis* formations. *Elateroplicites africaensis* is recognized in sediments of the Upper Albian-Upper Cenomanian (Turonian?), Of Brazil (Herngreen, 1973, 1975; Regali *et al*., 1974), of the Lower Cenomanian of Senegal; Middle (?) And Upper Albian from Nigeria, from the Upper Middle Cenomanian Albian of Gabon (Jardiné *et al*., 1965; Herngreen, 1975). Crybelosporites pannuceus is well known in the Albian-Cenomanian from several regions of the world such as Brazil (Herngreen, 1973), Egypt (Sultan, 1978; Schrank & Ibrahim, 1995), Gabon and Senegal (Doyle *et al*., 1982), North-East Libya (Batten & Uwins, 1985; Ibrahim *et al*., 1995), Maryland (Brenner, 1963), Peru (Brenner, 1968), Sudan (Schrank, 1990; Awad, 1994) and Tunisia (Reyre, 1970) in Bettar & Meon (2006). *Triorites* sp., *Tetracolpites* sp were identified by Jardiné & Magloire (1965) in deposits from Upper Albian to Lower Cenomanian in Senegal and Ivory Coast.

Cretacaeiporites polygonalis occurs in Senegal in sediments from the Upper Albian to the Lower Cenomanian. In Brazil, it is recognized in the lower Albian and in high proportion from the Albian to the Cenomanian. Isolated species of *Cretacaeiporites mulleri* and *C. scabratus* have been observed from the Upper Albian to the Cenomanian and also from DSDP sites 370 and 367. But these species are common to the Upper Albian and Cenomanian sediments of Brazil. These species are recognized only in Senegal in the Upper Cenomanian and the Turonian. The association composed of dinoflagellate cysts such as *Florentinia* spp, *Subtilisphaera perlucida*, and *Odontochitina operculata* represent an Albian-Cenomanian age in northeastern Libya (Batten & Uwins, 1985). *Hystrichokolpoma*? sp. cf. *Xenascus ceratioides*, according to Davey & Verdier (1971) are found from the Albian to the Maastrichtian in South Africa. The Turonian is highlighted by tricolpate forms often reticulated and sometimes striated (Jardiné & Magloire, 1965). It was recognized in our well by the following forms: *Tricolpites* sp S.427, as was the case in Senegal (Jardiné & Magloire, 1965) and in Côte d'Ivoire Digbéhi *et al*., (2011b). Angiosperm pollen grains with large reticles, Tricolpate, called *Tricolpites giganteus* represent a species characteristic of the Lower Turonian and Lower Senonian. These palynomorphs were previously observed in the Turonian formations of West and North Africa by Jardiné & Magloire (1965), Jan du Chêne et al. (1978), Lawal & Moullade (1986), Salard-Cheboldaeff (1990) and Schrank & Ibrahim (1995). *Tricolpites* sp SCI 348-155 is a species which proliferates in the lower Senonian and Turonian stages. However, it better characterizes the Turonian especially when it has a moderately large mesh reticulum (Jardiné & Magloire, 1965); *Tricolpites* sp SCI 99 characterizes the sequence preceding in probing the appearance of the genus *Classopollis*. In Senegal and Ivory Coast, it characterizes the Turonian as well as *Tricolpites* sp SCI 107. *Tricolpites* sp S 427 indicates a basal Turonian-Senonian age in Senegal. We also note *Tricolpites giganteus* which is a good marker for Turonian in Ivory Coast (Jardiné & Magloire, 1965). The species Tricolpites sp S 428 dates from the Lower Turonian-Senonian in Ivory Coast and Senegal (Jardiné & Magloire, 1965). The stratigraphic distribution of *Droseridites senonicus* encountered in the present work starts from the upper Turonian to the lower Senonian according to Jardiné & Magloire 1965.

CONCLUSION

This study made it possible to establish the lithology and to recognize the Cenomanian and Turonian stages in the sediments of the BENO-3X well located in the margin of Abidjan. It emerges lithologically that the cuttings at the intervals studied are characterized by an alternation of gray marl with whitish laminations, massive gray clays with subfissile, friable sandstones with calcareous cement and very rare whitish limestones, friable and sandy. At the palynostratigraphic level: the Cenomanian and the Turonian are highlighted by the forms continental environment, in this case the spores and the pollen grains; since the dinocysts observed have a large vertical distribution, they cannot therefore be used for dating said stages. The species that mark the Cenomanian observed here are: *Classopollis classoides, Ephedripites barghoornii, Classopollis* spp, *Classopollis triangulatus, Classopollis jardinei, Ephedripites barghoornii, Pemphixipollenites inequiexinus* and species with elaters *Elaterosporites protensus, Elateroplicites* sp, *Elateroplicites africaensis, Ephedripites barghoornii, Pemphixipollenites inequiexinus, Classopollis jardinei, Classopollis classoides, C. brasiliensis., Elaterosporites protensus, Elateroplicites* sp, *Elateroplicites africaensis, Pemphixipollenites inequiexinus* et *Triorites africaensis*. The discovery of *Galeacornea clavis* that Jardiné and Magloire (1965) could not find in the sediments of the Ivory Coast. The palynomorphs which have made it possible to date the Turonian in the Ivorian basin are: *Droseridites senonicus, Tricolporopollenites* sp. SCI 141, *Tricolpites giganteus, Tricolpites microstriatus* sp. SCI 107, *Tricolporopollenites* sp. SCI 428, *Steevesipollenites cupiliformis, Tricolpites* sp SCI 427, *Tricolpites* sp SCI 348-155, *Cretaceisporites polygonalis, Cretaceisporites* sp, *Tricolpites* sp. SCI 13.

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