

Short Research Article

LITHOSTRATIGRAPHIC CHARACTERISATION OF SENONIAN DEPOSITS ON THE ABIDJAN MARGIN

ABSTRACT

Context: The sedimentary basin of Côte d'Ivoire has generated numerous geophysical, sedimentological and biostratigraphic research. However, the lithostratigraphic characteristics for revealing seismic processes are very little known. **Objective:** This study was carried out with the aim of understanding the relationship between sea level variations and seismic terminations. **Method:** the studies carried out relate to the lithostratigraphic analysis of two seismic profiles of Senonian age in the Abidjan margin. The seismic study of this work is based on the interpretation of the seismic profile. Recognizing reflector terminations and reflector geometries is arguably one of the most useful aspects of this approach. **Results:** the seismic profiles show the Senonian formation is generally continuous and of approximately constant thickness overall. **Conclusion:** overall, the formation is affected by simple normal faults offshore, note the presence of structures that could constitute structural hydrocarbon traps.

Keywords: Onlap, downlap and toplap, Lithoseismics, Oil potential, Ivory Coast

1. INTRODUCTION

The Ivorian continental margin is a passive margin that has been the subject of a number of research studies, most of which have focused on sedimentology, biostratigraphy, tectonics and stratigraphy [1] and [2] on the one hand, and on structural aspects [3]; [4]; [5], [6] on the other. The few results obtained on the 'Bélier' deposit remain to be elucidated. The use of seismic data in terms of deposit processes can provide fundamental information on reservoir zones. It is in this context that the present study has been initiated with the theme: 'LITHOSTRATIGRAPHIC CHARACTERISATION OF THE SENONIAN DEPOSITS OF THE ABIDJAN MARGIN'. The général objective of this work is to understand the geological context of the Senonian deposits. Specifically, the aim is to match the various sequences derived from the drilling data to the reflector terminations and to describe the lithology according to the sedimentary processes. This study is based on data from five boreholes and seismic data from a single block located in the Abidjan margin (Figure 1: study area).

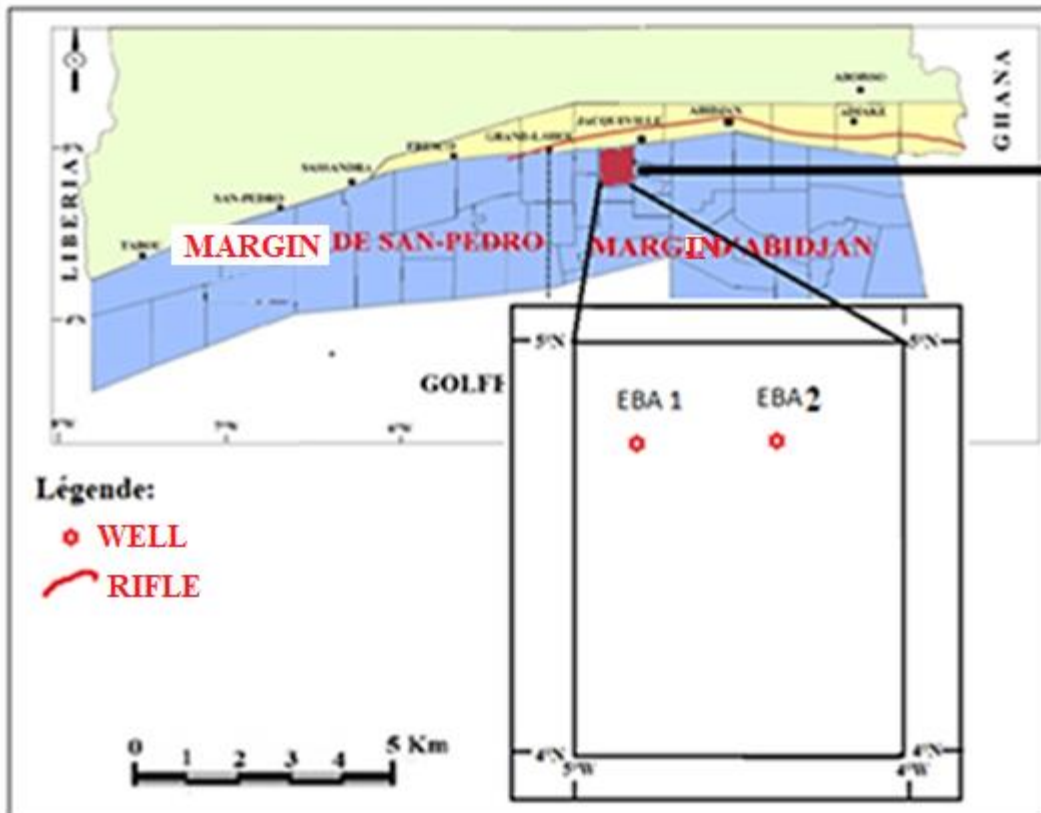


Figure 1: Geographical location of boreholes studied in the Abidjan margin

2. STUDY MATERIALS AND METHODS

The seismic study in this work is based on the interpretation of borehole data and seismic profiles. A number of seismic stratigraphic concepts, such as onlap, downlap and toplap, were used as a guide. A depositional sequence is therefore limited at its top and bottom by discontinuity surfaces underlined by reflection terminations. The seismic reflection-sequence boundary relationships were defined by [7] as a function of the termination of these reflectors on adjacent boundaries. Recognition of reflector terminations and reflector geometries is undoubtedly one of the most useful aspects of this approach. These terminations describe the contacts between reflectors. There are two boundaries for each sequence, the lower boundary and the upper boundary. These sequence boundaries are defined by their relationship to the sequence. These relationships are based on the parallelism or lack thereof between the strata and their boundary surfaces.

- The 'onlap' or aggradation bevel corresponds to the termination of horizontal strata on a sloping base surface or sloping strata on a base surface with a steeper slope. This arrangement marks a migration of deposits towards the coast in the case of a rise in sea level. In the case of a rapid fall in sea level, the onlap marks a migration of deposits towards the basin.
- The 'downlap' or progradation wedge is the termination of more inclined strata on a less inclined base surface. It corresponds to a lateral increase in deposits in the direction of the slope. Onlap' and "downlap" are indicators of a non-depositional hiatus rather than an erosional hiatus [7].

Once defined, the discontinuities that limit the sequence identify the constituent units in terms of seismic facies. These are first studied globally on the basis of the internal configuration of the reflections. Then, the characteristics of the reflections analysed are the internal parameters of the reflections. The seismic sections are used to identify seismic sequences, which often correspond to second- and third-order stratigraphic sequences. When the resolving power of seismic allows it, it is possible to identify sequences. Seismic drilling is used to match seismic sequences with stratigraphic sequences. Sequence boundaries are defined on the basis of the geometric relationships of the markers truncation by erosion, then Onlap for s

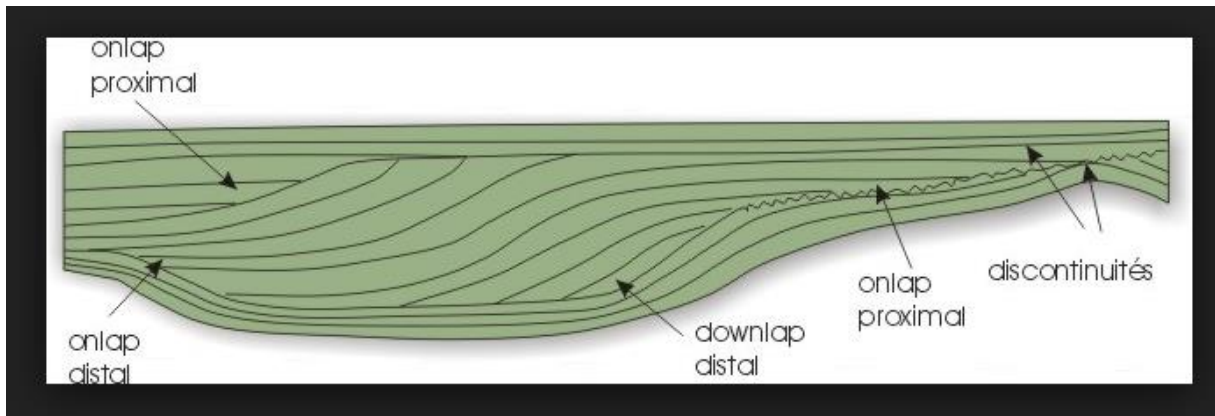


Figure 2: Geometry of contact surfaces between sedimentary bodies during the filling of a basin [8].

3. RESULTS AND DISCUSSION

3.1 CORRESPONDENCE OF THE GEOLOGICAL SEQUENCES TO THE REFLECTOR TERMINATIONS OF THE EBA 1 BOREHOLE

Following the fundamental principles of seismic stratigraphy defined by [9], [7] [10], the superimposed seismic units can be distinguished in the stratigraphic series [11].

Following the North-South direction of the profiles, the reflectors are not parallel but diverge over the whole section with an irregular, heavily eroded surface. In Unit 1 (U1), within the Maastrichtian sequences (U1), the reflectors are generally undulating. To the north, the reflectors are of the aggradation bevel type. This configuration indicates clastic coastal sediments transported by a watercourse or by waves or low-energy turbidity currents (Sangrée et widmer, 1977). In Unit 1, these less pronounced reflectors have very low amplitudes to the point of resembling a white facies with low to medium frequencies (Figure 2). Unit 2 (U2), the Campanian sequences present discontinuous reflectors throughout the profiles, with high and low amplitudes to the north and south respectively. The frequency is variable. Unit 1 is deposited in Onlap on unit 2. This is a fundamental indication of a relative rise in sea level, thus justifying the first marine transgression.

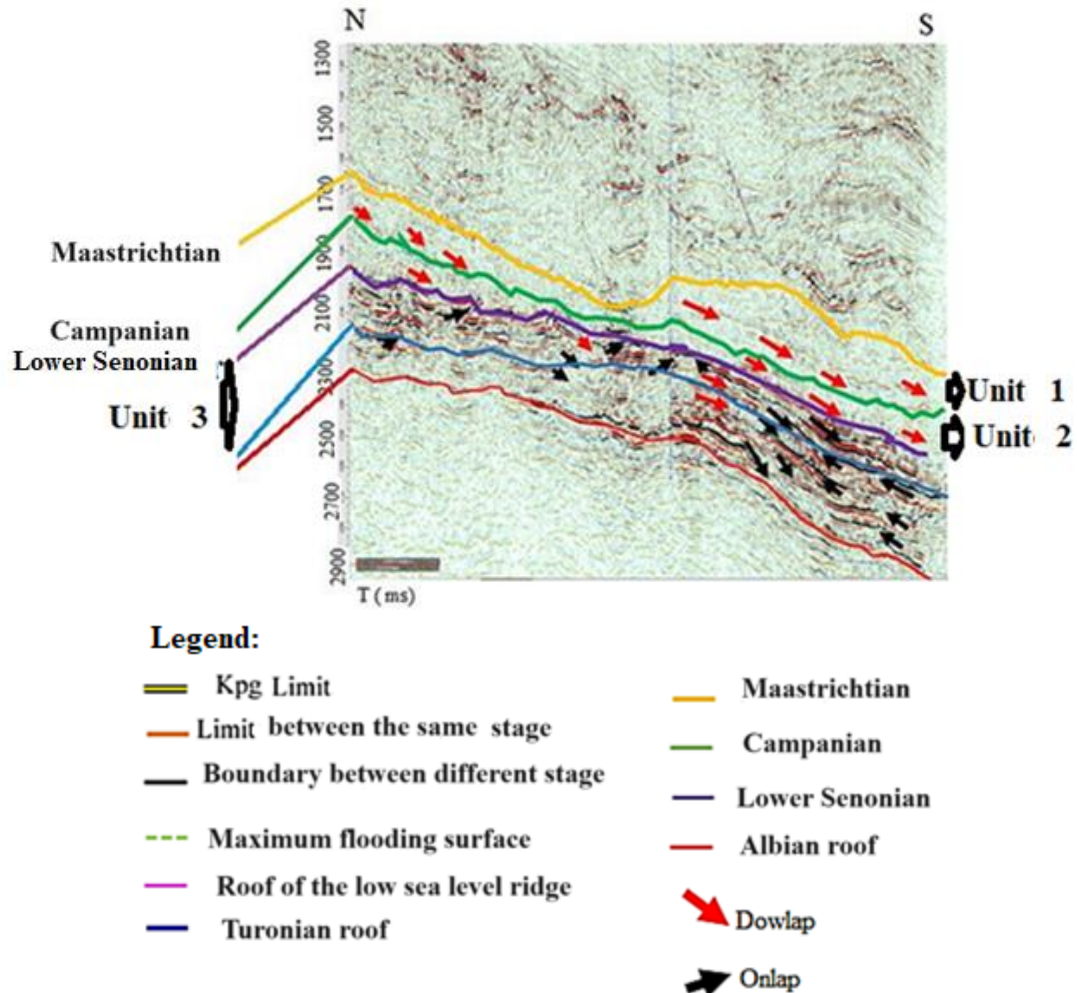


Figure 3: Seismic section of borehole EBA 1

3.2 MAPPING OF GEOLOGICAL SEQUENCES TO REFLECTOR TERMINATIONS IN BOREHOLE EBA 2

The North-South seismic line of borehole EBA2 (figure 3) was interpreted to see the evolution of the Senonian formations (Coniacian-Maastrichtian). The reflectors are discontinuous. From north to south, the thickness of the formations decreases. The seismic reflector is prograding. These reflectors are discontinuous, discordant, of variable amplitude and average frequency. The transition to the Campanian shows low amplitude reflectors. The Campanian sequences have high to low amplitude reflectors. The characteristics of the reflectors are almost similar to those of the Maastrichtian (units U1 and U2) are characterised by the sigmoidal-progressive shape of their internal reflectors, which are limited at the base by a downlap surface and at the top by an onlap surface. Between these 2 limits is a well-marked reflector that separates and announces the Lower Senonian (Coniacian-Santonian) sequences. The seismic reflectors are generally discontinuous throughout the section. They are discordant, of variable amplitude and high to low frequency from north to south. This

suggests a mixture of fine and coarse deposits. All the reflectors begin in onlap in the proximal part and in downlap towards the open sea.

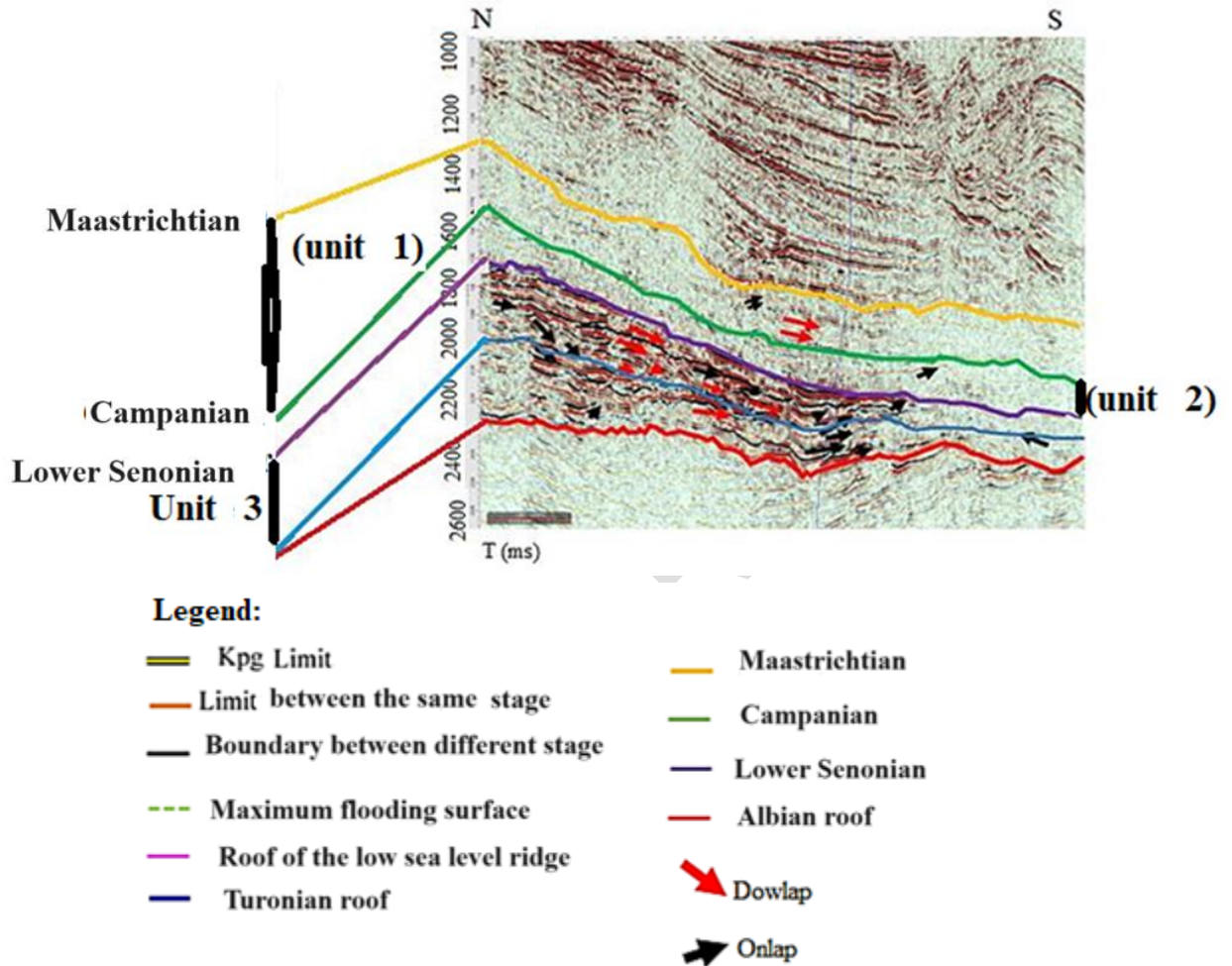
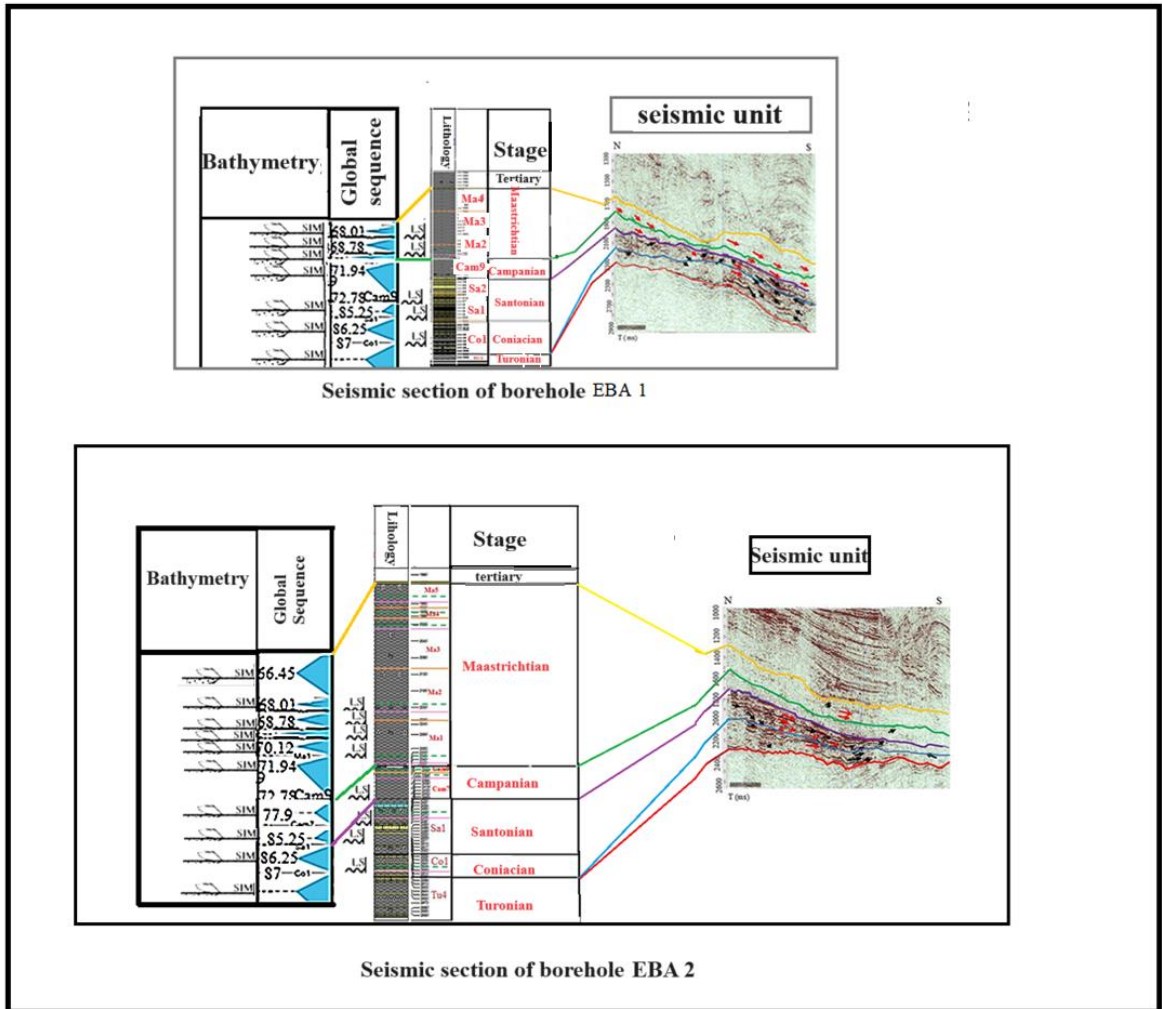


Figure 4: Seismic section of borehole EBA 2

3.3 LITHOLOGICAL DESCRIPTION BY SEDIMENTARY SEQUENCE

The sedimentary formation studied in this study revealed a succession of deposits ranging from Coniacian to Maastrichtian. The depositional sequences were determined on the basis of lithological and seismic studies. This study enabled us to identify in the different sequences low-level marine processes, transgressive processes and high-level marine processes. Sequences that are identical throughout a complete cycle are made up of genetically linked strata [15]. The identification of facies also enabled us to determine the periods of advancement of the depositional profile (progradation) or retreat (retrogradation) [16]. By superimposing these different depositional environments over time, we can define 10 depositional sequences. These sequences are made up of three depositional processes: the

transgressive procession and the high marine level procession are clayey and the low marine level procession is sandy with an intercalation.



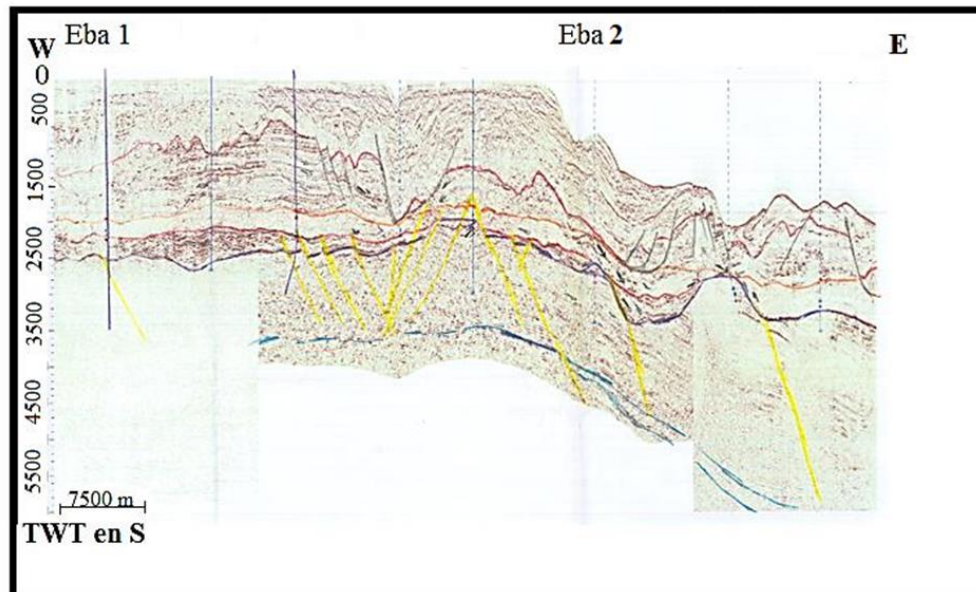
Legend:

- Kpg Limit
- Limit between the same stage
- Boundary between different stage
- - - Maximum flooding surface
- Roof of the low sea level ridge
- Turonian roof
- Maastrichtian
- Campanian
- Lower Senonian
- Albian roof
- ➔ Downlap
- ➔ Onlap

Figure 5: Seismic section of borehole EBA

4. Discussion

Two more or less continuous seismic lines confirm the transgressive and regressive trends. The Lower Senonian (Coniacian-Santonian) is characterised by unconformable reflectors with continuous facies. There is a wide range of reflections. From north to south, these reflectors are only present in the deposits of boreholes EBA 1 and EBA 2. As for the Upper Senonian (Maastrichtian - Campanian), over the whole of the seismic profile (figure 6), the reflectors are not very pronounced and are interspersed in areas with semi-transparent facies where the reflectors in the seismic profiles are not very continuous. The formations revealed are not consistent with each other. They are characterised by low amplitude reflectors. The thickness of the deposits decreases from north to south and from east to west. The lithological characteristics of the formations are often discontinuous. They have porous rock facies that cause few reflections and may characterise gravity deposits (turbidites) or disorganised sandy deposits [15]. In a north-south direction, the Upper Senonian becomes progressively thicker towards the open sea, where the proportion of clay becomes greater before the Upper Senonian. to reduce considerably in very deep water. From east to west, the thickness is almost constant with little variation in lithological composition.



Legend :

- Upper Senonian
- Lower Senonian
- Fault in the albian
- Albian

Figure 6: Correlation of seismic profiles from boreholes on the Abidjan margin

4. CONCLUSION

The litho-acoustic characteristics show that the Senonian reflectors are generally continuous, of almost constant thickness and of constant lithological composition in an east-west direction. In a north-south direction, the Senonian gradually thickens towards the open sea, where the clay content predominates, before reducing considerably in very deep water. Overall, the formation is affected by simple normal faults. Offshore, we note the presence of anticlinal

structures that could constitute structural hydrocarbon traps, while in the deep offshore, the configuration of the reflectors highlights lenticular structures that suggest the existence of hydrocarbon traps.

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