Stratigraphical nature and Palaeogeographical significance of the Top Albian surface in the South Cameroon Atlantic Margin.

Introduction

Located in the Gulf of Guinea, the study area belongs to the Cameroon Atlantic Margin (CAM) and stretches for about 402 km (Sayer et al., 1992), from Nigeria to the border with Equatorial Guinea. This domain is divided by the Cameroon Volcanic Line (CVL) into two components. The northwest component corresponds to the Rio Del Rey Basin while the southeast part is represented by the Douala/Kribi-Campo (DKC) Basin. Moreover, the DKC Basin is subdivided into Douala and Kribi-Campo sub-basins. The DKC Basin has been investigated by several works including both industry (Phillips, 1990; Pauken, 1992; Ngue et al., 1992; ECL, 2001; Bray et al., 2003; Loule et al., 2018) and academia (Njike Ngaha, 1984; Mbida, 2012; Mbesse, 2014). DKC Basin is characterized by a sedimentary cover exceeding 8 km in deep offshore (Mbida, 2012), dated late Jurassic to Recent (Loule et al., 2018). This sedimentation is subdivided, from the top basement to the seabed, into six main unconformities, namely Top Albian, Campanian, Danian, Oligocene, Middle Miocene and Messinian.

The Global Eustatic curves of Haq (2014), show that the Middle Cretaceous (Barremian to Late Albian) is globally considered as a transgressive period with a highstand sea-level reached at Late Cretaceous (Cenomanian-Turonian). For these authors, the Albian-Cenomanian boundary (Top Albian surface) corresponds to a flooding surface, which delimits transgressive Middle Cretaceous and minor regressive Cenomanian. However, some studies realized in the Southwest African margin (Ntamak-Nida et al., 2010; CGG Robertson, 2015) reveal that the Albian-Cenomanian boundary is regressive, because its followed a highstand sea-level occurred during the Aptian-Albian period. Following all these observations, the study of this boundary is an interesting element in the understandings of Early Cretaceous sea-level fluctuations in the CAM particularly and in the SW African margin in general.

This study aims to re-examine the stratigraphical nature and the palaeogeographical significance of the Top Albian surface of the CAM, using 2D seismic and wells data. This will permit to re-define the nature of this surface and understand the geological phenomenon responsible for its genesis.

Method and/or Theory

Data analyzed in this study were provided by the National Hydrocarbon Corporation (NHC) of Cameroon. They include two seismic lines and twenty well logs data. Seismic lines covers the shelf and deepwater portions of the southern part of study area. They were recorded in 2005 by ION Global Exploration Technology during the CameroonSpan campaign. They are high quality data characterized by deep penetration down to 10 km. The Well logs used in this work, were collected from several drilling campaigns carried out between 1961 and 2000, by ELF-SEREP, MOBIL, TOTAL, KELT, PHILIPS and SNH companies. They spread from onshore to southern deep offshore. The wells reach depths from 1 to 4 km deep below seabed and their stratigraphic interval ranges from Aptian to Recent. They have been chosen for the reliability of their data, including lithostratigraphy and chronostratigraphy. They cover a total areal of 6600 km² on the margin.

The Wells data analysis was performed according to these four main steps: gathering of middle and late Cretaceous lithostratigraphic data issued from each well, identification of top formations in different wells, correlation of lithochronostratigraphic intervals between wells tops, and construction of lithochronostratigraphic wells section. Through this wells section, main boundaries were identified, including the Top Albian surface. A 3D model of this surface was constructed over the study area, using Geological Data Modeling (GDM Suite) software, developed by the BRGM (Bureau des Recherches Géologiques et Minières-France). The Multilayer extension from GDM suite (version 7.2) is used to build the 3D geological models illustrated in this work based on Well log data. The first step of this program is to define the stratigraphic pile of different lithologies present in the dataset. After, data are coded according to the framework provided by this sedimentary cover. Finally, interfaces of formations are interpolated and combined each other. The interpolation consists of constructing a regular grid at
the nodes of which are estimated the variables of interest (formation top of base, formation thickness), from the data available.

The seismic analysis was conducted using the terminologies of standard seismic stratigraphy techniques (Mitchum and Vail, 1977; Mitchum et al., 1977a, 1977b; Vail et al., 1987; Duval et al., 1993) and the observations of recent studies (Glørstad-Clark et al., 2010, Catuneanu et al., 2011; Lenhart et al., 2019). The methodology can be summarized as follows: well-to-seismic calibration, Identification and description of seismic sequences (including sequence boundaries and main seismic facies) and correlation of seismic analysis results with the geological context of the study area based on previous studies.

**Examples (Optional)**

The well log and seismic analyses have conducted to a well section (Figure 1) showing the main boundaries identified on the study area. The main seismic sequences have been highlighted in deepwater domain and the correlation of all these results helped to the modelling of the Top Albian surface through the margin (Figure 2).

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**Figure 1** Spatial distribution of the Top Albian surface in south Sanaga area, using both seismic and wells data. A) NW-SE view; B) upset view. **A- General cross line section of the 23 wells:** the red color represents inner land, orange is continental shelf, yellow to green indicates bathymetry up to 200 km. **B- wells section showing the distribution of Aptian to Actual deposits from onshore to deep marne.**

1- Pliocene to Recent 2- Miocene to Recent 3- Miocene 4- Eocene 5- Paleocene- to Eocene 6- Paleocene 7- Maastrichtian 8- Campanian to Maastrichtian 9- Santonian to Campanian 10- Coniacian to Campanian 11- Coniacian 12- Turonian to Campanian 13- Cenomanian to Lower Campanian 14- Albion 15- Aptian to Albion 16- Aptian 17- Late Tertiary to Recent 18- Paleocene to Eocene 19- Upper Cretaceous 20- Middle Cretaceous.
**Figure 1** Spatial distribution of the Top Albian surface in south Sanaga area, using both seismic and wells data. A) NW-SE view; B) upset view.

**Conclusions**

CameroonSpan Seismic and well logs data analyses in this study have been used to determine that the Top Albian surface shows two characters. Erosive in proximal domain and concordant in deep marine. The presence of terrestrial and marine sediments within the Aptian-Albian stage in the shallow waters, implies a marine incursion before the late Albian epoch. This suggests that the Top Albian u/c resulted of a sea-level drop, related to margin uplift.

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**References**


