Paleoecology and biostratigraphy of the Paleocene and lower Eocene units in BB1/80, K1/65, D1/82 and A1a/84 wells; in the North-eastern part of Sirte Basin

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Abstract:

This study aims to investigate and evaluate the hydrocarbon potential of new prospects in the south eastern part of Concession 82 olso investigating the possibility of existence of a Paleocene reef growth in this area has been taken into consideration. In addition, to present and discuss the stratigraphic data obtained through paleontological and lithological analyses of the four wells samples that are located in the study area, and to correlate these data of these wells with the known surrounding units and to outline the paleoenvironmental evolution of the area. The recovery of an abundant and diverse palynomorphs assemblage

from the studied sections has allowed the determination of a high resolution palynomorphs biozonation for the Upper Cretaceous, Eocene and Paleocene interval. This has been related to both the chrono- and lithostratigraphy.

Fair electrical correlations between the wells D1/82 and A1a/84 allow us to extend the paleogeographic attributions of the first well to the second one. The lateral change of the stratigraphic facies, indicates the lateral variations of paleodepositional sedimentary environments which was dominated during the time of deposition of that units. The stratigraphic sequence, characterized by several sedimentary breaks and hiatuses are due to regression episodes and due to the location of the wells. A frequent presence of building skeletal organisms fragments especially in Paleocene and Eocene sediments is good evidence of existence possibility of reefs in or nearby the area of the study.

Keywords: S*tratigraphic facies, palynomorphs, Sirte Basin.*

I. Introduction

The study area lies in the SW Sirte Basin and is seated on Eni oil Company concession 82 (Figure 1). These wells were drilled as a stratigraphical test and assess the hydrocarbon potential of concession 82. In order to evaluate the hydrocarbon potential of new prospects in concession 82, the possibility of existence of a Paleocene reef growth has been taken into consideration.

Analysis of vertical fluctuations in assemblage diversity and relative abundances of microphytoplankton morphological classes permits palaeoenvironmental reconstructions of the Upper Cretaceous, Eocene and Paleocene interval strata sequences in the studied area.

The recovery of an abundant and diverse palynomorphs assemblage from the studied sections has allowed the determination of a high resolution palynomorphs biozonation for the Upper Cretaceous,

Eocene and Paleocene interval. This has been related to both the chrono - and lithostratigraphy.

For such purpose the sequence between the Upper Cretaceous and the Lower Eocene of four wells (BB1/80, K1/65, D1/82 and A1a/84 wells) located along an East-West line between the Sirte Basin and the Cyrenaica Plateform have been especially examined with reference to A1a/84 well only the portion of the Upper Cretaceous and one Paleocene bottom core have been examined. Fair electrical correlations between the wells D1/82 and A1a/84 allow us to extend the paleogeographic attributions of the first well to the second one.

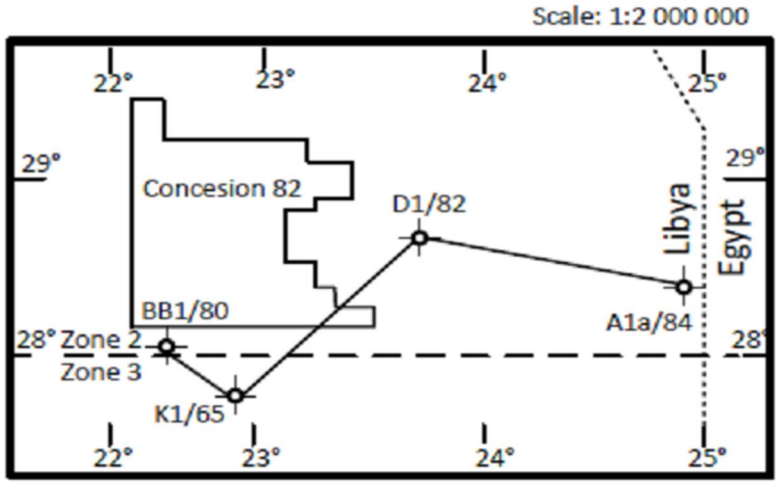

Figure 1. Location Map of the Study Area.

Explo. Division, Agip Oil Company, (1997). (unpublished report).

II. Method of Study

1. Samples were processed at PRC. Prepared slides representative of sample horizons were then studied every 30 feet. A Leitz Laborlux microscope was used.
2. Record sheets of each sample horizon were completed.

3. Results were fully integrated with studied wells biostratigraphy report referring palynofacies analysis to the recorded palynomorph assemblages.
4. Interpretation of palynofacies data and integration and interpretation of the Electrofacies using the Schlumberger book, Serra, (1989), as a guide was undertaken. From this a detailed high-resolution palaeoenvironmental breakdown of the studied wells were achieved.
5. Conclusion allow a relationship of environmental and facies development to be determined. From this an idea of hydrocarbon potential may be achieved.

III. Stratigraphy

The facies of the four wells belong respectively to Sirte region for BB1/80 and to the Cyrenaica region for the remaining wells even if in the BB1/80 and the K1/65 wells some portions of the sequence are locally differing from the typical sequences of both areas. **Barr, F. T. and Weegar, A. A. (1972).** From the standpoint of the formational attributions the same formation nomenclature of the previous Agip reports has been used in BB1/80 well; with reference to the remaining three wells, we tried where possible, to keep Agip's names previously used, considering, in the same time, the recent stratigraphical nomenclature, now used by Egyptian Authors (Figure 2). In order to avoid confusions the formation nemonclature, now used in Egypt for the western desert (Figure 3), the ones used in this report and the ones previously used in Agip reports have been reported and correlated in plate1, EGPC, (1992). Till few years ago, the Western Desert Basin formations were generally deemed to have everywhere the same age. Recent studies on the contrary showed that in deferent areas the same formation can have deferent age. The " Esna shale" formation, for instance, was previously only of Paleocene age, but recently it has been proved to be, in the same areas, comprehensive of Lower Eocene.

G. Mazzola (1976).

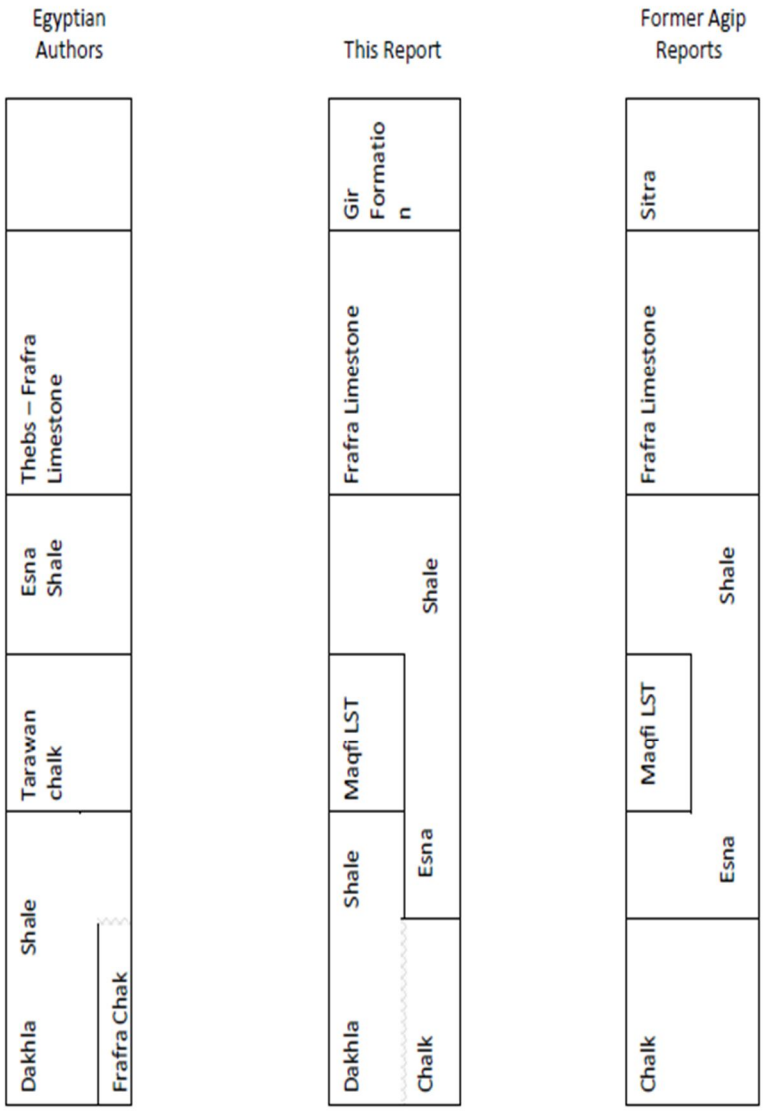

Figure 2. Nomenclature of Libyan Formation from Upper Cretaceous to Lower Eocene in Cyrenaica.

After Eni Exploration Staff (2003-2004). (unpublished reports).

In Figure 3, the Western Desert Basin Formations and their choronological variations have been reported.

II.1) BB1/80 well

a Formation

6500' (beginning of study) – 6878' : Gir Formation
6878' -8315' : Kheir Formation
8315' – 8950' Heira: Formation
8915' – 9000' (end of study) : Kalash Limestone

b Age

6500' -7158' : Lower Eocene
7158' – 8300' : Upper Paleocene
8300' – 8882' : Middle Paleocene
8882' – 8915' : Lower Paleocene
Unconformity
8915' – 9000' : Maastrichtian

c Microfaunal Assemblages

6500' – 6860' : Unzonable
6860' – 7050' : Alveolina elongata zone
7050' – 7158' : Alveolina & Operculina zone
7158' – 7350' : Alveolina primaeva zone
7350' – 8300' : Globorotalia velascoensis zone
8300' – 8790' : Globorotalia angulata zone
8950' – 8882' : Globorotalia uncinata zone
8882' – 8915' : Globorotalia trinidadensis zone
Unconformity
8915' – 9000' : Globorotalia stuarti zone
7350' – 8300' : Globorotalia velascoensis zone
8300' – 8790' : Globorotalia angulata zone
8950' – 8882' : Globorotalia uncinata zone
8882' – 8915' : Globorotalia trinidadensis zone
Unconformity

8915' – 9000' : Globorotalia stuarti zone

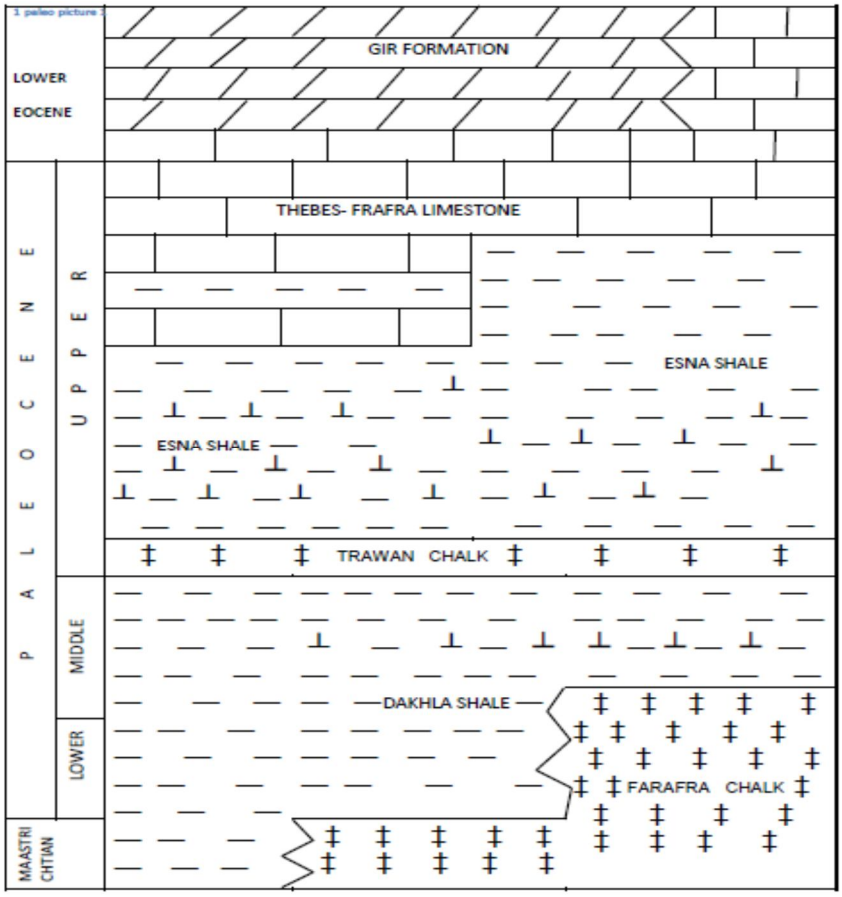

Figure 1. Different facie and ages of south-westrn Egypt formations from Upper Cretaceous to Lower Eocene

Figure 3. Different facies and ages of south-westrn Egypt formations from Upper Cretaceous to Lower Eocene. After ***K. Tawengi, Agip Oil Company, (1997).***

II.2) K1/65 Well

a Formations

6000' (beginning of study) – 6260' : Gir Formation

6260' – 7282' : Frafara limestone

7282' – 7807' : Esna shale
7807' – 7920' : Maqfi limestone member
7920' – 8300' : (end of study) : Dakhla shale

b Age

6000 – 7282' : Lower Eocene
7282' – 7807' : Upper Paleocene
7807' – 8070' : Middle Paleocene
8070' – 8120' : Lower Paleocene
8120' – 8300' : Maastrichtian

c Microfaunal Assemlages

6000' – 6260' : Unzonable
6260' – 6650' : Alveolina elongata zone
6650' – 7040' : Alveolina & Operculina zone
7040' – 7282' : Globorotalia rex & globorotalia Formosa zone
7282' – 7807' : Globorotalia velascoensis zone
7807' – 8020' : Globorotalia angulata zone
8020' – 8070' : globorotalia uncinata zone
8070' – 8120' : Globorotalia trinidadensis zone
8120' – 8300' : Undefined

II.3) D1/82 Well

a Formations

4500' – 4560' : (beginning of study) : Gir Formation
4560' – 5560' : Farafra limestone
5560' – 5627' : Esna shale
5627' – 5732' : Maqri limestone member
5732' – 5800' : (end of study) : "Chalk"

b Age

4500' – 5089' : Lower Eocene
5089' – 5500' : Upper Paleocene
5500' – 5737' : Middle Paleocene
Unconformity
5737' – 5800' : Maastrichtian

c Microfaunal Assemblages

4500' – 4560' : Undefined
4560' – 4790' : Alveolina elongata zone
4790' – 5089' : Alveolina & Operculina Zone
5089' – 5500' : Globorotalia velascoensis zone
5500' – 5680' : Globorotalia angulata zone
5680' – 5737' : Globorotalia uncinata zone
Unconformity
5737' – 5800' : Globorotalia stuarti zone

II.4) A1a/84 Well

Up to 2513' depth only paleocenic bottom core from 2465' to 2470' is available. From 2513' to 2550' (end of the studied interval), the "Chalk" formation of Maastrichtian (Globorotalia stuarti zone) has been drilled.

III) Paleoenvironment interpretation

III.1) Maastrichtian

This stage is represented by "Kalash limestone" (BB1/80), "Chalk" (D1/82 and A1a/84) and " Dakhla shale" formation (K1/65). The "Kalash limestone" and the "Chalk" formations are similar in lithology, generally chalky limestones, and their depositional environment is of deep platform. Also the "Dakhla shale" formation generally shows a deep platform environment and only in late Maastrichtian and early Paleocene

it has been involved in restricted shallow platform episode, in connection with the regression of the end of cretaceous (Figure 4 and Figure 5).

In the other examined wells this regression is well marked by a more or less wide stratigraphic gap, whereas in the K1/65 well the sedimentation did not have any break but only a decrease in the basin depth.

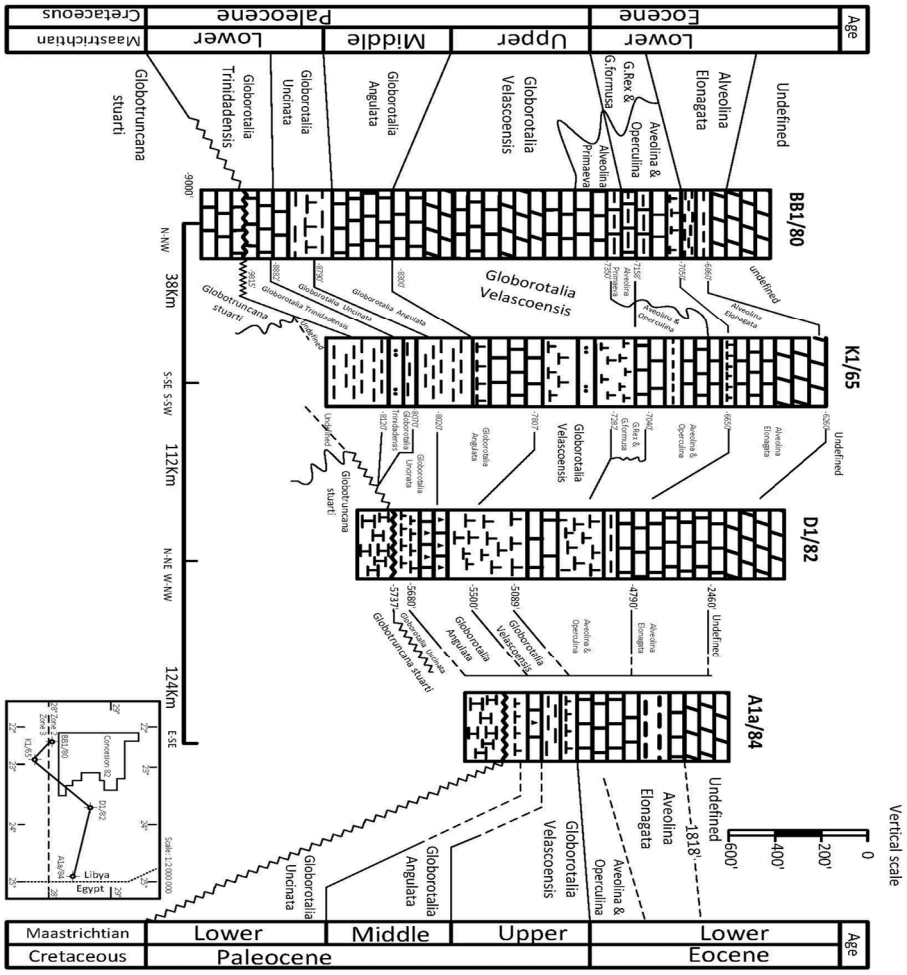

Figure 4. Chronological subdivisions and Biozones in Paleocene and Lower Eocene, intervals of, BB1/80, K1/65, D1/82, A1a/84 wells.

II.2) Paleocene

The Paleocene is represented by the following formations:

- "Heira" (BB1/80)
- " Kheir" formation" pro parte (BB1/80)
- "Dakhla shale" pro parte (K1/65)
- "Esna shale" (K1/65, D1/82 , A1a/84)

Maqfi limestone member is also present in K1/65, D1/82 and A1a/84 wells.

Immediately after the paleocenic transgression in the involved areas a deep platform environment took place evidenced by limestone's and marls with planktonic Foraminifera of the lowermost Paleocene. Later the two basins, the Sirte Basin and the Western Desert Basin, had different environments of sedimentation. In the BB1/80, in fact, the deep platform marls underlie the platform limestone's having talus sediments interbedded. Open shallow platform limestone's and then prevailing limestone's with interbedded dolomite and shale of restricted shallow platform complete the paleocenic sedimentary cycle. In Cyrenaica platform area, on the contrary, during the whole Paleocene deep platform environment took place with the occurrence of some talus episodes in upper part of Paleocene only in the wells near the Western border (K1/65, D1/82).

III.3) Lower Eocene

The Lower Eocene is represented by the upper part of the "Kheir Formation" (BB1/80), by the "Farafra limestone" (K1/65, D1/82, A1a/84) and the "Gir formation" (BB1/80, K`/65, D1/82, a1a/84). In the BB1/80 well Eocene is present with limestone and marl of restricted shallow platform, with tidal flat episodes, followed by evaporites sediments, dolomite and evaporate of tidal flat. In the remaining three wells of Cyrenaica Platform the regression has been more gradual and becomes more and more recent Eastward. So in K1/65 well the "Farafra limestone" formation is from the bottom to the top, of open shallow platform, then of restricted shallow platform environment with elements of tidal flat complex; D1/82 well the open shallow platform sediments are followed

only by the restricted shallow platform ones. In A1a/84 the basal portion of the "Farafra limestone" formation is still of deep platform with talus episodes followed by open shallow platform and restricted shallow platform environment.The Lower Eocene in the three wells ends with the evaporitic episode of the "Gir Formation".

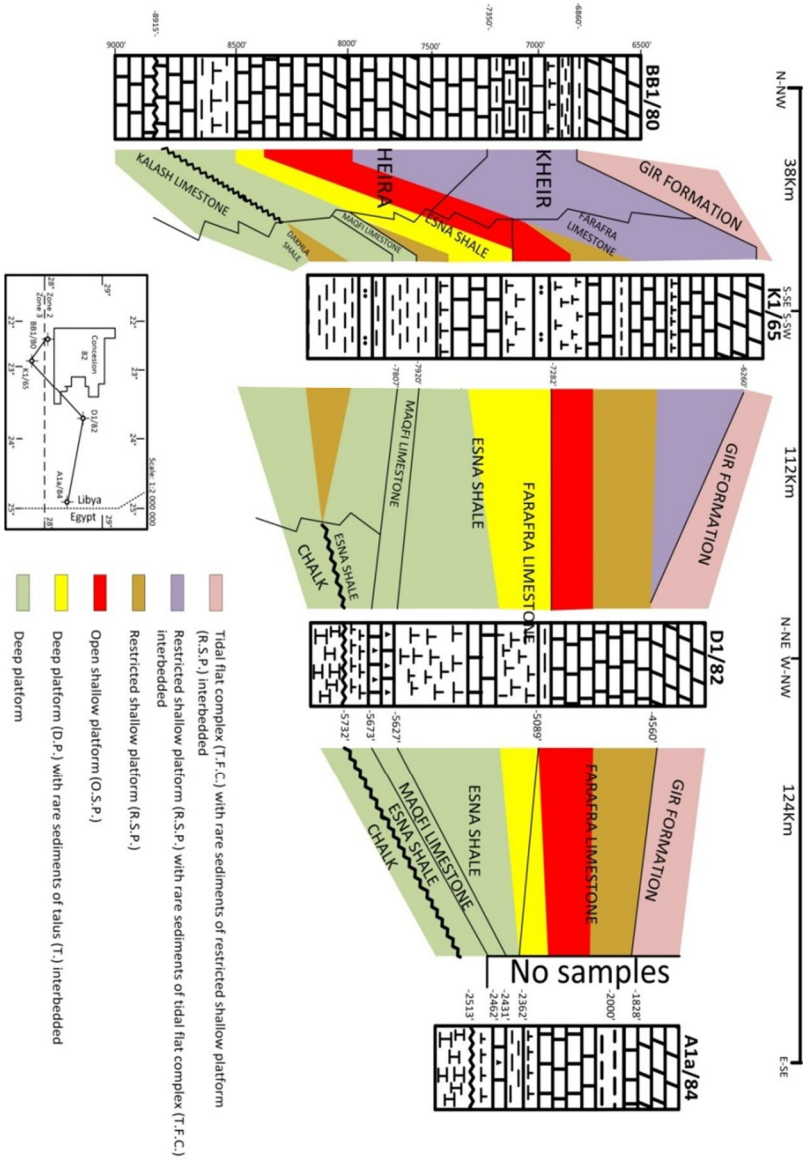

Figure 5. Paleoenvironmental correlation of the studied wells. (This study).

IV) conclusions

On the basis of the stratigraphic study the following has been observed:

a) A frequent presence of building skeletal organisms fragments in some samples of the four involved wells.

b) Depositional environment east of the K1/65 well during Paleocene were favorable to a reefoidal deposition.

Such conclusion allows us to extend the studied area for the possibility of existing reefs in Eocene and Paleocene sediments, if more data is available.

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