The Late Cenomanian-Coniacian Gattar and Aleg reservoirs in Sidi Bouzid area, Central Tunisia: Logging, diagenesis and reservoir implications

Jalel Jaballah[1,2,*], Mohamed Hédi Negra[1]

1- Tunis El Manar University, Faculty of Sciences of Tunis, UR (Pétrologie sédimentaire et cristalline), Campus Universitaire, 2092, Manar II, Tunis, Tunisia.
2- King Fahd University of Petroleum and Minerals, College of Petroleum Engineering and Geosciences, Dhahran, Saudi Arabia.

* Corresponding Author: jalel.jaballah@fst.utm.tn

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Abstract

At the Sidi Bouzid area located in Central Tunisia, Cenomanian-Turonian reservoir rocks are well outcropping, especially in the Jebel el Kébar and Meloussi areas. The present work confirms that these carbonate intervals constitute the lateral equivalent of the Early-Middle Turonian Biréno and Late Turonian-Coniacian Douleb reservoir Members which are included within the pelagic marls of the Turonian-Early Campanian Aleg Formation. In addition to the Late Cenomanian-Early Turonian Gattar dolomites, the Biréno and Douleb fractured carbonates constitute, in this area, good reservoirs and thus potential targets in subsurface since they produce oil to the East in Sfax area or in the Gulf of Gabès. Detailed sedimentological, petrographic and petrophysical studies carried out from several sections surveyed at Jebel el Kébar and Jebel Meloussi have focused on the vertical stacking of the carbonate series, thickness, geometry, composition and pore types within the main Cenomanian-Turonian reservoir layers. However, at a North-South transect, these reservoir layers are characterized by frequent and rapid changes in facies and thickness from Jebel el Kébar to Jebel Meloussi and within the Jebel el Kébar itself. These lateral changes appear in close relation with the particular paleogeographic setting which could be governed by several processes such as sea level changes and, especially, contemporaneous tectonic activities. The latter have strongly influenced the reservoir thickness and properties. Furthermore, this study focuses on the origin of fluids controlling the main diagenetic processes (e.g., dolomitization and dissolution) and on the pore type, volume and their interconnection. These latter could be a part of the reservoir aspect characterization. Moreover, attention will also be paid to the spatio-temporal distribution of the Cenomanian-Turonian carbonate Members which would be served as an analog for reservoirs in the Sidi Bouzid area (Central Tunisia) and elsewhere (e.g., African Tethyan margin, North America, and Middle East).

Keywords: Cenomanian-Turonian series, Diagenetic processes, Pore system, Reservoir characterization, Central Tunisia.

1- Introduction

In the Sidi Bouzid area, Cenomanian-Turonian carbonate reservoir bodies have been studied along a North-South transect starting from Jebel el Kébar to Jebel Meloussi (Masse and Philip., 1981; Philip and Floquet., 2000; Jaballah and Negra., 2016; Negra *et al*., 2016; Jaballah., 2017). Toward the East, these carbonates correspond to proven oil and/or gas reservoirs exploited in different onshore and offshore fields (e.g., Guebiba, Gremda and Ashtart oil fields; Chaabouni and Bouaziz., 1995; M'Rabet *et al*., 1996; Saidi *et al*., 1997; Gordon *et al*., 2008). Based on sedimentological, petrographic, biostratigraphic and petrophysical analyses, the Late Cenomanian-Coniacian Members show spectacular changes in facies compositions, thickness, geometry and pore system, especially, within the Gattar and Biréno reservoir Members. In fact, all these changes seem to be closely related to the influences of several processes such as contemporaneous tectonic movements associated to sea level changes.

In terms of reservoir analysis, porogenesis processes (fracturing, dissolution and especially dolomitization), which have preferentially affected the Late Cenomanian-Early Turonian Gattar and the Early-Middle Turonian Biréno carbonates of the Jebel el Kébar section, have provoked the development of different types of pores and have clearly improved their reservoir characters. However, in the Khanguet Zebbag section at Jebel Meloussi, poronecrosis processes, mainly materialized by dolomitization, have destroyed all pore type of the Cenomanian-Coniacian carbonate series. It appears that certain diagenetic processes such as dolomitization could improve the reservoir potential but, also destroy it in certain conditions.

The aims of this study will be to highlight the vertical and lateral changes affecting the Cenomanian-Coniacian reservoir Members in the Sidi Bouzid area and also to focus on the main processes controlling the distribution of their pore types.

2- Geographic and geological setting

In Central Tunisia, at the Sidi Bouzid area, the Cenomanian-Coniacian carbonate series are well expressed in Jebel el Kébar and Jebel Meloussi (Fig. 1).

The Jebel el Kébar is a faulted NE-SW asymmetric anticline in Central Tunisia, located about 7 Km to the South of the Sidi Bouzid city. The Cenomanian-Coniacian carbonate facies, outcrop well especially on three main sections (the Oued el Khecha; OKh, Oued el Dakhla; OD and North flank; FNK sections; Fig. 2), surveyed in the South Western part of Jebel el Kébar whose core is occupied in this area by Mid-Cretaceous carbonates (Khessibi., 1978).

More to the South, the Khanguet Zebbag section is located in the Northern flank of Jebel Meloussi, about 18 Km South of the Jebel el Kébar anticline (Fig. 1). Late Jurassic marls and limestone conformably overlain by Early Cretaceous siliciclastics (M'Rabet, 1981) occupy the core of this asymmetric anticline.

Concerning the lithostratigraphic staking, Late Cretaceous series in Central-Southern Tunisia, show, from base to top, the following succession (Fig. 3):

- The Cenomanian-Early Turonian Zebbag Formation: subdivided into 5 members (Zebbag A, Zebbag B, Zebbag C, Zebbag D and Gattar Members; Khessibi., 1978; M'Rabet., 1981; Razgallah *et al*., 1994). The Zebbag D Member is mainly constituted by the alternation of marls and bioclastic carbonates including stromatolites, bivalves and echinoderms. Immediately above, the Gattar Member shows rudist-rich dolomitic limestones.

- The Early Turonian Annaba Member: formed of thick pelagic marl deposits with rare intercalations of argillaceous limestone thin beds (Khessibi., 1978; M'Rabet., 1981; Gargouri-Razgallah., 1983; Razgallah *et al*., 1994; Jaballah and Negra., 2016; Jaballah., 2017).

- The Early-Middle Turonian Biréno carbonates: composed of two carbonate units (Biréno 1 and Biréno 3), separated by the Biréno 2 marly Unit (Zagrarni., 1999; Negra *et al*., 2002; Zagrarni *et* *al*., 2003; Negra and Zagrarni., 2007; Jaballah and Negra., 2016; Jaballah., 2017).

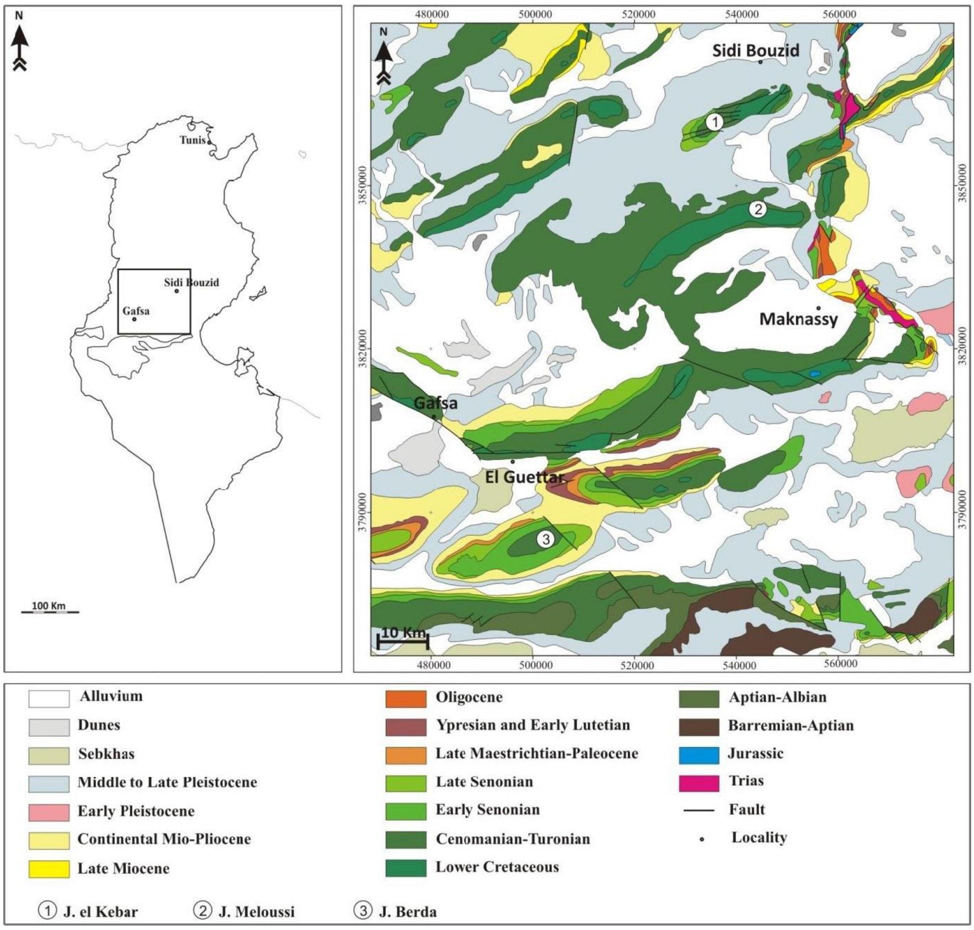

Figure 1) Geological map of Central-Southern Tunisia (modified from Ben Haj Ali et al., 1985).

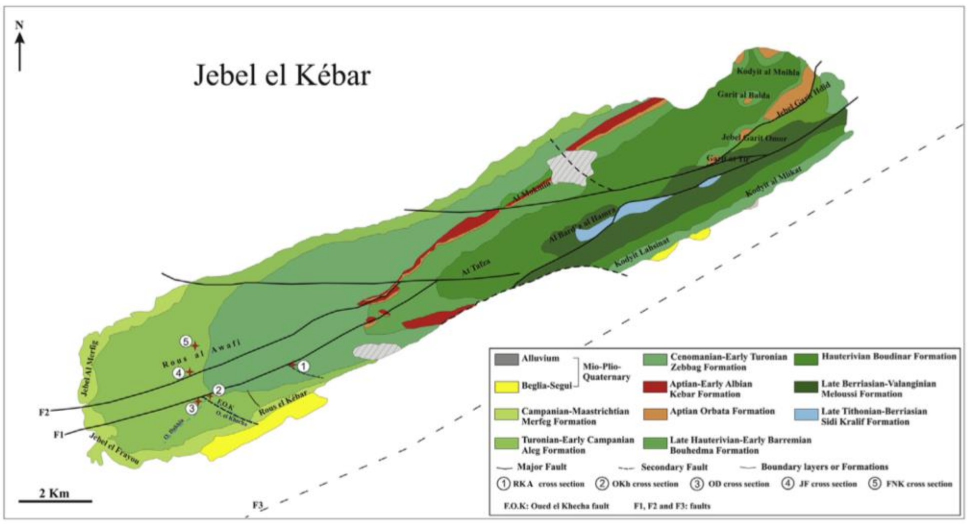

Figure 2) Geological map of Jebel el Kébar showing the studied cross sections: The Rous el Kébar; RKA, Oued el Khecha; OKh, Oued el Dakhla; OD, Jebel el Frayou; JF and North flank; FNK sections (Ouali et al., 1986; Jaballah and Negra., 2016).

- The Late Turonian-Coniacian Douleb Member: formed of bioclastic carbonate layers (Jomaa-Salmouna *et al*., 2014; Jaballah and Negra., 2016; Jaballah., 2017). The latter covers the Late Turonian lower Aleg Marls.

- The Coniacian-Early Campanian upper Aleg Member, consists of pelagic marls interbedded with limestones containing scarce, well preserved inoceramids and echinoderms (Jaballah and Negra., 2016; Jaballah., 2017).

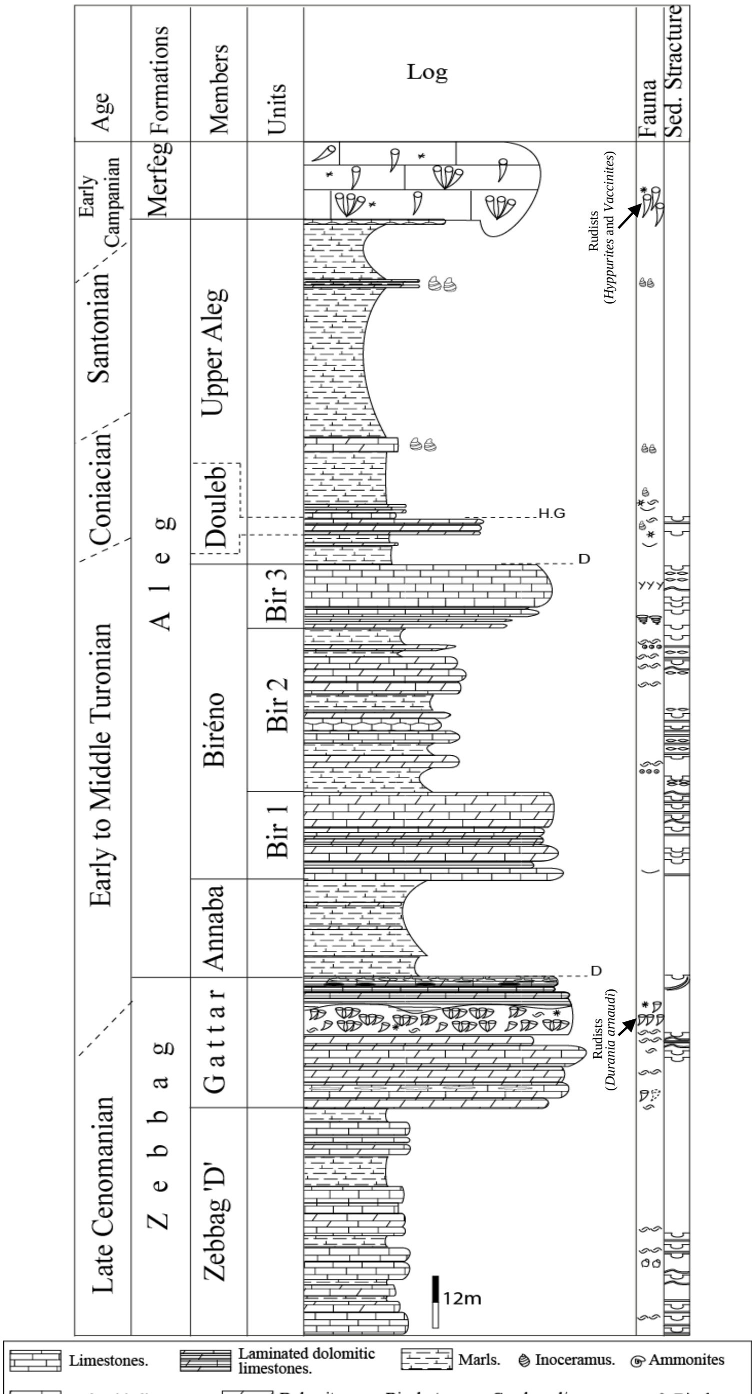

Figure 3) Synthetic lithostratigraphical log of the Late Cretaceous series in Central-Southern Tunisia (Jaballah., 2017).

3- Materials and methods

Advanced sedimentological field investigation was conducted along the Cenomanian-Coniacian carbonate series of the Jebel el Kébar and Jebel Meloussi sections. About 400 thin sections have been prepared to determine the microfacies compositions and their characteristics and to study the pore system in order to identify the main pore types, volume and their interconnection mode. For the finest facies, a high-resolution SEM (High resolution field emission scanning electron microscope) with magnifications of 1:10.000 and 1:20.000 were used for the identification of pore types.

On the other hand, clay and marl samples were washed through sieves of 200, 355 and 800µm then oven dried at a temperature less than 50°C. The obtained residues were used to identify planktonic foraminifera specimens and other associated species (determination realized for the present work by H. Bismuth). The biostratigraphic study was realized to provide a precise age for the studied reservoirs and also to collect data concerning their depositional environment setting.

Concerning petrophysical analysis, we have performed porosity measurements (realized in the "CRDP", ETAP) to characterize, in part, the reservoir potential. We used helium porosimeter which applies Boyle's law to determine the solid volume of the plug samples. Helium, as a rare and light gas, has the ability to easily penetrate and saturate the sample pores and thus measuring the total porosity of the carbonate rock.

4- Results

4.1- Lithostratigraphy characteristics of the Late Cenomanian-Coniacian reservoir Members

In the Southern Tethyan Margin, the distribution of the Cenomanian-Coniacian reservoir layers was mainly controlled by different global events such as the Late Cenomanian transgressive event, the Cenomanian-Turonian anoxic event (OAE2) and the Aptian-Turonian extension regime (NE-SW trend; Abdallah and Meister., 1996; Guiraud., 1998; Abdallah., 2002; Caron *et al*., 2006; Zagrarni *et al*., 2008).

In fact, the Late Cenomanian transgressive event is well expressed in Central Tunisia by the deposition of shallow marine rudist-rich carbonates known as the Gattar carbonate platform (Burollet., 1956; Khessibi., 1978; Gargouri-Razgallah., 1983; Razgallah *et al*., 1994; M'Rabet *et al*., 1995; Philip and Floquet., 2000).

In the Sidi Bouzid area, especially at the Jebel el Kébar section, the Late Cenomanian-Early Turonian Gattar reservoir Member consists of carbonates exhibiting three major units; from base to the top, we distinguish:

- The first unit (G1): Well bedded carbonates showing relatively rich bivalve assemblages (graded bioclastic packstone-grainstone constituted almost exclusively by rudist debris). The latter are organized into shallowing-upward sequences separated by discontinuities illustrating well contrasted granulometric changes.

- The second unit (G2): Lensoid cores, which are as much as about 30 m thick and may extend laterally for many hundred meters. These massively bedded lensoid lithosomes (Skelton and Gili., 1991; Negra *et al*., 2002; Jaballah and Negra., 2016) show abundant fossils mostly dominated by joined, position-life entire-rudists, represented by *Durania arnaudi* (Razgallah *et al*., 1994). These latter are dissolved, in part, and shows moldic to vuggy porosity well expressed in the field.

- The third unit (G3): Well thin bedded and laminated dolomites, abruptly onlapping the convexed top of the G2 Unit. The third unit represents the principal outcropping series of the Gattar reservoir Member in the Rous el Kébar area. These latter are usually showing frequent fracture and enlarged moldic pores.

During the Early to Middle Turonian time, Central Tunisia was marked by the development of a shallowing-up trend resulted in rudist-rich platform carbonates and deposition of the Early-Middle Turonian Biréno reservoir Member (Zagrarni., 1999; Zagrarni *et al*., 2003; Negra and Zagrarni., 2007). In fact, at the Jebel el Kébar section, especially at its SW part, the Early-Middle Turonian Biréno Member is organized into two bioclastic limestone units including planktonic foraminifera (*Praehelvetoglobotruncana helvetica*, *Whiteinella paradubia*; Jaballah and Negra.,

2016) and separated by marly-slighly dolomitized limestone intercalations rich in stromatolites, bivalves and echinoderms.

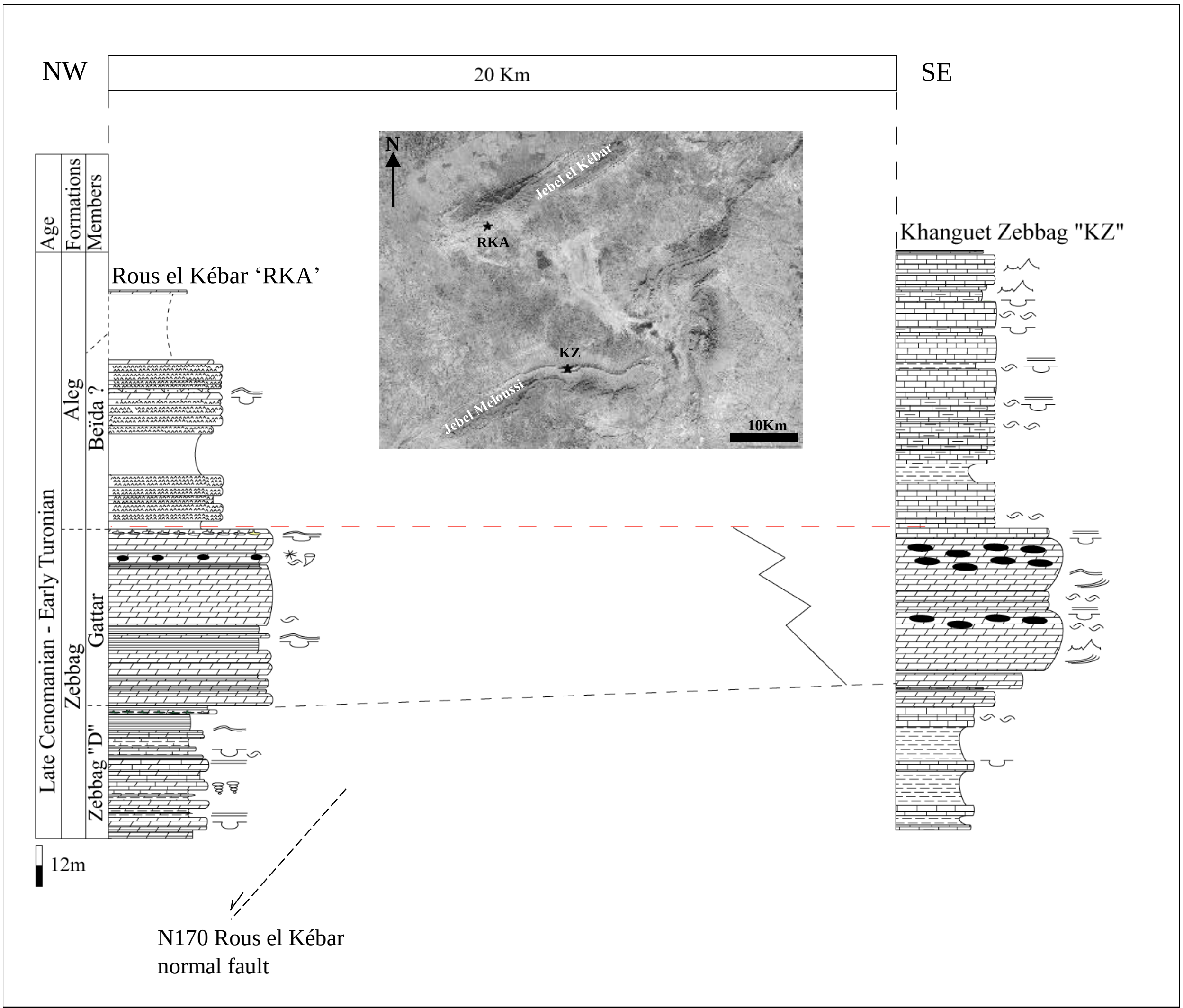

Figure 4) NW-SE correlation of Late Cenomanian-Early Turonian Gattar reservoir Member from Jebel el Kébar (the Rous el Kébar section) to Jebel Meloussi (the Khanguet Zebbag section).

More to the South, at the Khanguet Zebbag cross section of Jebel Meloussi, the Biréno Member shows an obvious increase in thickness associated to an abrupt lateral facies variations expressed by well laminated dolomites including scarce rudist debris (Fig. 5).

During the Late Turonian-Coniacian interval, Central Tunisia was characterized by the development of the Douleb carbonate Member. The latter is formed of dolomitized limestone beds containing large inoceramid debris, echinoderms, glauconite and phosphatic grains and including marly intercalations rich in *Frondicularia* sp., *Marginotruncana sigali*, *Marginotruncana marginata*, *Contusotruncana fornicata* and *Brachycythere dumoni*. This member is comparable in term of facies and thickness along the South-Western periclinal ending of Jebel el Kébar. However, at the Jebel Meloussi section, the massive Douleb Member which gets thicker comparatively to its equivalent at the Jebel el Kébar section, shows highly fractured and dolomitized limestones with a lower content in bioclastic debris.

Therefore, we note that these lateral variations, starting from Jebel el Kébar and reaching Jebel Meloussi, are directly related to the pre-existing palaeomorphology strongly influenced by contemporaneous tectonic movements and/or sea level fluctuations.

The NE-SW synsedimentary normal fault (Kadri *et al*., 2015), which bounds the Jebel el Kébar SW periclinal ending, has closely controlled the distribution of the rudist-rich facies during their deposition. The lateral changes of these facies, from Jebel el Kébar to Jebel Meloussi, are mainly expressed by an obvious thickening of the Early-Middle Turonian series, especially in the Khanguet Zebbag section (Jaballah and Negra., 2016).

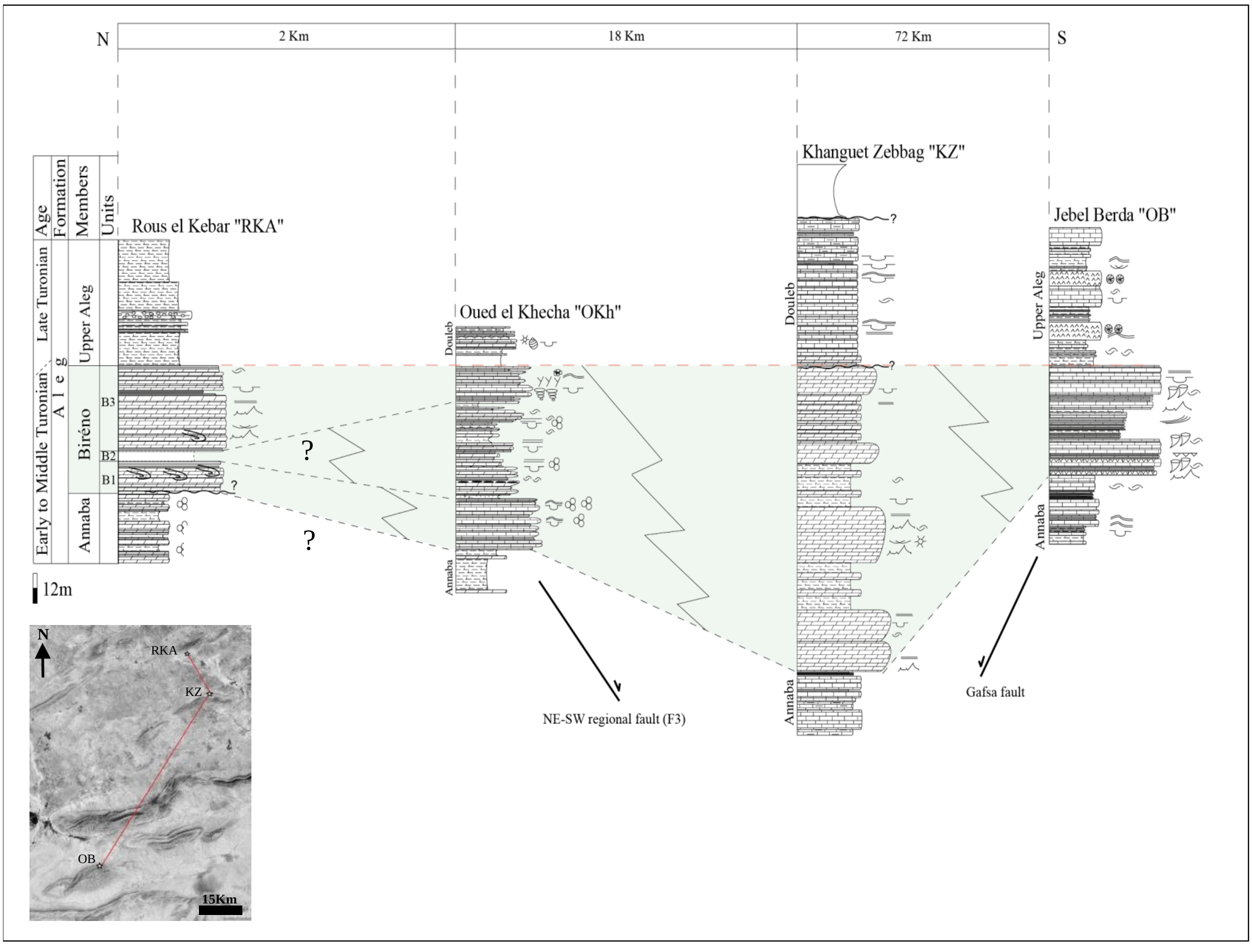

Figure 5) N-S Early-Middle Turonian Biréno reservoir layers' correlation in Jebel el Kébar-J. Meloussi-J. Orbata.

4.2- The pore system within the Cenomanian-Coniacian carbonate Members

The study of the pore type distribution and porosity values of the Late Cretaceous series has been performed by means of petrographic and petrophysical analyses. These analyses have especially concerned the Cenomanian-Coniacian carbonate reservoir Members well outcropping in Jebel el Kébar (the Rous el Kébar, RKA, Oued el Khecha, OKh and Jebel el Frayou, JF cross sections) and in the Khanguet Zebbag section, at Jebel Meloussi. In fact, according to the porosity values distribution, we can note that the highest measured values range from 13.5 to 30% (Figs. 6 and 7). They are mainly observed at the Gattar carbonate layers of the Oued el Khecha section, at the lower part of the Biréno carbonates in Rous el Kébar and Oued el Khecha sections, and at Jebel el Frayou within the Douleb carbonate Member.

The petrographical study of these porous carbonates shows an obvious porosity materialized by the development of several pore types mainly represented by vuggy, moldic, intergranular and intercrystalline pores (Fig. 8). In fact, this pore system is directly influenced by several porogenesis processes, such as dissolution and, especially, dolomitization, which enhance the pore space development (Figs. 9 and 10). In the Oued el Khecha section, dolomitization converts the tight mud-supported limestones of the Early-Middle Turonian Biréno layers to porous units because of the larger crystals and intercrystalline pore space (Purser *et al.*, 2009). In contrast, at the Khanguet Zebbag cross section, low porosity values, ranging from 2,5 to 6,5%, were noted within the wholly dolomitized series of the Gattar and Biréno Members (Fig. 6). In these carbonates, the dolomitization has filled and destroyed all types of pores (poronecrosis process; Fig. 9, photo A).

5- Interpretation

5.1- Lateral changes of the Cenomanian-Coniacian reservoir Members in the Sidi Bouzid area

Cenomanian-Coniacian reservoir Members studied in Sidi Bouzid area, along a North-South transect, starting from Jebel el Kébar and reaching Jebel Meloussi, show frequent and rapid changes in term of thickness, geometry, facies composition and pore types. These variations are controlled by several processes such as contemporaneous tectonic movements associated to sea level changes.

		Porosity values and pore type			
		Jebel el Kébar			Jebel Meloussi
		Jebel el Frayou **'JF'**	Oued el Khecha **'OKh'**	Rous el Kébar **'RKA'**	Khanguet Zebbag **'KZ'**
Douleb		JF23⟶ 16.5 - Intercrystal (+++) - Intergranular (++)	OKh189⟶ 9 - Intercrystal (++) - Fractures (+) - Intergranular (+)		
Biréno	**Bir3**	JF12⟶ 4 - Fractures (+) - Intercrystal (+) JF6 ⟶ 4.5 - Intercrystal (+)	OKh180⟶ 6.7 - Intercrystal (++) - Fractures (+) OKh160⟶ 30.1 - Vuggy (+++) - Intercrystal (+++)	RKA279⟶ 3.4 - Intercrystal (+) RKA264 ⟶ 15.2 - Fractures (+) - Vuggy (+++) - Intercrystal (+++)	
	Bir2				KZ129⟶ 2.4 - Intercrystal (+)
	Bir1		OKh118⟶ 12 - Vuggy (+) - Intergranular (+++) - Intercrystal (+) OKh75 ⟶ 5.4 - Intercrystal (+)	RKA245 ⟶ 10 - Vuggy (++) - Intercrystal (+)	
Gattar			OKhG2⟶ 13.5 - Fractures (++) - Vuggy (+++) - Intergranular (+) - Intercrystal (+++)		KZ102⟶16.5 - Vuggy (++) - Intercrystal (+)

Rare (+), Frequent (++), Very frequent (+++)

Figure 6) Porosity values and pore type distribution of the Cenomanian-Coniacian carbonate Members, Sidi Bouzid area.

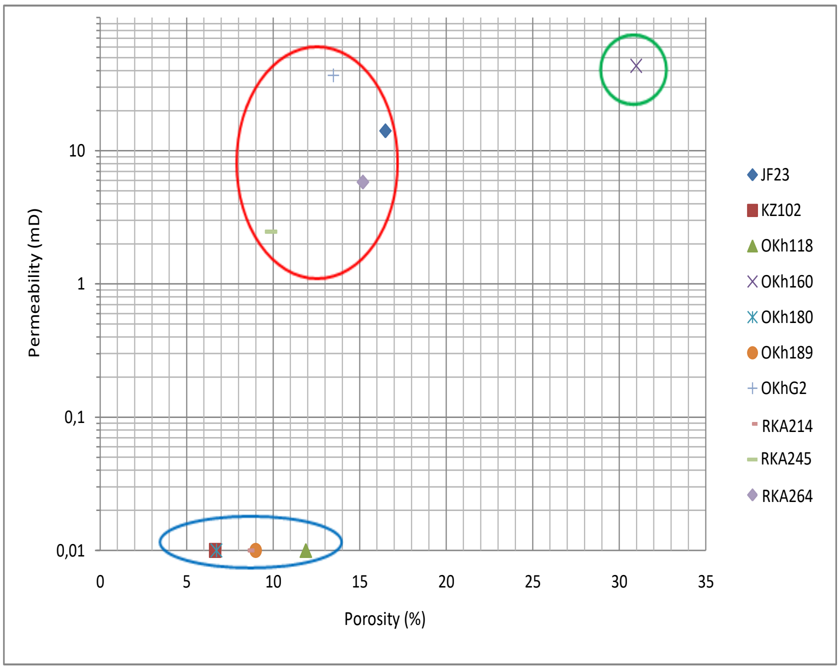

Figure 7) Porosity-permeability relationship of the Late Cretaceous carbonates, Sidi Bouzid area.

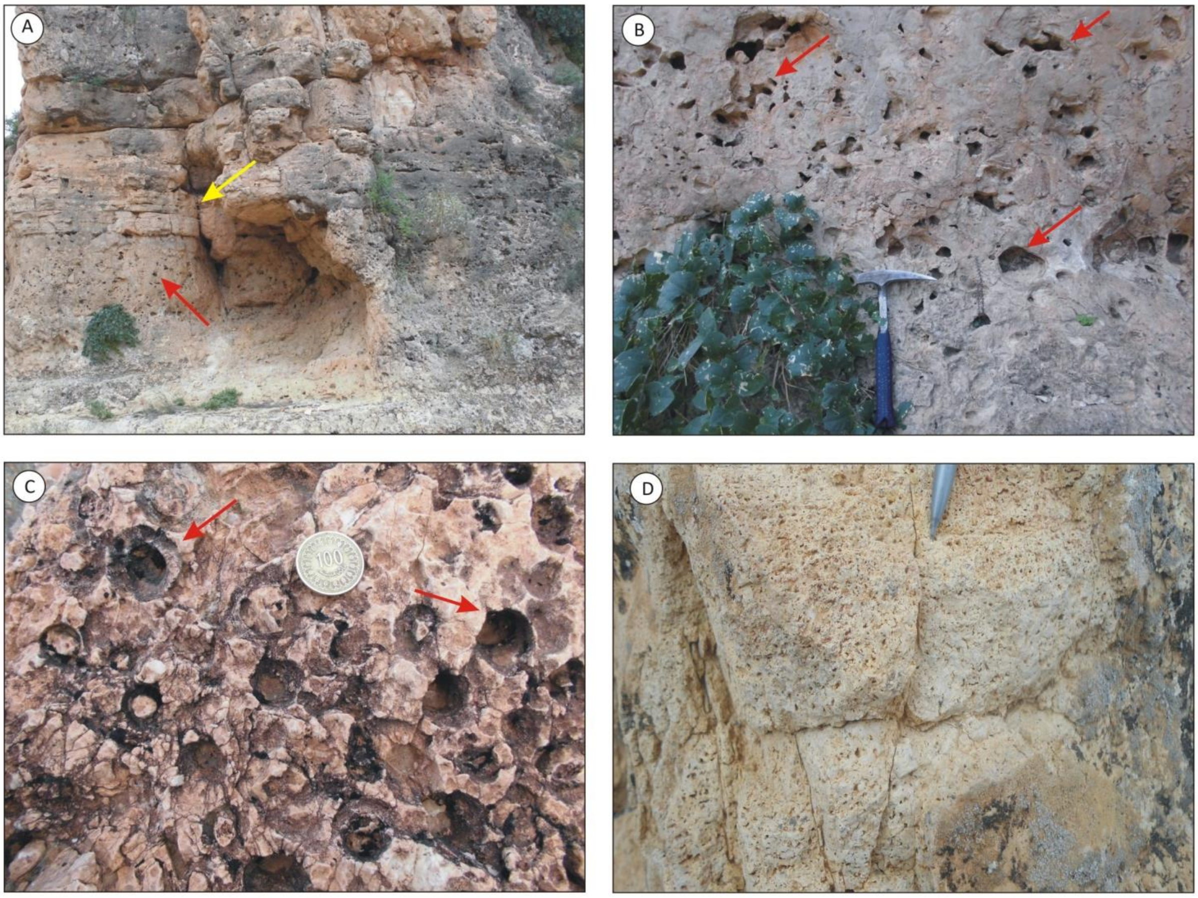

Figure 8) Field view of some particular pore types of the Jebel el Kébar Cenomanian-Coniacian reservoir carbonates. (A) Vuggy porosity (red arrow) and fracture porosity (yellow arrow) within the Gattar Member. The Oued el Khecha section. (B) Detailed view vuggy porosity (red arrows) within the Late Cenomanian-Early Turonian rudist-rich Gattar Member (Oued el Khecha section). (C) High-porosity within transverse rudist shell sections (Gattar Member, Rous el Kébar section; RKA). (D) Close view moldic porosity, lower part Biréno Member (Bir1 Unit) (Oued el Khecha section).

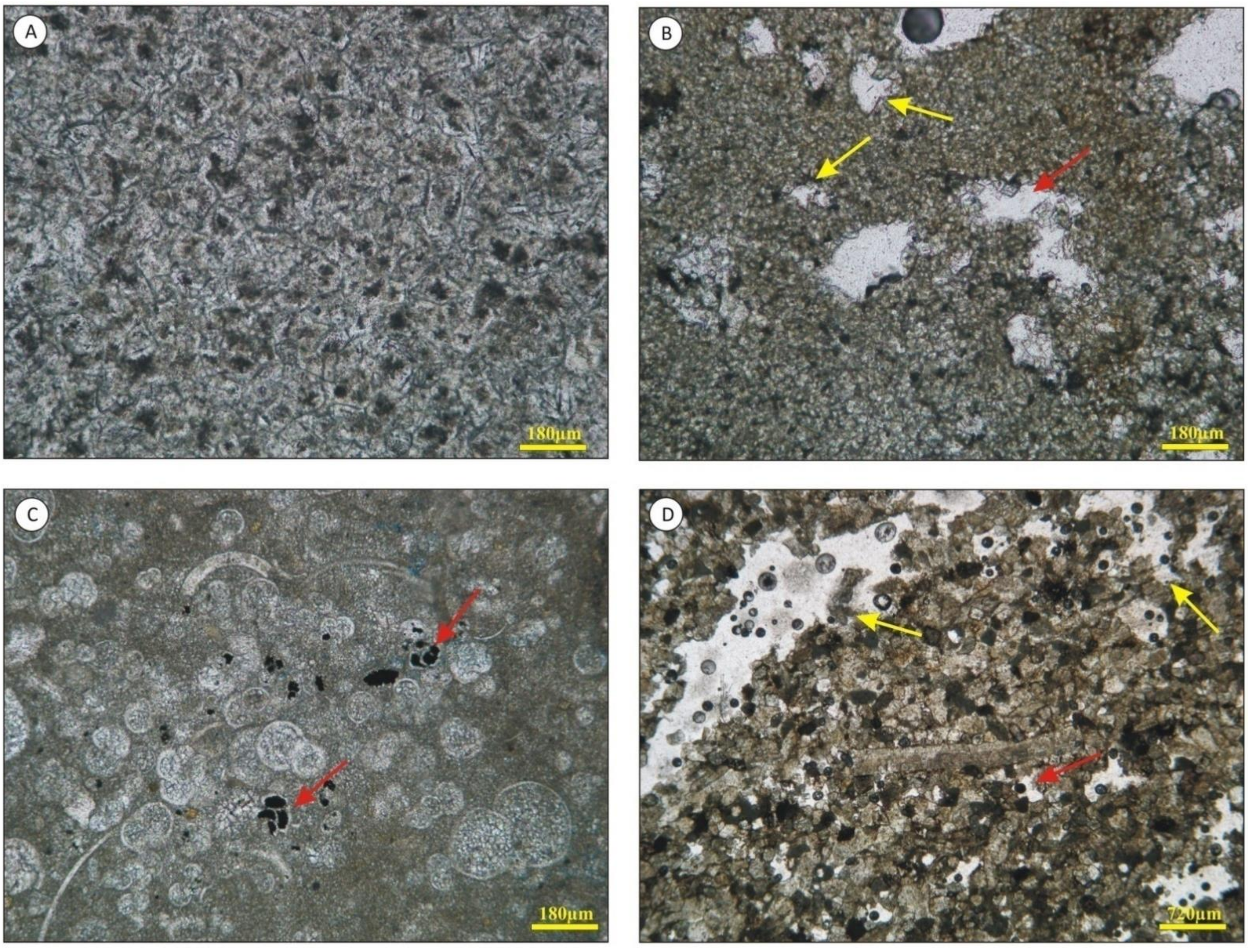

*Figure 9) Cenomanian-Coniacian micropore system, Sidi Bouzid area. (A) Totally dolomitized microfacies of the Gattar Member showing dolomicrosparite cement (Khanguet Zebbag section, NL, G*10*4). (B) Dolomicrosparites including intracrystalline porosity (yellow arrows) and partly connected intracrystalline pore spaces (red arrow). Middle part Gattar Member, Rous el Kébar section (NL, G*10*4). (C) Moldic porosity (red arrows) infilled by organic matter. Upper part Biréno1 Unit, Oued el Khecha section (PL, G*10*4). (D) Photomicrograph showing intracrystalline porosity (red arrow) and connected vuggy porosity (yellow arrows). Douleb Member, Jebel el Frayyou section (NL, G*2,5*4).*

In fact, at a local scale, at the South-Western flank of Jebel el Kébar, frequent normal faults mainly oriented E-W and NE-SW are obvious. In addition, at a regional scale, a major synsedimentary normal fault (F3; Figs: 2, 5), with NE-SW trend, is bordering the Jebel el Kébar anticline at its Southern part (Kadri *et al*., 2015). This major fault, which has been reactivated during an extensional Turonian tectonic regime, has compartmentalized the Sidi Bouzid area into two main tilted blocks: the Jebel el Kébar and Jebel Meloussi blocks (Jaballah and Negra., 2016).

5.2- North-South correlation of the Late Cenomanian-Early Turonian Gattar reservoir Member from Jebel el Kébar to Jebel Meloussi

In the Rous el Kébar section, “RKA”, the Gattar Member is represented by rudist-rich carbonate facies which are partially dolomitized. This Member shows a well-developed moldic porosity (within rudist shells; Fig. 8, photo C), associated to common fracture and vuggy porosity. Using petrographic and scanning electron microscopes, we have noted that the porogenesis processes, such as dolomitization, have allowed to the development of a very common intercrystalline porosity (Fig. 9, photo B; Fig. 10). Laterally, to the Oued el Khecha section, the Late Cenomanian-Early Turonian facies get thinner. They are expressed by partly to wholly dolomitized rudist-rich limestones. Within these carbonates, the porosity is obviously more frequent. It is mainly represented by very frequent enlarged and locally connected moldic pores (Fig. 8, photos A, B) associated to frequent partly open fractures. In the Khanguet Zebbag section, at Jebel Meloussi, the Late Cenomanian-Early Turonian Gattar reservoir Member gets thinner comparing to the same at the Rous el Kébar section of Jebel el Kébar (Fig. 4). This highly dolomitized limestone member shows floating rudist-debris associated to abundant flint nodules. In term of pore system, poronecrosis processes have destroyed all pore spaces (Fig. 9, photos A).

5.3- North-South Early Turonian to Coniacian Biréno and Douleb reservoir layers' correlation from Jebel el Kébar to Jebel Meloussi

In the Rous el Kébar section, the upper part of the Biréno Member shows good values of porosity, measured in bioclastic, partially dolomitized limestones (Figs. 6, 7). The well-bedded pelagic limestone layers of this Member show good petrophysical properties (30% of measured porosity) associated to a very common moldic and interparticular porosity (Figs. 6, 7). At the Jebel el Frayou section, the Early-Middle Turonian Biréno reservoir Member is mainly represented by its upper part (the Biréno 3 Unit) which corresponds to a massively bedded carbonate unit. The latter presents the lowest porosity values measured in the Biréno carbonates of the Jebel el Kébar area (Figs. 6, 7). With the Douleb Member equivalent, it constitutes a topographic land-mark which is comparable in terms of facies and thickness along the South-Western periclinal ending of Jebel el Kébar. Locally, at Jebel el Frayou, the Douleb Member exhibit high porosity values reaching 16.5% mainly related to the very frequent intercrystalline and intergranular porosity (Fig. 6). On contrary, more to the South, at Jebel Meloussi, the Biréno and Douleb dolostone Members are totally dolomitized and fractured. They show a very reduced intercrystalline porosity. On polarizing microscope, the microfractures, moldic and vuggy pores are totally filled with calcite or/and dolomite crystals.

On the whole, bioclastic carbonates identified in Jebel el Kébar exhibit good petrophysical characteristics. They are mainly affected by porogenesis processes, especially materialized by dolomitization and dissolution, provoking the genesis of a very common porosity and thus good reservoir properties. These porogenesis processes are similar to that described by Saller and Henderson (1998) for the dolostone reservoirs on the Central Basin Platform in West Texas. They argued that "as diagenetic fluids migrate basinward, they could become less saturated with respect to dolomite after much of it had been 'used-up' by replacement and cementation. From this point basinward, the migrating brines could trigger simultaneous dolomitization and dissolution of CaCO3 with the end result being more porous and permeable dolostones near the self-margin, where excess dolomitization as cement did not occur" (Saller and Henderson., 1998. In: Wayne, 2008). However, poronecrosis processes, expressed by dolomitization, have destroyed all pore types of the Cenomanian-Coniacian carbonate facies of the Jebel Meloussi section.

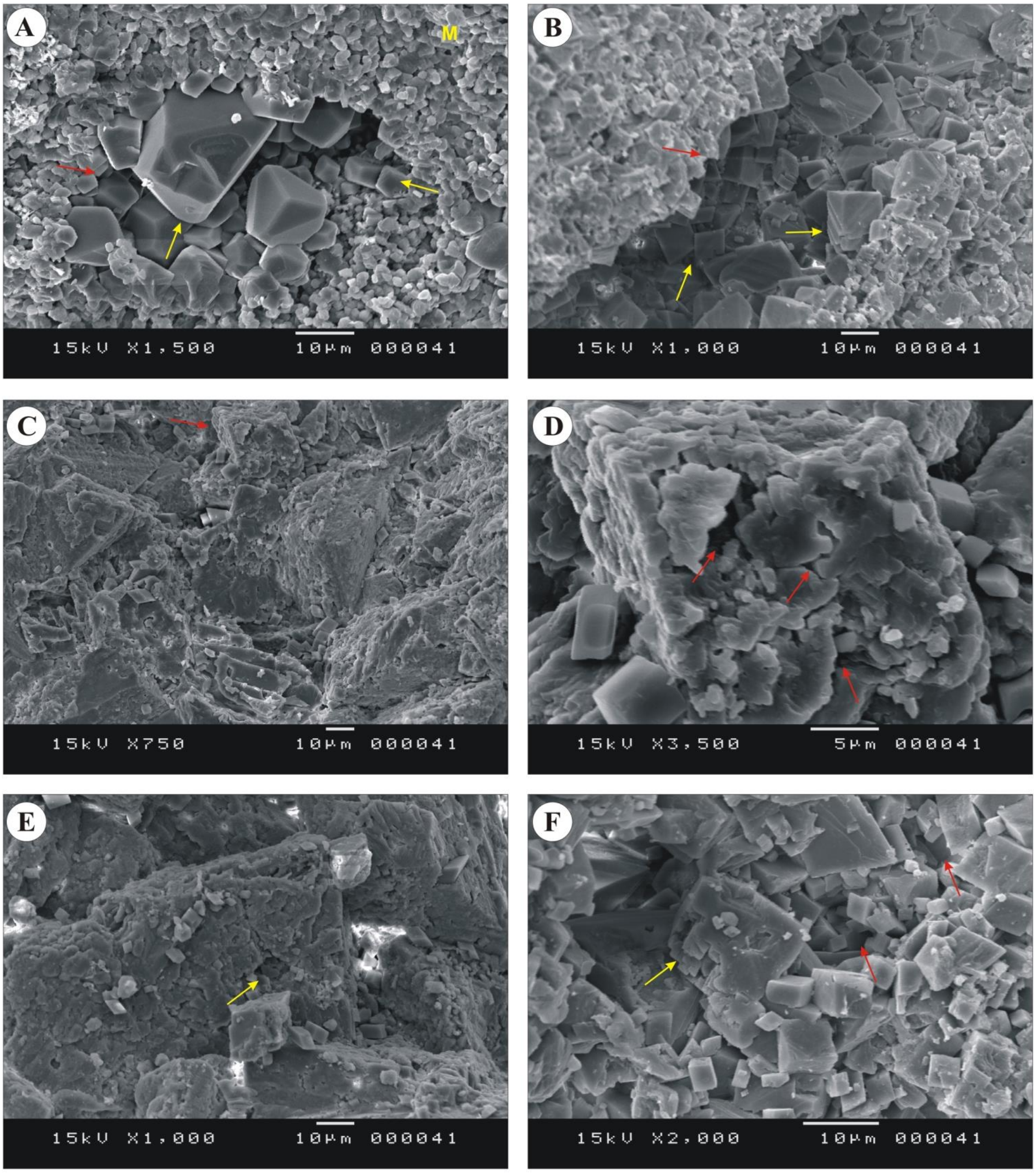

Figure 10) Scanning electron micrographs of the G2 carbonate Unit of the Late Cenomanian-Early Turonian Gattar Member. The Rous el Kébar section. (A) Nanopore-matrix contact (red arrow). The nanopore is partially filled with dolomite crystals (yellow arrows). Lower part of the G2 Unit. (B) Nanofracture-matrix contact (red arrow). The nanofracture is partially cemented by rhombohedral crystals of dolomite (yellow arrows). Lower part of the G2 Unit. (C) Tight-binding nanostructures showing matrix and partly dissolved dolomite crystals (red arrow). Middle part of the G2 Unit. (D) Close-up of the previous photo showing intracrystalline porosity developed within a dolomite crystal (red arrows). (E) Intracrystalline porosity (yellow arrow) probably related to dedolomitization. Upper part of the G2 Unit. (F) Carbonate matrix bearing tight intercrystalline (red arrows) and intracrystalline porosity (dedolomitization process, yellow arrow). Upper part of the G2 Unit.

On the other hand, different types of fractures (open fractures, partially cemented fractures, and micro-fractures) were highly developed in the Biréno and Douleb carbonate Members of Jebel el Kébar. Most of the identified fractures are open and have an important impact on the enhancement of permeability in some samples by dramatically increasing the hydraulic connectivity of all the Turonian-Coniacian petrofacies even if the fractures are rough (Glover *et al*., 1997).

6- Discussion and conclusions

The Late Cretaceous series constitute, in the Sidi Bouzid area, good reservoir rocks. They are mainly represented by the Late Cenomanian-Early Turonian Gattar Member, the Early-Middle Turonian Biréno Member and the Late Turonian-Coniacian Douleb Member. These latter have been studied along a North-South transect from Jebel el Kébar to Jebel Meloussi.

However, sedimentological, petrophysical and petrographic studies, focused on their vertical and lateral distribution, show spectacular changes in geometry, lithofacies and pore system. These variations could be related to the particular paleoenvironments (generally ranging from subtidal to shallow carbonate platform environments) and paleogeography governed by several processes such as sea level changes and, especially, activities materialized by contemporaneous tectonic reactivated fault-plane network.

Early Turonian Salt tectonic movements have affected the distribution of rudist-rich reservoirs in Central Tunisia (Boukadi and Bédir, 1996; Abdallah, 2000; Jaballah and Negra., 2016). These movements have raised particular compartments limited by major faults favoring the development of highly porous rudist bioconstructions.

In terms of reservoir aspect, the porogenesis processes (fracturing, dissolution and especially dolomitization, well represented at the Jebel el Kébar section) have affected the Late Cenomanian-Coniacian carbonate series, provoking the development of different types of pores which improve their reservoir properties. However, in Jebel Meloussi, at the Khanguet Zebbag section, the dolomitization does not seem to have a privileged distribution. It has filled and destroyed all types of pores. Giving the size and arrangement of dolomite crystals, the dolomitization process may contributes to the enhancement of the pore spaces by the creation of large intercrystalline pores (inter-dolomite porosity) or to destroy them by the development of joined-fine grained dolomite crystals.

In fact, in Sidi Bouzid area, especially at Jebel el Kébar, the Late Cenomanian-Coniacian interval constitutes three potential reservoir rocks (Gattar, Biréno and Douleb Members). The sealing of these latter is insured by the Early Turonian Annaba marls which cover the rudist-rich Gattar Member and the Coniacian-Early Campanian upper Aleg onlapping marls and/or clays, sealing both the Biréno and Douleb Members. Concerning the source rock, it has to be identified in deeper stratigraphic positions (e.g., local Cretaceous organic-rich facies, and/or older lithostatigraphic facies; Abdallah *et al*., 2000; Jaballah and Negra., 2016; Jaballah., 2017).

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