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Microstratigraphy and interpretation of the karst sedimentary fillings associated to the Aptian–Albian unconformity in Jebel Semmama (central Tunisia)

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ABSTRACT

In this paper, the aim was proposing a new microstratigraphy and interpretation of the karst sedimentary fillings associated to the Aptian–Albian unconformity in Jebel Semmama, central Tunisia. In all the previous studies, this unconformity was interpreted as the result of a major sea-level fall followed by a continuous emersion of the Aptian platform that lasted broadly the Lower and Middle Albian. In the present work, the field examination of the exposure surface in Jebel Semmama area in central Tunisia shows several centimetric epikarsts filled with different marine and non-marine deposits. According to the sedimentologic and microstratigraphic analyses, the karstic fillings may be linked with several sea-level oscillation cycles. Accordingly, the presence of such fillings suggests that the Aptian platform was not continually emerged during the lower and middle Albian as already assumed in previous works. Rather, it was episodically inundated by marine incursions. At least eighteen different sedimentary fillings have been recognized and sampled from the epikarsts. As these fillings are never totally regrouped in the same epikarst, the reconstruction of their microstratigraphy was based on (i) identification of their facies (ii) comparison and correlation of the different fillings between epikarsts (iii) analysis of the stratigraphic relation between the different fillings. A composite microstratigraphic column was established, it shows a regular alternation of shallow marine and non-marine deposits which are arranged into nine karstic sedimentary cycles. The latter may understandably be the result of nine relative sea-level oscillation cycles that broadly happened during the Lower and Middle Albian. For lack of biostratigraphic markers, the previous karstic cycles remain neither dated nor correlated with any eustatic chart. Moreover, the previous cycles have been controlled by significant local salt tectonics.

1. Introduction

In central Tunisia (Fig. 1), the Aptian–Albian transition is associated to a major stratigraphic gap (hiatus) illustrated by the lack of sedimentary records of the Lower and Middle Albian and probably the Clansayesian (M'Rabet, 1987; Touir et al., 1989; Zghal, 1994). This unconformity in central and southern Tunisia is materialized by a subaerial exposure surface at the top of the Aptian carbonate platform, so-called Orbata platform (Fig. 2). In northern Tunisia, the gap seems limited to the Clansayesian interval (Fig. 3) (Burollet, 1956; M'Rabet et al., 1995; Memmi, 1999; Chihaoui et al., 2010; Trabelsi et al., 2010).

In northern central Tunisia, particularly in Jebel Semmama area, the Aptian–Albian unconformity is located at the top of the upper unit (Gargasian) of the Orbata platform (Bismuth, 1973), and it is overlain with upper Albian marls (*Planomalina buxtorfi* zone) (Bismuth, 1973; Bismuth et al., 1981, 1982). Whereas, in southern central Tunisia (e.g. Jebel Meloussi, Jebel Kebar) (Fig. 1), the unconformity reaches the top of the lower unit (Bedoulian) of the platform (Fig. 3); the middle and upper units have understandably been eroded (Masse, 1984; M'Rabet, 1987; Memmi, 1999). The previous erosion surface is overlain with an alternation of Upper Albian marls and carbonates (*Planomalina buxtorfi* zone) (Boltenhagen, 1985; M'Rabet, 1987). Nevertheless, locally in Jebel Kebar area the hiatus is replaced by a lagoonal to lacustrine

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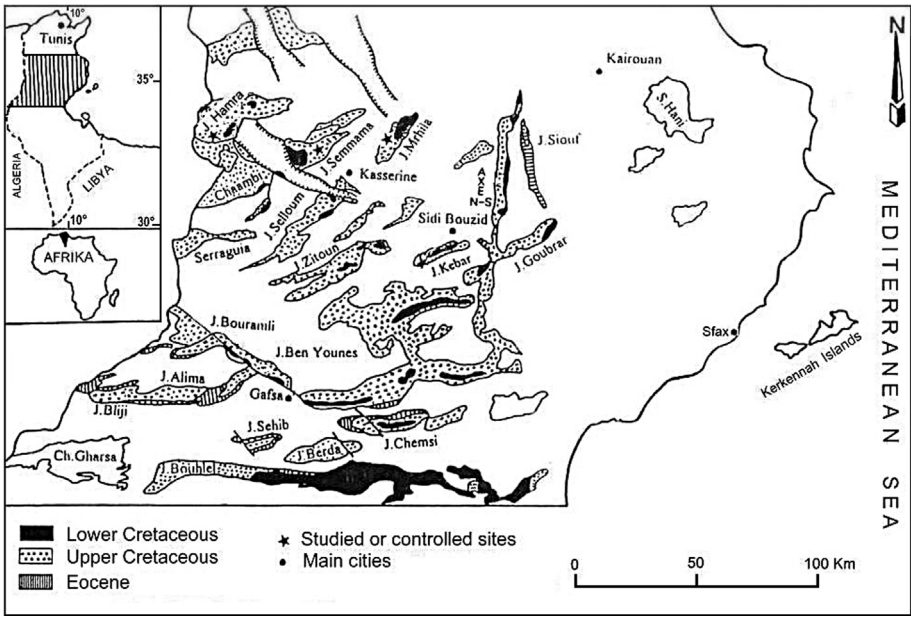

Fig. 1. Location map of the study area, showing in particular the outcrops which were studied or evoked in this work: Jebel Semmama, Jebel Kebar, Jebel Meloussi, Jebel Hamaïma.

succession so-called Kebar Formation that was ascribed by charophytes to the Uppermost Aptian to Lower and Middle Albian (Trabelsi et al., 2010). In this regard, it is worth noting that Jaillard et al. (2006) reported in Jebel Hamra, west central Tunisia (Fig. 1), the presence of an early graben filled with a condensed Lower and Middle Albian marine succession sealed by Upper Albian marls.

The gap of Clansayesian and Lower and Middle Albian in central Tunisia (including the study area) is regarded in the whole previous works as resulting from a long continuous emersion of the Aptian Otbata platform related to the major Upper Aptian sea-level fall (Khessibi, 1978; Boltenhagen, 1985; M'Rabet, 1987; Chaabani et al., 1992). Due to the lacks of visible sedimentary remains, previous studies have ascribed the long gap between the Upper Aptian and Upper Albian to a prolonged uninterrupted subaerial exposure of the platform surface throughout central Tunisia. Nonetheless, the close examination of the previous surface through many outcrops in central Tunisia shows several centimetric epikarsts filled with various marine and non-marine (continental) sedimentary materials. The latter are the most exposed and preserved in Jebel Semmama area. In fact, apart from the lagoonal to lacustrine Formation described in Jebel Kebar area (Trabelsi et al., 2010) as well as the condensed marine succession filling locally the early graben in the Jebel Hamra area west central Tunisia (Jaillard et al., 2006), no coeval records to the previous karstic fillings in central Tunisia were reported in the literature. On the other hand, it is worth noting that the Orbata platform is currently emerged in Jebel Semmama area since the Upper Miocene, when central Tunisia experienced the well-known atlasic folding, which is contemporaneous, with a major marine regression. Nevertheless, according to field observations taking into account the presence of marine deposits within epikarsts, no recent karstic fillings were observed on the platform surface, and we suppose that the studied fillings are primarily Aptian and Albian in age.

The present work is meant to supply new significant information on the major Aptian–Albian unconformity in central Tunisia and to discuss the emersion of the Orbata platform toward the Upper Aptian, based on the presence of karstic sedimentary fillings in Jebel Semmama area.

2. Study area

The Aptian–Albian unconformity surface was examined at the top of the Aptian Orbata platform in Jebel Semmama and other localities in central Tunisia (Fig. 1). The Jebel Semmama area corresponds to a NE–SW anticlinal structure with a Lower Cretaceous core while the periphery includes Upper Cretaceous deposits. The Aptian is primarily represented by a 320 m-thick carbonate formation making up the Orbata platform; it outcrops as thick cliffs dominating the local landscape (Fig. 4). The Orbata platform includes three distinct lithological members respectively limited by unconformities, from D1 to D4, corresponding to sedimentary sequence boundaries (M'Rabet, 1987). The boundary D4 corresponding to the Aptian–Albian unconformity makes the object of the present work. The lower member of the platform is Bedoulian in age, whereas the median and upper ones are Upper Aptian (Bismuth et al., 1981, 1982; Mass, 1984; Boltenhagen, 1985), most likely Gargasian (Bismuth, 1973). The upper member ends with a bedded dolomitic succession exhibiting rudists and phantoms of *orbitolina foraminifers*. According to Masse (1984), these rudists are represented by *Polyconites* sp. associated to Requieniidae and Monopleuridae, which can indicate the Upper Aptian. The previous succession ends with a subaerial exposure surface upon which rest on the Upper Albian marls (*Planomalina buxtorfi* biozone) (Bismuth et al., 1981, 1982).

The Jebel Semmama is limited to the SW by the NW–SE major fault of Kasserine which was during the Aptian–Albian transition implied in salt tectonics (Chihi et al., 1984; Chihi and Ben Ayed, 1991) as illustrated by many diapirs in central Tunisia (Ben Brahim, 1983; Boukadi and Bedir, 1996) including the study area (Ladeb et al., 1995). In addition, this tectonics cut out the Aptian Orbata platform into many northward down-stepping blocks (Boltenhagen, 1985; Jaillard et al., 2006; Rigane et al., 2010).

Added to abundant epikarsts, the more or less gullied subaerial exposure surface at Aptian–Albian unconformity in Jebel Semmama area preserves many other emersion figures such as the lapiaz, desiccation cracks, and dissolved rudists. The latter are particularly developed and preserved in Boulâaba locality, located at the SW of Jebel Semmama area approximately 15 km to the north