

Turonian-Santonian echinoids from Wadi Qena, Eastern Desert, Egypt; a new arrangement of apical disc plating in spatangoids



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ABSTRACT

Eighteen echinoid species (seven regular and eleven irregular) belonging to twelve genera have been described from the Turonian-Santonian succession of two sections located in the northern part of Wadi Qena, Eastern Desert. The diversity of the recorded species is low in the Turonian (six species), but comparatively high in the Coniacian-Santonian (twelve species). Of the recorded species, Most of these species (72%) are recorded for the first time from Wadi Qena area, one left in open nomenclature, *Mecaster* sp., represents a new species, and two, *Phymosoma microtuberculatum* and *Thylechinus (T.) saidi*, represent new records for Egypt. The taxonomic rank of *Parapygus sudrensis* has been changed. *Phymosoma microtuberculatum* which is known from the 'Senonian' of southwest Europe is recorded herein in the lower Turonian. Two echinoid assemblage zones are recognizable in each of the studied two sections. They are correlated with other fossil assemblage zones in Egypt. Faunal affinity and paleobiogeography of the species are discussed. A new arrangement of apical disc plating in spatangoids is described and discussed.

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1. Introduction

Wadi Qena is located in the Eastern Desert of Egypt (Fig. 1A). It is bordered in the west by a large Cenomanian-Eocene succession. The Upper Cretaceous strata are well exposed. They are represented by the Wadi Qena Formation (lower Cenomanian), Galala Formation (middle-upper Cenomanian-lower Turonian), Umm Omeiyid Formation (middle-upper Turonian), and Hawashya Formation (Coniacian-Santonian), succeeded higher up by Campanian-Eocene strata (Fig. 1B). Although previous studies on the stratigraphy and paleontology of the Upper Cretaceous of Wadi Qena and the neighborhoods are numerous (e.g. Abdallah and El Adindani, 1963; Awad and Abdallah, 1966; Bandel et al., 1987; Kassab, 1982, 1985, 1994, 1999; Luger and Gröschke, 1989; Kora et al., 2001; Zakhera, 2002; Kassab and Zakhera, 2002; Hewaidy et al., 2003; Abdel-Gawad et al., 2006, 2007; Abdelhady, 2007; Nagm et al., 2010a, b, 2011; Nagm and Wilmsen, 2012), those published on echinoids are rare (Fourtau, 1899, 1914; Geys, 1989, 1992; Abdelhamid and Azab, 2003, 2012; El Qot, 2010; Abdelhamid, 2014a,b).

The present work aims to study the Turonian-Santonian echinoids of Wadi Qena area with respect systematic paleontology and

biostratigraphy and additionally throw light on their faunal affinity and paleobiogeography. The material has been collected from two sections at Wadi Qena, at north Wadi Qena (N 27° 57' 57", E 32° 30' 58") and Wadi El-Burga (N 27° 44' 51", E 32° 33' 55") (Figs. 1–3).

2. Lithostratigraphy

The Turonian-Santonian sediments at Wadi Qena are represented by the upper part of the Galala Formation, the Umm Omeiyid Formation and the Hawashya Formation. The upper part of the Galala Formation (lower Turonian) is mainly composed of limestone and marl, yielding frequent Turonian echinoids dominated by *Phymosoma abbatei* (Gauthier in Fourtau, 1898), *Coenohlectypus turonensis* (Desor in Agassiz and Desor, 1847) and *Mecaster turonensis* (Fourtau, 1921), besides the ammonites *Choffaticeras securiforme* (Eck, 1909) and *Choffaticeras segne* (Solger, 1903), and the bivalve *Plicatula auressensis* (Coquand, 1862). These ammonite species were previously recorded from lower Turonian rocks (Abdallah et al., 2001; Aly and Abdel-Gawad, 2001; Khalil 2007) recorded *Choffaticeras segne* also from the middle Turonian of Wadi Watir, East Sinai, Egypt.

The Umm Omeiyid Formation (middle-upper Turonian) was established by Klitzsch et al. (1986) and modified by Hermina et al. (1989) for the Turonian sandstone unit at Wadi Umm Omeiyid at

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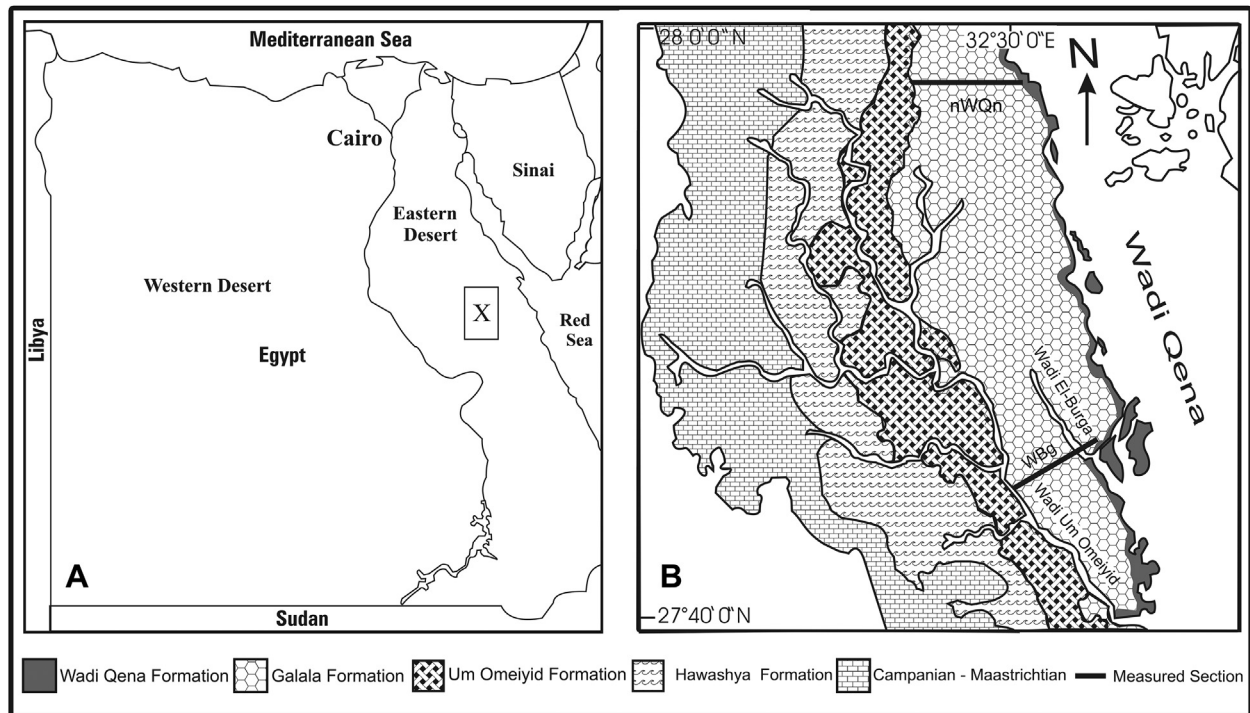


Fig. 1. A. Location of the study area (X); B, geological map (after Conoco, 1987) showing distribution of the Umm Omeiyid (Turonian) and Hawashya (Coniacian-Santonian) formations in the area of study (nWQn, North Wadi Qena section; WBg, Wadi El-Burga section).

central Wadi Qena. This formation is composed of about 43 m of shale and sandstone in the Wadi El-Burga section (north of Wadi Umm Omeiyid) and 57 m of marl, limestone and shale in the north Wadi Qena section. Frequent *Coilopoceras requinianum* (d'Orbigny, 1841) have been recovered from the upper part of this formation in the north Wadi Qena section. This ammonite species is known from the upper Turonian (Kassab, 1991; Kassab and Obaidalla, 2001; Hewaidy et al., 2003; El Qot and Afify, 2010). The lithology of this formation gradually changes northwards due to deepening of the basin of deposition. It consists mostly of sandstone at the type locality, shale and sandstone in the Wadi El-Burga section, and marl and limestone in the north Wadi Qena section. It is correlated to the more offshore carbonate Wata Formation which is exposed farther to the north at Wadi Dakhil as well as in Central Sinai (Abdelhamid and Azab, 2012).

The Hawashya Formation (Coniacian-Santonian) is composed mainly of sandstone, with few interbeds of shale, marl and limestone in the basal part (Fig. 3). The marly beds contain frequent echinoids. It attains 50 m in the north Wadi Qena section and about 77 m in the Wadi El-Burga section. The Hawashya Formation was established by Hermina et al. (1989) to include the Coniacian-Santonian sediments at Wadi Hawashya, north of Wadi Qena. It is correlated with the Matulla Formation at Central and Southern Sinai.

3. Biostratigraphy

Two echinoid assemblages can be distinguished in the Turonian-Santonian sequence in each of the studied two sections. These zones could be correlated with other macroinvertebrate zones in previous literature (Table 1). The echinoid assemblages at the North Wadi Qena section (Fig. 2) are included in the following two zones:

1. *Phymosoma abbatei*-*Coenholectypus turonensis* Assemblage Zone: It occurs at the top of the Galala Formation (lower Turonian), bed 22 (Fig. 2). This zone is distinguished by the dominant occurrence of *Phymosoma abbatei* (Gauthier in Fourtau, 1899) and *Coenholectypus turonensis* (Desor in Agassiz and Desor, 1847), and includes the echinoids *Phymosoma major* (Coquand, 1862), *P. microtuberculatum* (Cotteau in Cotteau and Triger, 1860) and *Mecaster turonensis* (Fourtau, 1921). It also includes the ammonite *Choffaticeras segne* (Solger, 1903) and the bivalve *Plicatula auressensis* (Coquand, 1862).
2. *Mecaster fourneli*-*Petalobrissus waltheri* Assemblage Zone: It occurs in the Hawashya Formation, bed 26 (Fig. 2). It is recognized by the dominance of *Mecaster fourneli* (Deshayes in Agassiz and Desor, 1847), *Petalobrissus waltheri* (Gauthier, in Fourtau, 1900) and *Rachiosoma rectilineatum* (Péron and Gauthier in Cotteau et al., 1881). These echinoids are also accompanied by *Goniopygus innesi* Gauthier in Fourtau, 1901, *Coenholectypus roachensis* (Fourtau, 1914), *Pygorhynchus aegyptiacus* (Fourtau, 1913), *Parapygus sudrensis* (Abdelhamid, 1997), *Nucleopygus minor* Agassiz, 1840, *Pseudholaster meslei* Thomas and Gauthier in Gauthier, 1889, and *Hemiasper wetherbyi* de Loriol, 1887.

The echinoid assemblage zones at the Wadi El-Burga section (Fig. 3) are included in the following two zones:

1. *Mecaster* sp. Assemblage Zone. It occurs in bed 9 (upper part of the Galala Formation, lower Turonian). It is defined by the occurrence of *Mecaster* sp. accompanied by the ammonite *Choffaticeras securiforme* (Eck, 1909). It is correlated with the *Phymosoma abbatei*-*Coenholectypus turonensis* Assemblage Zone of the North Wadi Qena section.
2. *Rachiosoma rectilineatum*-*Petalobrissus waltheri* Assemblage Zone. It occurs in Hawashya Formation, bed 13, being dominated

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