BULLETIN DE L'INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE, SCIENCES DE LA TERRE, 62: 139-154, 1992
BULLETIN VAN HET KONINKLIJK BELGISCH INSTITUT VOOR NATUURWETENSCHAPPEN, AARDWETENSCHAPPEN, 62: 139-154, 1992

Regular Echinoids, other than Hemicidaroida, from Upper Cretaceous deposits in the Wadi Qena-area (Eastern Desert, Egypt)

Joris F. GEYS

Abstract

Numerous regular echinoids have been collected by a German expedition in the Upper Cretaceous of Wadi Qena, Egypt. In this paper, the presence of six non-Hemicidaroid species in these deposits is discussed. Two genera (*Desoricidaris* and *Bandelicyphus*) and one species (*Bandelicyphus qenaensis*) are new.

Keywords: Echinoids, Cretaceous, Egypt, Taxonomy.

Résumé

De nombreux échinides réguliers ont été récoltés par une expédition allemande dans le Crétacé Supérieur du Wadi Qena, en Egypte. La présence, dans ces dépôts, de six espèces non-hémicidarides est discutée. Deux genres (*Desoricidaris* et *Bandelicyphus*) et une espèce (*Bandelicyphus qenaensis*) sont nouveaux.

Mots-clefs: Echinides, Crétacé, Egypte, Taxinomie.

Introduction

Wadi Qena is a long and wide, fault-bordered depression on the left bank of the River Nile, and parallel to the Red Sea. The wadi slopes gently south, until it reaches the Nile Valley close to the town of Qena. The area has been surveyed and its geology has been described by BANDEL, KUSS & MALCHUS (1987). During their field campaign in 1985, these authors collected a large number of fossils, some of which have been forwarded to me, for further study.

This paper is a systematic revision of a small part of these collections. Five species in the order Hemicidaroida have been discussed in a previous paper (GEYS, 1989). The remaining regular echinoids will be described below.

The stratigraphical framework, set up by BANDEL, KUSS and MALCHUS (1987) is used throughout the present text. Usefully named topographic features are few and wide apart in desert areas, such as the Wadi Qena. Localities in this paper are therefore indicated by letters, which also refer to BANDEL, KUSS & MALCHUS (1987).

Upper Cretaceous regular echinoids from Egypt have been described by GREGORY (1906), by FOURTAU (1900, 1901, 1905, 1909, 1912, 1913 and 1914) and by STEFANINI (1918). GREGORY (1906) mentioned five species:

"*Micropedina bipatellis*
Cyphosoma beadnelli, n. sp.
Thylechinus quincuncialis, n. sp.
Coptosoma abbatei (Gauthier), 1899
Coptosoma gunnehensis, n. sp."

A compilation of his earlier papers, published by FOURTAU (1914), yields the following list of 38 species and subspecies:

"*Cidaris Thomasi*, Gauthier 1901
Dorocidaris Schweinfurthi, Gauthier 1901
Typocidaris cenomanensis, Cotteau 1885
Typocidaris chercherensis, R. Fourtau 1909
Typocidaris essenensis, Schlüter 1909
Leiocidaris aegyptica, R. Fourtau 1914
Leiocidaris Balli, R. Fourtau 1914
Leiocidaris Bonolai, Gauthier 1900
Leiocidaris Crameri, de Loriol 1887
Plegiocidaris Teillardi, Fourtau 1909
Salenia batnensis, Peron et Gauthier 1879
race *tunetana*, Thomas et Gauthier 1889
Salenia aegyptica, R. Fourtau 1914
Orthopsis miliaris, d'Archiac 1835
Orthopsis Ruppelii, Desor 1847
G *Micropedina bipatellis*, Gregory 1906
Micropedina conica, R. Fourtau 1912
Micropedina Humei, R. Fourtau 1909
Micropedina olisiponensis, Forbes 1909
Micropedina olisiponensis, Forbes
race *Cotteaui*, Coquand 1862
G *Cyphosoma Abbatei*, Gauthier 1898
G *Cyphosoma Abbatei*, Gauthier 1898
race *Beadnelli*, Gregory 1906
Cyphosoma Baylei, Cotteau 1864
Cyphosoma deserti, R. Fourtau 1912
Cyphosoma Isidis, R. Fourtau 1912
Cyphosoma majus, Coquand 1862
Cyphosoma sinaeum, R. Fourtau 1914
Cyphosoma roachense, R. Fourtau 1914
Rachiosoma Delamarrei, Deshayes 1846

G *Coptosoma* (?) *gunnehense*, Gregory 1906
Coptosoma Lefebvrei, Gauthier 1906
Psilosoma constrictum, R. Fourtau 1912
Orthechinus arabicus, R. Fourtau 1912
G *Orthechinus quincuncialis*, Gregory 1906
Goniopygus Coquandi, Cotteau 1865
Goniopygus Innesi, Gauthier 1901
Goniopygus Innesi, var. *granulata* R. Fourtau 1914
Goniopygus Menardi, Desmarets 1825
var. *Brossardi*, Coquand 1865
Goniopygis Peroni, Thomas et Gauthier 1889
Codiopsis Quaasi, R. Fourtau 1914"

The five species mentioned by GREGORY (1906) have been repeated by FOURTAU (1914). They are preceded by "G" in the list above.

The most recent synoptic revision of Egyptian Cretaceous Echinoids has been published by STEFANINI (1918). He lists six species, among which four of FOURTAU's (preceded by "F" in the list below).

F *Cidaris Thomasi* Gauth.
F *Salenia batnensis* Peron et Gauth.
var *tunetana* Thom. et Gauth.
F *Micropedina olisiponensis* (Forbes)
Rachiosoma Brochii sp. n.
Goniopygus Menardi Lor. var. *subconica* n.
F *Goniopygus Coquandi* Cott.

Taking the Hemicidaroida into account, which have been described and discussed in a previous paper of mine (GEYS, 1989), 51 names have hitherto been used for the echinofauna from the Egyptian Upper Cretaceous. The presence of seven species has been confirmed by GEYS (1989 and in the present paper) in the Wadi Qena-area. Five taxa had to be added to the list, among which are two new species. Non-Hemicidaroid echinoids, found in the Wadi Qena-area are:

Desoricidaris balli (FOURTAU, 1914)
Desoricidaris pouyannei (COTTEAU, 1863)
Micropedina olisiponensis (FORBES, 1850)
Bandelicyphus qenaensis nov. gen & sp.
Orthopsis miliaris (D'ARCHIAC, 1835)
Rachiosoma rectilineatum (COTTEAU, PERON & GAUTHIER, 1881)
Goniopygus menardi (DESMAREST, 1825)

The stratigraphical distribution of these species is given in Table 1.

Abbreviations

D : ambital diameter of the test;
h : total height of the test;
ds : diameter of the apical system, measured along III-5.
dp : diameter of the periproct, measured along III-5.
KBIN : Royal Belgian Institute for Natural Science, Vautierstraat 29, 1040 Brussels, Belgium ("Koninklijk Belgisch Instituut voor Natuurwetenschappen" or "Institut Royal belge des Sciences Naturelles").
IST : "Invertébrés Secondaires et Tertiaires", name of the collection at the KBIN, where the type-specimens have been deposited.

Systematic descriptions

Subclass Perischoechinoida M'COY, 1849
Order Cidaroida CLAUS, 1880
Family Cidaridae GRAY, 1825
Genus *Desoricidaris* nov. gen.

In Mesozoic formations, a few species occur, which present the following combination of characteristics:

a — confluent pores;
b — non-crenulate primary tubercles;
c — poriferous zones which are simple throughout, not widening in the immediate vicinity of the peristome;
d — scrobicular tubercles which are well developed and usually not crescent-shaped.

Such species were formerly classified with the genus *Rhabdocidaris* DESOR, 1855 or *Leiocidaris* DESOR, 1855. In fact they belong neither to the former, nor to the latter.

DESOR (1855) pointed out clearly that primary tubercles in *Rhabdocidaris* are strongly crenulate, as they are in its type-species, *R. orbignyana* (AGASSIZ, 1840), from the Upper Jurassic of France. The genus *Leiocidaris* DESOR, 1855 was created to include some species, similar to *Rhabdocidaris*, but with non-crenulate primary tubercles. This would fit fairly well the species I have in mind. Unfortunately, DESOR (1855) chose "*Cidaris*" *imperialis* LAMARCK, 1816, from the recent Indo-Pacific, as a type-species for *Leiocidaris*. This species was subsequently demonstrated to belong to *Phyllacanthus* BRANDT, 1835 (MORTENSEN, 1928). Hence, *Leiocidaris* is merely a junior synonym of *Phyllacanthus*.

No Mesozoic species of *Phyllacanthus* are known. The Cretaceous and Jurassic species, formerly described as *Leiocidaris*, or as "*Rhabdocidaris* with non-crenulate tubercles", do not show the features, which are characteristic for *Phyllacanthus*: widening poriferous zones near the peristome and crescent-shaped scrobicular tubercles. In my opinion, these species are in need of a new genus. To pay tribute to E. DESOR, who most probably had these species in mind, while creating the name *Leiocidaris*, I propose to name this new genus *Desoricidaris*. As a type-species for *Desoricidaris*, I propose *D. pouyannei* COTTEAU, 1863. This species will be described and discussed at length in the following pages.

Rhabdocidarinae with non-crenulate interambulacral primary tubercles are numerous in Cretaceous faunas. Hence, a fair number of species are to be transferred from *Rhabdocidaris* or "*Leiocidaris*" to the new genus *Desoricidaris*. Some examples are listed below.

— *Desoricidaris sanctaecrucis* (COTTEAU, 1862), Valanginian, Switzerland;
— *Desoricidaris salviensis* (COTTEAU, 1857), Lower Cretaceous, France;
— *Desoricidaris venulosa* (AGASSIZ & DESOR, 1846), Cretaceous, Europe;
— *Desoricidaris balli* (FOURTAU, 1914), Cenomanian, Egypt;
— *Desoricidaris bonolai* (GAUTHIER in FOURTAU, 1900), Cenomanian, Egypt;
— *Desoricidaris subvenulosa* (COTTEAU, PERON & GAUTHIER, 1880), Turonian, Algeria;
— *Desoricidaris schweinfurthi* (GAUTHIER in FOURTAU, 1901), Santonian, Egypt;
— *Desoricidaris crameri* (DE LORIOL, 1887), Santonian, Egypt.

The presence of "*Leiocidaris*", alias *Phyllacanthus* in Cretaceous strata has not yet been demonstrated.

Desoricidaris balli (FOURTAU, 1914)
Pl. 1, Fig. 1-3.

* 1914 *Leiocidaris Balli*, FOURTAU, p. 5-6, pl. 1, fig. 3.
1925 *Leiocidaris Balli*, LAMBERT & THIERY, p. 560.

Locus typicus
Jebel Beit-Salama, Sinai-Peninsula, Egypt.

Stratum typicum
Cenomanian.

Specimens studied
El-Riz, South Bahariya Oasis, Egypt; Il-Heiz Member, Bahariya Formation, Upper Cenomanian; 1 specimen (KBIN-coll. nr. IST-10496, figured herein).

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
IST-10496	39,0	33,0	13,0	—	0,85	0,33	—

DESCRIPTION
Medium sized, subsphaerical cidaroid echinoid.

Peristome and periproct cannot be described because of the poor state of preservation of the specimen.

Ambulacra are sinuous and relatively wide, with depressed poriferous areas. Pores are conjugate. The pore-pairs are almost horizontal and separated by high and sharp ridges. Granuliform interporous partitions are not observed. Outer adradial ambulacral granules are large and arranged in two regular vertical series. In the perradial series, large and small granules alternate, but even the largest among these are smaller than those from the adradial series.

At the ambitus, 13 ambulacral plates are adradially in contact with one interambulacral plate. Interambulacral plates are six to seven in a series. Interambulacra are four times as wide as ambulacra. Primary tubercles are perforate, non-crenulate. Scrobicules are five times wider than the mamelons. The bosses are smooth and conical. Scrobicules are shallow, large parts of the bosses protruding over the rim of the scrobicular rings. These rings consist of 17 or 18 small, oval scrobicular tubercles. Scrobicules are not confluent. Below the ambitus, the rings touch each other. Adradial extrascrobicular surfaces are very narrow, only a few granules being inserted between the scrobicular rings and the adradial sutures. Interradially, they are moderately wide and covered by a dense granulation, without any regularity in its arrangement. Interambulacral granules are approximately of the same size as scrobicular tubercles and the outer perradial granules. Sutures between interambulacral plates are sunken and visible as faint grooves.

DIAGNOSTIC CHARACTERS

1. Peristome small.
2. Sphaerical shape.
3. Primary tubercles perforate, non-crenulate; scrobicules shallow.
4. Extrascrobicular surfaces very narrow adradially, moderately wide interradially.
5. Scrobicules closely packed, but not confluent.
6. Characteristic perradial granulation; large granules in regular adradial series, smaller and very small granules alternating in perradial series.

DISCUSSION
The arrangement of the perradial granulation is so characteristic in *D. balli*, that it is hardly possible to confuse it with other species. Yet, some other *Desoricidaris*, such as *D. pouyannei*, show a superficial resemblance to *D. balli*. Differences in shape between these two species, such as have been pointed out by FOURTAU (1914), are not always a reliable means to distinguish them. The specimen of *D. balli* discussed herein, has a very high h/D-ratio, well above the mean of *P. pouyannei*, but within the range of its variability. Unlike FOURTAU's statement, there is no significant difference in the number of ambulacral plates, forming a vertical series, between specimens of the same size of both species. The presence of reduced scrobicules in the adapical parts of the interambulacra of *D. balli*, cannot be confirmed, owing to the poor state of preservation of the specimen I examined. However, as a convenient distinctive feature, the perradial granulation of both species should be sufficient.

Desorocidaris pouyannei (COTTEAU, 1863)
Pl. 1, Fig. 4-7.

* 1863 *Rhabdocidaris pouyannei*, COTTEAU, pp. 346-349, pl. 1083.
1879 *Rhabdocidaris Pouyannei*, COTTEAU, PERON & GAUTHIER, pp. 179-181.
1925 *Leiocidaris Pouyannei*, LAMBERT & THIERY, p. 154.
1932 *Leiocidaris Pouyannei*, LAMBERT, p. 156.
v 1987 *Rhabdocidaris sp.*, GEYS in BANDEL, KUSS & MALCHUS, pl. 1, fig. 1a-b.

Locus typicus
Mograr-Tahtania, prov. Oran, Algeria.

Stratum typicum
Turonian.

Other known occurrences outside Egypt
Algeria: Middle Cenomanian at Bou-Saada (COTTEAU, PERON & GAUTHIER, 1879).

SPECIMENS STUDIED

Locality B (sample B2-3), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian: 1 specimen (KBIN- coll. nr. IST-10462).

Locality F (sample F122/43), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian: 2 specimens.

Locality F (sample F123/83), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian: 4 specimens (the identification of two specimens is tentative, because of their poor state of preservation).

Locality L (sample L1), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian: 7 specimens.

Locality M (sample M7), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian: 1 specimen.

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
IST 10468	34,8	21,6	15,4	13,7	0,62	0,44	0,39

Other specimens are fragmentary and were not measured.

DESCRIPTION

Medium sized, subsphaerical Cidaroid echinoid.

The peristome is subpentagonal and not sunken; buccal slits are absent. Peristome and periproct are the same size. The periproct is circular in outline.

Ambulacra are sinuous and relatively wide, with strongly depressed poriferous areas. Pores are conjugate and interconnected by a shallow groove. The pore-pairs are almost horizontal and separated by sharp ridges. Granuliform interporous partitions, which are present in most cidaroid echinoids, have not been observed in the present species. Outer perradial ambulacral granules are arranged in a single vertical series. A relatively wide inner perradial area is covered by a very fine granulation. The inner granules are obviously smaller than the outer ones. Moreover, they do not show any regular arrangement, neither in vertical, nor in horizontal series. Ambulacral series consist of about 60 plates, each showing one pore-pair and one adradial granule.

At the ambitus, 19 ambulacral plates are in direct contact with one interambulacral plate. Interambulacral plates are five to seven in a series. Interambulacra are 3.5 times wider than ambulacra. Primary interambulacral tubercles are perforate, non-crenulate. Scrobicules are four times as large as the mamelons. Bosses are smooth and conical. Scrobicules are shallow, so that large parts of the bosses protrude over the rim of the scrobicular rings. The concave border of the scrobicules is steep, but not overhanging. Scrobicular rings consist of about 17 tubercles. Scrobicules are not confluent, but in adoral plates, the rings may be in contact. The uppermost scrobicule of each ambulacrum is poorly developed. Extrascrobicular surfaces are exceedingly narrow adradially, but moderately wide interradially. They are covered by a fine and dense granulation, without any regularity in its arrangement. The granules are coarser than those on the perradial surfaces, their size being almost the same as that of adradial ambulacral granules. Sutures between interambulacral plates are clearly visible as shallow, but distinct grooves. These sutures, horizontal as well as vertical, are slightly sunken.

I have no data on the radioles of this species.

DIAGNOSTIC CHARACTERS

1. Horizontal, conjugate pore-pairs, without interporous partitions, but separated by sharp ridges.
2. Perradial granulation fine and irregularly arranged, except for the outermost granules, which are coarser and arranged in vertical series.
3. Ambulacral plates are 60 to a series; interambulacral plates are five to a series; at the ambitus, 19 ambulacral plates for each interambulacral plate.
4. Scrobicular rings of 17 tubercles.
5. Scrobicules shallow; tubercles perforate, non-crenulate.
6. Very narrow adradial extrascrobicular surfaces; in-

terradial extrascrobicular surfaces wide and narrow below the ambitus.
7. Extrascrobicular granulation fine and irregularly arranged.
8. Sutural grooves prominent and slightly sunken.
9. Scrobicules widely spaced.

DISCUSSION

Rhabdocidarinae with non-crenulate interambulacral tubercles are not rare in the Cretaceous of North Africa. Five species have been mentioned from Egypt by FOURTAU (1901, 1914). Two more species, among which *D. pouyannei*, have been reported from Algeria, by COTTEAU, PERON & GAUTHIER (1879).

Perradial granules are arranged in vertical series in *D. aegyptica* (FOURTAU, 1914), *D. schweinfurthi* (GAUTHIER in FOURTAU, 1901) and *D. crameri* (DE LORIOL, 1887). Perradial granulation is very characteristic in *D. balli* (FOURTAU, 1914) and differs completely from that in *D. pouyannei*. Interambulacral tubercles are more numerous and more closely packed in *D. aegyptica*, *D. bonolai* (GAUTHIER in FOURTAU, 1900), *D. crameri*, *D. schweinfurthi* and *D. subvenulosa* (COTTEAU, PERON & GAUTHIER, 1880). None of these species can be confused with *D. pouyannei*.

Subclass Euechinoida BRONN, 1860
Superorder Diadematacea DUNCAN, 1889
Order Pedinoida MORTENSEN, 1939
Family Pedinidae POMEL, 1883
Genus *Micropedina* COTTEAU, 1866

Type species

Codiopsis cotteaui COQUAND, 1864 (= *Echinus olisiponensis* FORBES, 1850); by original designation.

DIAGNOSIS

— test subglobular to subconical;
— ambulacra trigeminate; uppermost pore-pair lies outermost;
— numerous tubercles, arranged in many series.

Micropedina olisiponensis (FORBES, 1850)
Pl. 1, Fig. 8-14.

* 1850 *Echinus Olisiponensis*, FORBES, p. 195-196, pl. 25, fig. 1.
* 1864 *Codiopsis Cotteaui*, COQUAND, p. 254, pl. 28, fig. 11-13.
1866 *Micropedina Cotteaui*, COTTEAU, p. 823-825, pl. 1197.
1878 *Micropedina Cotteaui*, COTTEAU, PERON & GAUTHIER, p. 217-219.
1887 *Micropedina olisiponensis*, DE LORIOL, p. 62-63, pl. 10, fig. 3, 6.
* 1906 *Micropedina bipatellis*, GREGORY, p. 220-221, pl. 10, fig. 4, 5a-f.
* 1909 *Micropedina Humei*, FOURTAU, p. 100-102, pl. 6, fig. 8-9.
1910 *Micropedina olisiponensis*, LAMBERT & THIERY, p. 206.
1912 *Micropedina olisiponensis*, FOURTAU, p. 156-157, pl. 2, fig. 2.
1914 *Micropedina bipatellis*, FOURTAU, p. 25-26, pl. 3, fig. 1.
1914 *Micropedina Humei*, FOURTAU, p. 27.
1914 *Micropedina olisiponensis*, FOURTAU, 27-28.
1914 *Micropedina olisiponensis* race *Cotteaui*, FOURTAU, p. 28.
1918 *Micropedina olisiponensis*, STEFANINI, p. 130.
1932 *Micropedina Cotteaui*, LAMBERT, p. 157.
1932 *Micropedina olisiponensis*, LAMBERT, p. 157.
1940 *Micropedina Cotteaui*, MORTENSEN, p. 123, fig. 68a-b.
1940 *Micropedina olisiponensis*, MORTENSEN, p. 123, fig. 69a-b.
1940 *Micropedina Humei*, MORTENSEN, p. 123.
v 1987 *Micropedina bipatellis*, GEYS in BANDEL, KUSS & MALCHUS, pl. 1, fig. 2a-b, pl. 5, fig. 6a-b.

Loci typici

M. olisiponensis: Lisbon, Portugal.
M. cotteaui: Batna, Algeria.
M. bipatellis: Jebel Gunneh, Egypt.
M. humei: Bahariah Oasis, Egypt.

Strati typici

M. olisiponensis: "Hippurite Limestone", Upper Cenomanian.
M. cotteaui: Upper Cenomanian.
M. bipatellis: Cenomanian.
M. humei: Upper Cenomanian.

Other known occurrences outside Wadi Qena

Algeria: Cenomanian of Aïn Baïra and Jebel Bou-Thaleb (COTTEAU, PERON & GAUTHIER, 1878).

Egypt: Cenomanian of Wadi Araba, S.Anthony and St.Paul's Monastery, Wadi Deir Bahit, Wadi Horaida, Wadi Askal, Wadi Hayal, Abu Daraya, Wadi Cheni (STEFANINI, 1918), Wadi Hawwashia, Wadi Gharamul (FOURTAU, 1914), Wadi Hemaiet, Wadi Dara (FOURTAU, 1912).

Portugal: Cenomanian of Ourem, Olival, Alcantara, Baroiço, Sargento-Mor, Fagundo, Coimbra (DE LORIOL, 1887).

Nigeria: Cenomanian-Turonian (BRIGHTON, 1925).

The species seems to be restricted to the Tethyan Cenomanian, being mainly known from Portugal, Egypt and Algeria. A variety (*M. olisiponensis gongilensis*) has been described from Nigeria, in beds of the same age (BRIGHTON, 1925).

STUDIED SPECIMENS

Locality B (sample B1/5), Wadi Qena, Egypt: upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen.

Locality B (sample B2-3), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 5 specimens.

Locality B (sample BIV/2-4), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen.

Locality C (sample CI2), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 7 specimens.

Locality D, Wadi Qena, Egypt; upper member of Atrash Formation Cenomanian-Turonian; 8 specimens.

Locality E (sample E4), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen.

Locality F (sample F120/83), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 6 specimens.

Locality F (sample F122/43), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 2 specimens.

Locality F (sample F123a/83), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 2 specimens.

Locality H, Wadi Qena, Egypt; Atrash Formation, Cenomanian; 4 specimens.

Locality H (sample H1), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 2 specimens.

Locality K (sample K3), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen.

Locality L (sample L1), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 3 specimens (e.g. IST-10467).

Locality M (sample M7), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 4 specimens.

Locality M (sample M10), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 14 specimens e. g. IST-10466).

Locality M (sample M15), Wadi Qena, Egypt; lower member of Tarfa Formation, Turonian; 4 specimens.

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
CI2	41.0	33.4	14.3	—	0.81	0.35	—
	32.9	—	13.4	—	—	0.41	—
	28.0	—	11.5	—	—	0.41	—
	17.0	10.4	6.8	3.0	0.61	0.40	0.18
	16.5	11.0	7.6	—	0.67	0.46	—
	15.9	12.4	—	3.3	0.78	—	0.21
E4	30.4	—	11.6	—	—	0.38	—
F120/83	50.8	41.1	21.6	7.6	0.81	0.43	0.15
	43.7	31.7	15.4	8.5	0.73	0.35	0.19
	41.1	32.0	15.9	—	0.78	0.39	—
	50.0	31.7	13.2	8.5	0.63	0.26	0.17
	29.6	22.0	11.3	5.2	0.74	0.38	0.18
	27.9	20.7	9.9	—	0.74	0.35	—
F122/43	32.9	23.5	—	12.2	0.71	—	0.37
F123	31.8	27.4	10.3	4.8	0.86	0.32	0.15
	33.4	27.7	—	5.1	0.83	—	0.15
	41.6	29.6	—	7.2	0.71	—	0.17
	30.1	20.0	9.4	—	0.66	0.31	—
	24.6	20.2	8.8	—	0.82	0.36	—
F123a/83	31.8	27.4	5.1	10.3	0.86	0.16	0.32
	33.3	27.5	—	—	0.82	—	—
H	46.0	36.3	12.4	7.2	0.79	0.27	0.16
	36.5	26.6	12.6	5.6	0.73	0.35	0.15
	24.8	20.0	8.3	3.9	0.81	0.33	0.16
L1							
IST-10467	37.7	25.3	5.5	11.0	0.67	0.15	0.29
M7	22.8	19.6	—	4.0	0.86	—	0.18
	25.4	19.2	9.1	3.8	0.76	0.36	0.15
	35.0	—	11.2	—	—	0.32	—
M10							
IST-10466	46.3	35.0	5.5	13.8	0.76	0.12	0.30
M10	31.4	22.6	11.7	4.8	0.72	0.37	0.15
	42.6	37.7	—	—	0.88	—	—
	41.9	32.8	—	8.3	0.78	—	0.20
	34.6	23.5	12.3	5.5	0.68	0.36	0.16
	39.7	31.7	13.0	5.7	0.80	0.33	0.14
	21.3	17.5	—	—	0.82	—	—
	47.2	39.9	15.4	—	0.85	0.33	—
	45.0	36.9	11.8	7.3	0.82	0.26	0.16
	29.3	20.5	11.6	5.5	0.70	0.40	0.18
	29.8	23.4	10.40	4.8	0.79	0.35	0.16
	30.1	24.9	10.3	—	0.83	0.34	—
	37.1	27.9	11.9	—	0.75	0.32	—
M15/2	39.5	26.9	—	5.8	0.68	—	0.15
	32.8	25.5	10.9	—	0.78	0.33	—
	39.7	28.2	5.7	—	0.70	0.14	—
	33.2	25.6	—	11.6	0.77	—	0.34
mean	34.1	26.3	11.0	6.8	0.76	0.33	0.20

DESCRIPTION

Medium sized to large *Micropedina*, with hemisphaerical to conical shape.

The apical system is caducous and leaves a small circular hole in the test. Its plates are not preserved in our specimens.

The peristome is not sunken, moderately large, with ten shallow buccal slits. As our specimens are all filled with hard matrix, the perignatic girdle could not be observed.

Ambulacra are straight and consist of 35 compound, trigeminate plates. They correspond to arcs of 27°, being 1/13th of the circumference of the test at the ambitus. Ambulacral plates are arbacioids triads, with a central main component and two demiplates, one aboral and one adoral. The pore-pairs are arranged in oblique arcs of three. The pore-pair on the adapical demiplate of each triad is closest to the adradial suture. There is no narrowing or broadening of the poriferous areas near the peristome. The main component of each triad shows two (three in the largest specimens) small tubercles, which are arranged in irregular vertical series. These tubercles are better developed in the vicinity of the peristome. Minute granules are present near the margins of the plates.

Interambulacra are 1.7 times wider than ambulacra and correspond to arcs of 45°, being 1/8th of the circumference of the test at the ambitus. These plates are horizontally elongated and show numerous small tubercles of the same size as those on ambulacral plates. The number of tubercles is variable and increases with the overall size of the specimen, from seven to 14. They are not arranged in regular vertical series, but on each plate, the tubercles form horizontal rows. Yet, their arrangement shows considerable variability from one plate to another, even in the same specimen. In its simplest form, the tubercles are aligned in a simple series, on the horizontal axis of the plate. Very often, a central tubercles lies slightly off-centre, below the axis of the plate, the remaining tubercles being situated on the upper half. In some plates, three or four tubercles on the interradial half, form a straight series, while the remaining tubercles are arranged in a zig-zag manner adorally and adapically. On many plates, the tubercles are arranged in two series adradially, merging into one interradially. Interambulacral tubercles are better developed adorally. Tiny granules are present near the margins of the plates.

DISCUSSION

The arrangement of the tubercles on interambulacral plates shows considerable variability in *M. olisiponensis*. This has led to the distinction of several "taxa" by former authors: *M. bipatellis* GREGORY, 1906, *M. humei* FOURTAU, 1909 and the species under discussion. They have all been described from the Cenomanian of the Tethys. The *Micropedina*-specimens from the Wadi Qena-area show interambulacral plates of *olisiponensis*-, *bipatellis*- and *humei*-type, often united in the same specimen. Hence, there seems to be no clear distinction between the three "taxa". *M. bipatellis* and *M. humei* are thus junior synonyms of *M. olisiponensis*.

M. cotteaui COQUAND, 1864 was considered a subspecies of *M. olisiponensis* by FOURTAU, 1914. *M. cotteaui* is by no means isolated in time or space from *M. olisiponensis*, so that I feel there is no need to distinguish a separate subspecies or taxon. Hence, *M. cotteaui* and *M. olisiponensis* are subjective synonyms, the latter name having priority.

Superorder Echinacea CLAUS, 1876
Order Temnopleuroida MORTENSEN, 1942
Family Glyphocyphidae DUNCAN, 1889
Genus *Bandelicyphus* nov. gen.

DIAGNOSIS

Specimens showing the following combination of characteristics should be classified in the family of Glyphocyphidae, but they clearly do not belong to any established genus:

1. narrow, ring-shaped, monocyclic apical system;
2. primary tubercles perforate and crenulate;
3. ambulacra polyporous (4- or 5-geminate) at the ambitus and adorally.

Such specimens show some similarity with *Glyphocyphus* and with *Hemidiadema*. Yet, the ambulacra of *Glyphocyphus* are invariably trigeminate, while *Hemidiadema* is easily recognised, because of the characteristic arrangement of its ambital ambulacral tubercles in a single, vertical series. Species showing the characteristics listed above, belong to a new, as yet unnamed genus, which I propose to call *Bandelicyphus*.

Type species

Bandelicyphus qenaensis nov. sp.

Derivatio nominis

Named in honour of my friend and colleague, Prof. Dr. K. BANDEL (University of Hamburg), who discovered and collected the specimens described herein, in the Middle Cretaceous of Wadi Qena, Egypt.

Bandelicyphus qenaensis nov. gen., nov. sp.
Pl. 2, Fig. 1-7.

v 1987 *Glyphocyphus* cf. *radiatus*, GEYS in BANDEL, KUSS and MALCHUS, pl. 1, fig. 3a-b.

Derivatio nominis

Named after Wadi Qena, Egypt, where the specimens under discussion have been discovered and collected.

SPECIMENS STUDIED

Locality J (sample J3), Wadi Qena, Egypt; lower member of Tarfa Formation, Turonian: 30 specimens (e.g. IST-10498, 10499, 10500, 10501).

Holotype

IST-10498, KBIN-collections.

DIMENSIONS

	D	H	ds	dp	h/D	ds/D	dp/D
J3	25.7	13.0	9.6	—	0.50	0.37	—
	28.0	9.1	—	9.6	0.32	—	0.34
	20.4	9.8	5.8	—	0.48	0.28	—
	21.2	8.2	7.4	—	0.38	0.35	—
	15.4	7.0	—	6.2	0.44	—	0.39
	19.7	—	—	6.7	—	—	0.34
	24.5	11.6	6.7	8.0	0.47	0.27	0.32
	18.0	8.3	5.1	7.1	0.46	0.34	0.39
	15.6	6.8	—	6.2	0.43	—	0.39
	22.3	10.5	7.8	—	0.47	0.35	—
	22.3	9.5	5.4	—	0.42	0.24	—
	27.0	8.3	6.3	8.0	0.30	0.23	0.30
	23.5	10.9	7.8	—	0.46	0.33	—
	21.2	10.6	—	6.4	0.50	—	0.30
	17.0	7.6	4.8	5.0	0.44	0.28	0.29
	23.3	10.3	6.6	9.4	0.44	0.28	0.40
	12.3	—	—	5.2	—	—	0.42
	18.6	7.5	6.3	7.7	0.40	0.34	0.41
	17.1	10.4	4.6	—	0.61	0.26	—
	16.6	7.4	—	—	0.44	—	—
	18.2	8.1	5.3	7.9	0.44	0.29	0.43
	18.7	8.0	—	7.9	0.43	—	0.42
	16.1	7.2	4.7	—	0.45	0.29	—
	23.6	12.2	—	9.7	0.46	—	0.41
	19.2	8.5	4.5	8.2	0.44	0.23	0.42
	19.6	11.2	—	8.5	0.57	—	0.43
	17.6	8.4	—	—	0.48	—	—
	13.8	7.2	5.0	6.0	0.52	0.36	0.43
	23.5	11.3	—	6.7	0.49	—	0.28
mean	23.0	9.7	4.6	8.9	0.24	0.50	0.26

DESCRIPTION

Medium sized Glyphocyphid echinoid, with circular, flat, dome-shaped test.

The apical system is small, hardly wider than 1/5th of the ambital diameter. It is monocyclic, its plates forming a narrow ring surrounding a huge periproct.

The peristome is circular and moderately large. It is lightly sunken, situated in the centre of a concave adoral surface. Buccal slits are fairly deep and conspicuous.

Ambulacra are straight and narrow. At the ambitus, their width corresponds to arcs of 16°. Ambulacral plates are 14 in a series. They are compound, of diadematoid type. Sutures between the components of the plates are visible as dirt-filled cracks and grooves. In some specimens, these are widened by weathering and solution. Each plate shows a primary tubercle, which is crenulate and perforate, and which is surrounded by a smooth, conical boss. Primary tubercles are arranged in vertical series. Poriferous zones are sinuous, narrow and simple throughout. The plates are 4-geminate adapically. At the ambitus and adorally, 5-geminate and polyporous plates prevail. Pore-pairs are almost horizontal. In most specimens, fine surface features, such as scrobicular rings and extrascrobicular granulation, have been destroyed by weathering.

Interambulacra are more than thrice as wide as ambulacra, their width corresponding to arcs of 56°. They consist of vertical series, each 10 plates high. Each plate shows a well developed primary tubercle. These are arranged in two vertical series. Scrobicules are not confluent, but separated by a small scrobicular tubercle. Secondary tubercles are absent. Interradial extrascrobicular surfaces are narrow and granulated. In most specimens, fine surface features, such as scrobicular rings, extrascrobicular granulation, sutural pits, etc., are obliterated by weathering.

In some specimens, radioles are preserved, attached to the test. These are cylindrical and slender, with a narrow, crenulated annulus. Sometimes, a very faint longitudinal striation can be seen on the shafts. Most of these radioles however show very few diagnostic features.

DIAGNOSTIC CHARACTERS

1. Narrow, ring-shaped, monocyclic apical sytem.
2. Peristome sunken; concave adoral surface; gill- slits well developed.
3. Ambulacra narrow, 4-geminate adapically, 5-geminate or polyporous at the ambitus and adorally; poriferous zones straight and simple; 14 ambulacral plates in a series.
4. Interambulacra wide; 10 plates in a series.
5. Primary tubercles crenulate, perforate.

DISCUSSION

The species under discussion cannot belong to the genera *Glyphocyphus* or *Hemidiadema*, for reasons explained above. In addition to its polyporous ambulacra, *B. qenaensis* differs from *Glyphocyphus radiatus* (HOENINGHAUS in GOLDFUSS, 1826), from the Cenomanian of Western Europa (COTTEAU, 1864) in the width-ratio of its ambulacra and interambulacra (A/IA-ratio in *G. radiatus* = 0.5; A/IA-ratio in *B. qenaensis* = 0.3).

The only representative of the genus *Glyphocyphus* in the Tethys-province, is *G. intermedius* COTTEAU, 1864 (pl. 1128) from the Cenomanian of southern France. Yet, differences with *B. qenaenis* are considerable: the ambulacra are much wider and the ambulacral tubercles are less numerous in *G. intermedius*.

Because of its monocyclic, annular apical system, *Bandelicyphus* must be closely related to *Glyphocyphus* and to *Hemidiadema*, yet is sufficiently different to justify the establishment of a separate genus.

Order Phymosomatoida MORTENSEN, 1904
Family Phymosomatidae POMEL, 1883
Genus *Rachiosoma* POMEL, 1883

Type species
Cyphosoma delamarrei DESHAYES in AGASSIZ & DESOR, 1846; by subsequent designation of LAMBERT & THIERY, 1911.

Rachiosoma rectilineatum (COTTEAU, PERON & GAUTHIER, 1881)
Pl. 2, Fig. 8-9.

* 1881 *Cyphosoma rectilineatum*, COTTEAU, PERON & GAUTHIER, p. 104-106, pl. 7, fig. 1-4.
v 1985 *Rachiosoma rectilineatum*, BANDEL & GEYS, p. 111, pl. 8, fig. 3-7, pl. 9, fig. 1.

Complete synonymy is given in the latter paper (BANDEL & GEYS, 1985).

Locus typicus
Les Tamarins, near Alger, Algeria.

Stratum typicum
Santonian.

SPECIMENS STUDIED

Locality M (sample M10), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen.
Locality U (sample U8A), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 1 specimen (IST- 10503).

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
M10	20.0	8.6	6.5	8.7	0.43	0.32	0.43
U8A	28.5	10.1	7.2	9.5	0.35	0.28	0.33

DESCRIPTION
The species has been described in detail by BANDEL & GEYS (1985).

DISCUSSION
R. rectilineatum is closely related to the type-species of this genus, *R. delamarrei* (DESHAYES, 1846), from the Turonian of North Africa. Important points of difference have been indicated by BANDEL & GEYS (1985). *R. rectilineatum* is confined to the Tethys and has been found in Algeria, Jordan and Egypt. Its stratigraphical range is fairly wide and can now be extended from basal Turonian (possibly top Cenomanian) up to Santonian beds.

Order Arbacioida GREGORY, 1900
Family Arbaciidae GRAY, 1855
Genus *Goniopygus* AGASSIZ, 1838

Type species
Salenia peltata AGASSIZ, 1836; by original designation.

Goniopygus menardi (DESMAREST, 1825)
Pl. 2, Fig. 10-13.

* 1825 *Echinus Menardi*, DESMAREST, p. 101.
v 1985 *Goniopygus menardi*, BANDEL & GEYS, p. 111-112, pl. 9, fig. 2-6.
v 1985 *Goniopygus menardi*, GEYS, p. 138-139, pl. 3, fig. 8- 9, pl. 4, fig. 1.
v 1987 *Goniopygus menardi*, GEYS in BANDEL, KUSS & MALCHUS, pl. 5, fig. 5a-b.

Extensive synonymy is given in GEYS (1985).

Locus typicus
"Dans les environs du Mans", Sarthe dept., France.

Stratum typicum
Cenomanian.

SPECIMENS STUDIED

Locality E (sample E4), Wadi Qena, Egypt; upper member of Atrash Formation, Cenomanian-Turonian; 4 specimens (e.g. IST-10492 & 10493).

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
E4							
IST-10492	25.7	16.7	10.0	—	0.65	0.39	—
IST-10493	18.0	10.0	8.5	9.8	0.55	0.47	0.54
	25.9	17.2	11.2	—	0.66	0.43	—
	18.7	10.9	—	9.2	0.58	—	0.49
mean	22.1	13.7	9.9	9.5	0.61	0.43	0.51

DESCRIPTION
Previous descriptions of this species have been based on rather poorly preserved specimens (GEYS, 1985; BANDEL & GEYS, 1985). It may therefore be useful to redescribe the species, using the excellent specimens collected in the Wadi Qena.

Large *Goniopygus* with moderately flattened to hemisphaerical test and a flat adoral surface. The peristome is circular, very large and not sunken. Buccal slits are clearly visible in its rim.

The apical system is dicyclic and smooth. It consists of 10 plates, which are firmly connected with each other

and with the coronal plates. Yet, sutures between these plates are clearly visible. Genital plates are heptagonal, one of the extremities directed outwards. The genital pores are situated at the tips of these distal corners. In the madreporite, the same distal extremity shows two depressed poriferous zones, along both sides. The genital plates surround a suboval periproct. Three of the genital plates show a semicircular depression near their proximal borders, so that the periproct seems to be triangular in outline. A small granule is present in each of these depressions. Ocular plates are much smaller than genital plates and pentagonal. One of their sides is directed outwards and slightly concave. A small, but prominent axial extension is present. In outline, the ocular plates vaguely resemble bats. The apical system has the overall appearance of an irregular, 15-pointed star, with five points belonging to genital plates, the remaining being the corners of ocular plates.

Ambulacra are fairly narrow and correspond to arcs of 23° at the ambitus. Ambulacral primary tubercles are non-perforate, non-crenulate. They are 13 to 17 in a series. The plates are trigeminate; the pore-pairs show an adradial inclination of 25°. Scrobicules are hardly developed. Miliary granulation is absent.

Interambulacra are more than twice as wide as ambulacra and correspond to arcs of 49° at the ambitus. Interambulacral primary tubercles are non-perforate, non-crenulate and arranged in vertical series of 6 to 9. The areoles are smooth, conical and confluent along the horizontal sutures. Scrobicular tubercles are large, few and far apart, merely six of them surrounding a scrobicule. Very fine miliary granules are present throughout, inter- and perradially.

DISCUSSION

G. menardi is a readily recognisable species, which seems to be fairly common in Tethyan and Boreal mid-Cretaceous strata, having been recorded from France, Germany, Belgium, Portugal, Algeria, Tunisia, Jordan, Syria and Egypt. The short discussion by GEYS (1985) remains entirely valid.

Apart from *G. menardi*, two other species of *Goniopygus* have been reported from the Mid-Cretaceous of Egypt. *G. coquandi* COTTEAU, 1865, from the Cenomanian of Algeria, differs from the species under discussion in its high, sphaerical shape, its greater number of tubercles, its larger periproct and its sculptured apical system. The species can hardly be confused with *G. menardi*. A second species, *G. innesi* GAUTHIER in FOURTAU, 1901, is only known from younger, Santonian strata. It differs from *G. menardi* in the structure of its apical system and in its ambulacral poriferous zones, which do not widen in the vicinity of the peristome. Moreover, its ambulacral tubercles are fewer and larger than in the latter species.

COQUAND in COTTEAU (1865) described specimens from Algeria as a new species, *G. brossardi*, meanwhile drawing the attention to its similarity with *G. menardi*. As a matter of fact, only the radioles seem to be somewhat different in shape. Similar fossils were discovered in Egypt. FOURTAU (1914) considered them to belong to a subspecies of *G. menardi*. As I have not examined any specimens with radioles attached, I would rather not express an opinion about this claim.

According to STEFANINI (1918), topotypical specimens of *G. menardi* from France are larger and less conical ("piu larghi, meno conici") than specimens from Egypt. For that reason, he described some French, Portuguese and Egyptian specimens as *G. menardi* var. *subconica* STEFANINI, 1918. In my opinion, the differences by which this variety is distinguished from type *G. menardi*, are slight and well within the range of its intraspecific variability. Hence, the name *subconica* should be ignored.

The poorly preserved specimen, described as *G. peroni* FOURTAU, 1904, could well be a fragment of *G. menardi*. Unfortunately, description and figure given by FOURTAU, are insufficiently accurate.

Order Orthopsida MORTENSEN, 1942
Family Orthopsidae DUNCAN, 1889
Genus *Orthopsis* COTTEAU, 1864

Type species
Cidarites miliaris D'ARCHIAC, 1835; by original designation.

Orthopsis miliaris (D'ARCHIAC, 1835)
Pl. 2, Fig. 14-16.

* 1835 *Cidarites miliaris*, D'ARCHIAC, p. 170, pl. 9, fig. 8.
v 1985 *Orthopsis miliaris*, GEYS, pp. 143-144, pl. 5, fig. 8-10.
v 1986 *Orthopsis miliaris*, GEYS & JAGT, pp. 102-145, fig. 4c-g.

Extensive synonymy has been given by GEYS (1985)

Locus typicus
Royan, Charente-Maritime, France.

Stratum typicum
"Etage 4, Senonien".

SPECIMENS STUDIED

Locality W (sample W2A), Wadi Qena, Egypt; lower member of Atrash Formation, Cenomanian; 3 specimens (e.g. IST- 10502).

DIMENSIONS

	D	h	ds	dp	h/D	ds/D	dp/D
W2A	17.7	9.5	—	7.0	0.54	—	0.39
	15.3	8.1	3.4	6.7	0.53	0.22	0.44
	16.1	9.0	—	—	0.56	—	—
mean	16.4	8.9	—	6.8	0.54	—	0.41

DESCRIPTION

I refer to the paper of GEYS (1985), where the species has been described at length.

DISCUSSION

The species has been thoroughly discussed by GEYS (1985) and by GEYS & JAGT (1986). I already pointed out the synonymy of *O. granularis* (AGASSIZ & DESOR, 1846) and *O. miliaris*. *O. miliaris* has a remarkably large stratigraphic and geographic range. It has been reported from the Cenomanian of France, Germany, Spain, Portugal, Yugoslavia, Algeria, Egypt and Israel, from the Turonian and the Coniacian of France and Tunisia, from the Santonian of France, Algeria and Egypt, from the Campanian of France and Spain, as well as from the Maastrichtian of France, Belgium, the Netherlands, Spain and Algeria. Hence, the species lived throughout the Upper Cretaceous, in Boreal and Tethyan realms.

Acknowledgements

I would like to expres my sincere gratitude to K. BANDEL (University of Hamburg, Germany), J. KUSS (Universität Bremen) and N. MALCHUS (Technische Universität, Berlin), for the opportunity to study this most interesting material, to D. CAHEN, director of the Royal Belgian Institute for Natural Sciences in Brussels (KBIN), for working facilities and for access to the collections in their care, to J. ROMAN (Museum National d'Histoire Naturelle, Paris) and D. LEWIS (The Natural History Museum, London, U.K.) for suggestions and improvements and to A. V. DHONDT (KBIN, Brussels) for help in many ways.

References

AGASSIZ, L., (1836). Note sur les fossiles du Jura neuchâtelois. *Mémoire de la Société des Sciences Naturelles de Neuchâtel 1*, 141.

AGASSIZ, L., (1838). Monographie d'Echinodermes vivants et fossiles. I. Des Salénies, 32 pp., 5 pl., Neuchâtel.

AGASSIZ, L., (1839-1840). Description des Echinodermes de la Suisse. *Allgemeine Schweizerische Gesellschaft, Neue Denkschriften 1/1*, 101 pp., pl. 1-13bis; 2/4, 108 pp., pl. 14-23.

AGASSIZ, L. & DESOR, E., (1846). Catalogue raisonné des familles, des genres et des espèces de la classe des échinodermes I. *Annales des Sciences Naturelles (3) Zoologie 6*, 305-374.

BANDEL, K. & GEYS, J.F., (1985). Regular Echinoids in the Upper Cretaceous of the Hashemite Kingdom of Jordan. *Annales de la Société Géologique du Nord 104*, 97-115, pl. 3-9.

BANDEL, K., KUSS, J. & MALCHUS, N., (1987). The sediments of Wadi Qena (Eastern Desert, Egypt). *Journal of African Earth- Science 6*, 427-455.

BRIGHTON, A.G., (1925). On some Cretaceous Echinoids from Nigeria. *Geological Survey of Nigeria*. Occasional Paper 3, 21 pp.

BRONN, H.G., (1860). Klassen und Ordnungen des Thier-Reichs, Vol. 1, Amorphozoen, 434 pp., 48 pl., Leipzig & Heidelberg.

CLAUS, C.F.W., (1876). Grundzüge der Zoologie, V. 1, 7 + 821 pp., V. 2, 4 + 522 pp., Marburg & Leipzig.

COQUAND, H., (1864). Géologie et Paléontologie de la région sud de la province de Constantine, 320 pp., 35 pl., Paris.

COTTEAU, G., (1857-1878). Etudes sur les Echinides fossiles du département de l'Yonne, 518 pp., 84 pl., Paris.

COTTEAU, G., (1861-1867). Paléontologie française. Description des animaux invertébrés commencée par Alcide d'Orbigny. Terrain Crétacé 7, Echinides Réguliers, 892 pp., pl. 1007-1204, Paris.

COTTEAU, G., PERON, P. & GAUTHIER, V., (1876-1884). Echinides fossiles d'Algérie. Description des espèces déjà recueillis dans ce pays et considérations sur leur position stratigraphique. Terrains Secondaires I. Terrains Jurassiques, étage Tithonique, Néocomien, Urgo-Aptien, Albien et Cénomanien, 235 pp., 41 pl., Paris.

D'ARCHIAC, A., (1835). Mémoire sur la formation Crétacée du Sud-Ouest de la France. *Mémoires de la Société Géologique de France (1) 2*, 157-192, pl. 11-13.

DE LAMARCK, J.B., (1816). Histoire naturelle des animaux sans vertèbres,... Tome III, 586 pp., Paris.

DE LORIOL, P., (1887-1888). Recueil d'Etudes paléontologiques sur la faune Crétacique du Portugal. II. Description des Echinodermes, 123 pp., 22 pl., Lisboa.

DESMAREST, A.G., (1825). Oursin, in DEFRANCE (ed.), Dictionaire des Sciences Naturelles 37, 59-102, Strasbourg & Paris.

DESOR, E., (1855-1859). Synopsis des Echinides fossiles, 490 pp., 44 pl., Paris.

DUNCAN, P.M., (1889). On the Echinoidea of the Cretaceous of the Lower Narbada Region. *Quarterly Journal of the Geological Society of London 43*, 150-155.

FORBES, E., (1850). Description of fossil Echinidae from Portugal. *Quarterly Journal of the Geological Society of London 6*, 195-199.

FOURTAU, R., (1900). Notes sur les Echinides fossiles de l'Egypte I. *Bulletin de l'Institut Egyptien (4) 1*, 165-167.

FOURTAU, R., (1901). Notes sur les Echinides fossiles de l'Egypte II. *Bulletin de l'Institut Egyptien (4) 2*, 31-117, pl. 1-6.

FOURTAU, R., (1905). Notes sur les Echinides fossiles de l'Egypte III. *Bulletin de l'Institut Egyptien (4) 5*, 121-140, pl. 1.

FOURTAU, R., (1909). Description des Echinides fossiles recueillis par MM. W.F. Hume et John Ball dans le désert Libyque et le nord du désert Arabique. *Mémoire de l'Institut Egyptien 6*, 93-175, pl. 6-9.

FOURTAU, R., (1912). Notes sur les Echinides fossiles de l'Egypte IV. *Bulletin de l'Institut Egyptien (5) 5*, 137-176, pl. 1-3.

FOURTAU, R., (1913). Notes sur les Echinides fossiles de l'Egypte V. *Bulletin de l'Institut Egyptien (5) 7*, 62-71, pl. 6.

FOURTAU, R., (1914). Catalogue des invertébrés fossiles de l'Egypte, représntés dans les collections du Musée de Géologie au Caire. Terrains Crétacés, 1re Partie: Echinodermes. *Geological Survey of Egypt, Palaeontological Series 2*, 109 pp., 8 pl.

GEYS, J.F., (1985). Regular Echinoids from the Cenomanian of Hainaut (Belgium and France). *Bulletin van de Belgische Vereniging voor Geologie 94*, 129-157.

GEYS, J.F., (1989). Hemicidaroid Echinoids from Upper Cretaceous deposits in the Wadi Qena-area (Eastern Desert, Egypt). *Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen - Aardwetenschappen 59*, 127-135.

GEYS, J.F. & JAGT, J., (1986). Additional Regular Echinoids from the Upper Cretaceous in the Maastricht area (Belgium). *Paläontologische Zeitschrift 60*, 93-107.

GOLDFUSS, A., (1826-1844). Petrefacta Germaniae. Abbildungen und Beschreibungen der Petrefacten Deutschlands und der angrenzenden Länder, 252 + 312 + 128 pp., 200 pl., Düsseldorf.

GRAY, J.E., (1855). An arrangement of the families of Echinida, with description of some new genera and species. *Proceedings of the Zoological Society of London 23*, 35-39.

GREGORY, J.W., (1900). Echinoidea, in LANKESTER, E.R. (ed.), A treatise on Zoology III, The Echinodermata, pp. 282-332. London.

GREGORY, J.W., (1906). Fossil Echinoidea from Sinai and Egypt. *Geological Magazine (New Series) Dec. 5 3*, 216-255, pl. 10-11.

LAMBERT, J., (1909). Révision de quelques Cidaridae de la Craie. *Bulletin de la Société Scientifique d'Histoire Naturelle de l'Yonne 62*, 114-175, pl. 72.

LAMBERT, J., (1931-1933). Etude sur les Echinides fossiles du Nord de l'Afrique. *Mémoires de la Société Géologique de France, Nouvelle Série 16*, 228 pp., 8 pl.

LAMBERT, J. & THIERY, P., (1909-1925). Essai de nomenclature raisonnée des Echinides, 607 pp., 15 pl., Chaumont.

MORTENSEN, T., (1904). The Danish expedition to Siam, 1899- 1900. II. Echinoidea. *Kongelige Danske Videnskabernes Selskabs Skrifter (7) 1*, 1-124, 7 pl.

MORTENSEN, T., (1928). A Monograph of the Echinoidea. I. Cidaroidea, 551 pp., 88 pl. Köbenhavn.

MORTENSEN, T., (1939). New Echinoidea (Aulodonta). *Videnskabelige Meddelelser Dansk Naturhistorsk Forenig 103*, 547-559.

MORTENSEN, T., (1940). A Monograph of the Echinoidea. III 1. Aulodonta. With additions to Vol. II (Lepidocentroida and Stirodonta), 370 pp., 77 pl. Köbenhavn.

MORTENSEN, T., (1942). New Echinoidea (Camarodonta). *Videnskabelige Meddelelser Dansk Naturhistorisk Forenig 106*, 225-232.

POMEL, A. (1883). Classification méthodique et générale des Echinides vivants et fossiles, 131 pp., 1 pl., Alger.

STEFANINI, G. (1918). Echinidi Cretacei e Terziari d'Egitto, racolti da Antonio Figari Bey (parte prima). *Bolletino de la Societa Geologica Italiana 37*, 121-168.

Joris F. GEYS
Dienst voor Delfstofkunde,
Aardkunde en Fysische
Aardrijkskunde
Universiteit Antwerpen (R.U.C.A.)
Groenenborgerlaan 171
B-2020 Antwerpen
Belgium

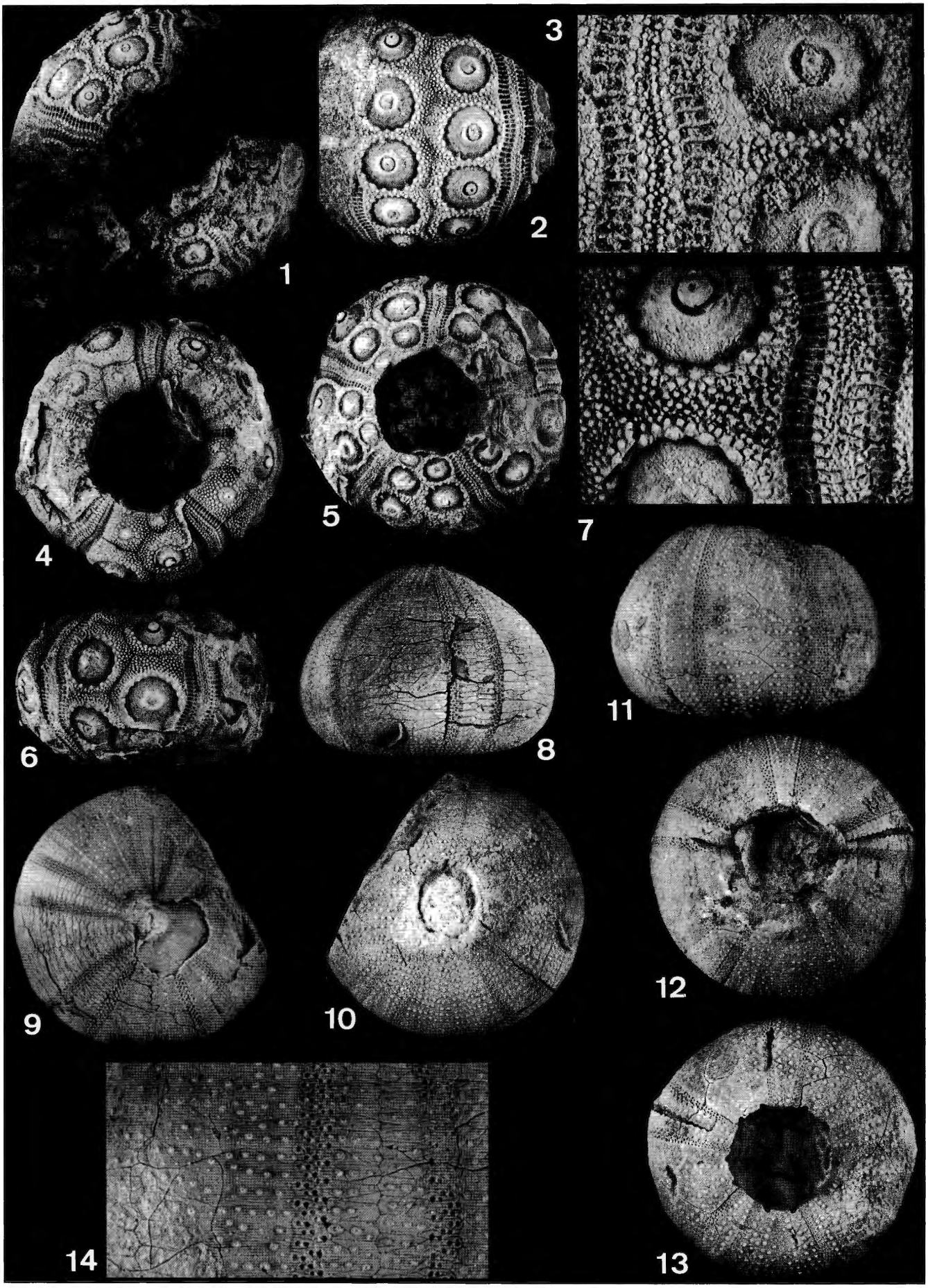
1
2
3
4
5
6
7
8
9
10
11
12
13
14

PLATE 1

1 — *Desoricidaris balli* (FOURTAU, 1914); Il-Heiz Member, Bahariya Formation, Upper Cenomanian; El-Riz, Bahariya Oasis, Egypt; KBIN IST-10496; adoral view; x 1,5.

2 — Idem, same specimen; lateral viex; x 1,5.

3 — Idem, same specimen; ambital detail of ambulacrum and interambulacrum; x 4.

4 — *Desoricidaris pouyannei* (COTTEAU, 1863); Upper member of Atrash Formatio, Cenomanian-Turonian; Locality B (sample B2-3), Wadi Qena, Egypt; KBIN IST-10462; adapical view; x 1,5.

5 — Idem, same specimen: adoral view; x 1,5.

6 — Idem, same specimen: lateral view; x 1,5.

7 — Idem, same specimen; ambital detail of ambulacrum and interambulacrum; x 4.

8 — *Micropedina olisiponensis* (FORBES, 1850); Upper Member of Atrash Formation, Cenomanian-Turonian; Locality M (sample M10), Wadi Qena, Egypt; KBIN IST-10466; lateral view; x 1,5.

9 — Idem, same specimen; adapical view; x 1,5.

10 — Idem, same specimen; adoral view; x 1,5.

11 — Idem; Upper Member of Atrash Formation; Locality L (sample L1), Wadi Qena, Egypt; KBIN IST-10467; lateral view; x 1,5.

12 — Idem, same specimen; adapical view; x 1,5.

13 — Idem, same specimen; adoral view; x 1,5.

14 — Idem, same specimen; ambital detail of ambulacrum and interambulacrum; x 3.

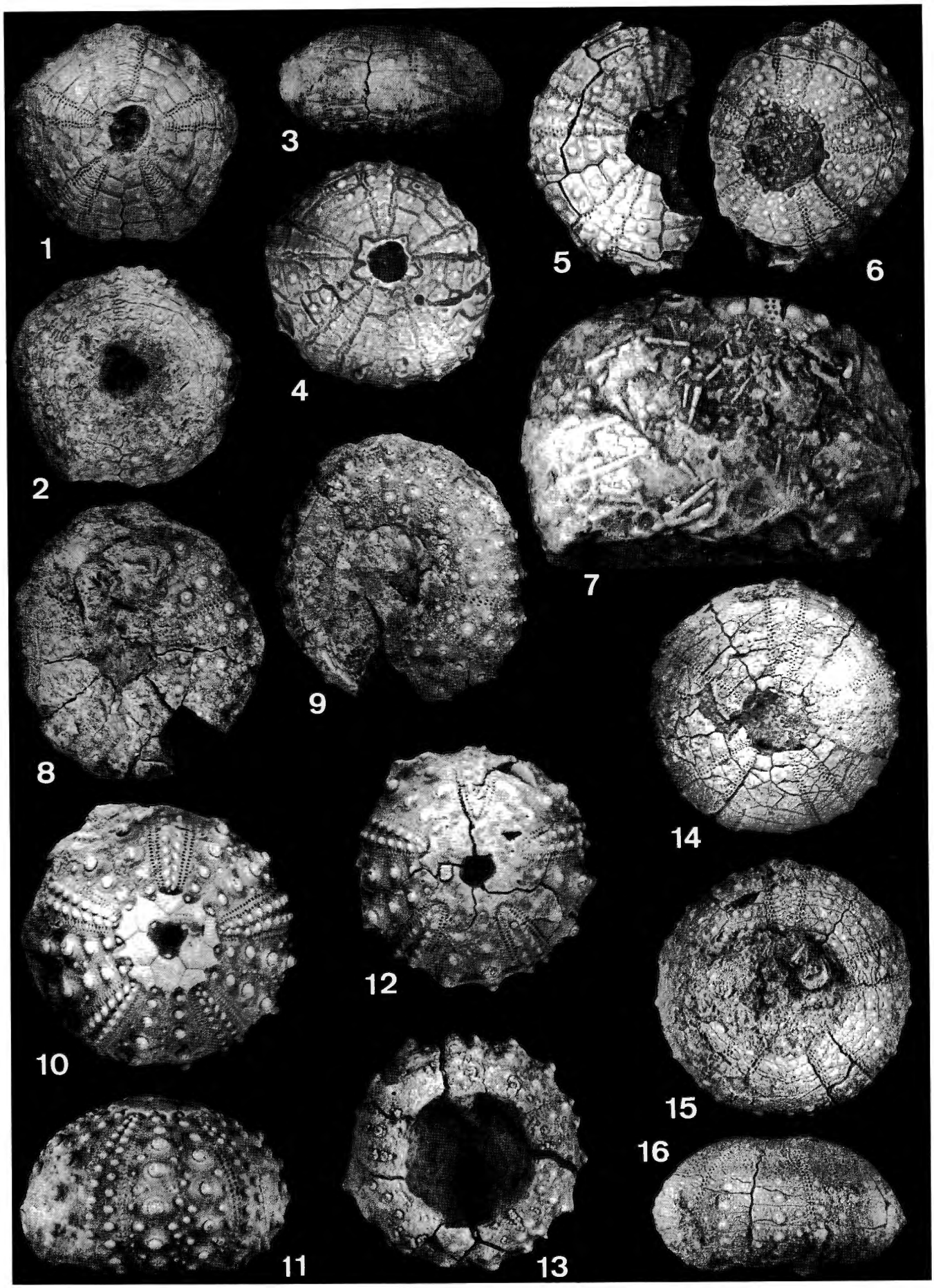
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

PLATE 2

1 — *Bandelicyphus qenaensis* n. g. & n. sp.; Lower member of Tarfa Formation, Turonian; Locality J (sample J3), Wadi Qena, Egypt; KBIN IST-10498; adapical view; x 2.

2 — Idem, same specimen; adoral view; x 2.

3 — Idem, same specimen; lateral view; x 2.

4 — Idem, KBIN IST-10499; adapical view; x 2

5 — Idem, KBIN IST-10500; adapical view; x 2.

6 — Idem, same specimen; adoral view; x 2.

7 — Idem, KBIN IST-10501; adapical side of corona, with radioles; x 4.

8 — *Rachiosoma rectilineatum* (COTTEAU, PERON & GAUTHIER, 1881); Upper Member of Atrash Formation, Cenomanian-Turonian; Locality U (sample U8A), Wadi Qena, Egypt; KBIN IST-10503; adapical view; x 1,5.

9 — Idem, same specimen; adoral view; x 1,5.

10 — *Goniopygus menardi* (DESMAREST, 1825); Upper member of Atrash Formation, Cenomanian-Turonian; Locality E (sample E4), Wadi Qena, Egypt; KBIN IST-10492; adapical view; x 2.

11 — Idem, same specimen; lateral view; x 2.

12 — Idem, KBIN IST-10493; adapical view; x 2,5.

13 — Idem, same specimen; adoral view; x 2,5.

14 — *Orthopsis miliaris* (D'ARCHIAC, 1835); Lower member of Atrash Formation, Cenomanian; Locality W (sample W2A), Wadi Qena, Egypt; KBIN IST-10502; adapical view; x 3.

15 — Idem, same specimen; adoral view; x 3.

16 — Idem, same specimen; lateral view; x 3.