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REGULAR ECHINOIDS FROM THE TURONIAN AND THE CONIACIAN (UPPER CRETACEOUS) OF THE MONS BASIN (BELGIUM)

BY

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(With one textfigure and four plates)

SUMMARY

Three Turonian and two Coniacian species of regular echinoids are described, belonging to three different orders. Two of these species cannot be specifically identified, owing to their state of preservation. One new species is described : *Salenia cherei* nov. sp.

RESUME

Trois espèces d'échinides réguliers du Turonien et deux du Coniacien, appartenant à trois ordres différents, sont décrites. Deux de ces espèces sont inidentifiables, à cause de leur état de conservation. Une espèce nouvelle est décrite : *Salenia cherei* nov. sp.

1. INTRODUCTION

This is the fifth paper of a series, dealing with the systematic revision of the regular echinoids from the Belgian Cretaceous.

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Regular echinoids appear to be rare in Turonian and Coniacian strata of the Mons Basin.

Previous systematic treatment of these echinoids, by J. SMISER (1935), was based essentially on the collections of the « Koninklijk Belgisch Instituut voor Natuurwetenschappen » (K. B. I. N.), then called « Musée Royal d'Histoire Naturelle de Belgique », in Brussels. Earlier, material from some private collections was studied by G. COTTEAU (1874). The present paper, limited to the collections of the K. B. I. N., but including more recently acquired material, presents a systematic revision of the regular echinoids from the Turonian and Coniacian of Belgium, adopting the classification of the « Treatise on Invertebrate Paleontology » (H. FELL & D. PAWSON, 1966).

In the collections of the K. B. I. N. two species from Coniacian and three from Turonian strata are present. Two of those are in such a fragmentary condition, that proper identification is impossible. They are indicated as « type 1 » and « type 2 ». The remaining three species belong to the genera *Tylocidaris*, *Salenia* and *Gauthieria*.

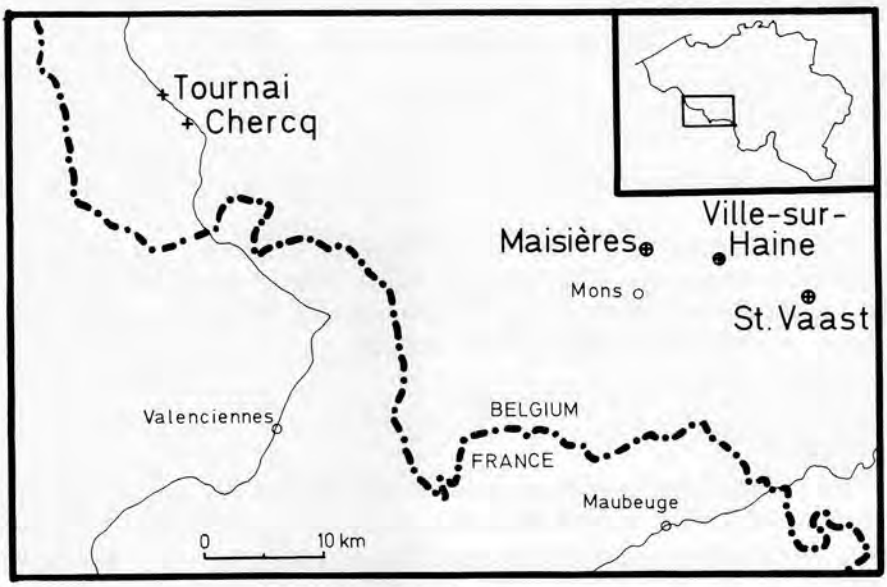

Fig. 1. — Localities where Turonian (+) and Coniacian (⊕) regular echinoids have been found.

Two echinoids-bearing deposits are of importance in this paper. The Dièves deposits are generally considered to be of Turonian age. Though the « Dièves » are now divided into different lithostratigraphical units, as proposed by F. ROBASZYNSKI (1975).

The Maisières Chalk was formerly believed to be of Turonian age (R. MARLIERE, 1954). More recently this deposit has been proved to be

Coniacian (T. MOORKENS, 1969; J. HERMAN, 1975; F. ROBASZYNSKI, 1975). The stratigraphical distribution of the investigated specimens is shown in table 1.

TABLE 1

Stratigraphical distribution of the specimens discussed in this paper (number of specimens).

	Tylocidaris clavigera	Cidaroid type 1	Cidaroid type 2	*Salenia cherei* nov. sp.	*Gauthieria radiata radiata*
Coniacian					
Maisières Chalk	—	—	2	—	5
Turonian					
Dièves (Thulin Fm. & Thivencelles Fm.)	1	3	—	1	1

Treatise terminology is used in the descriptions.

Dimensions are measured by means of callipers; the absolute error is 0.1 mm.

Numerous radioles of several cidaroid species are conserved in the K. B. I. N. collections. The specific attribution of these fossils is too uncertain; they were not discussed in the present paper.

ABREVIATIONS

1. Morphological terms :

   D : ambital diameter of the test
   h : height of the test;
   dsI : diameter of the apical system, from 3 to V.
   dsII : diameter of the apical system, from 2 to IV.
   dp : diameter of the peristome

2. Stratigraphical terms.

   Co : Coniacian;
   Tu : Turonian.

3. Geographical terms.

   Unless otherwise stated, all localities are situated in the province of Hainaut, Belgium.

4. In the synonymy lists, the conventional signs, used by A. V. DHONDT (1972) are adopted.

2. Ordo CIDAROIDA CLAUS, 1880

2.1 Familia *PSYCHOCIDARIDAE* IKEDA, 1936

2.1.1. Genus Tylocidaris POMEL, 1883

Type-species. — *Cidaris clavigera* KÖNIG, 1822, by subsequent designation of J. LAMBERT & P. THIERY (1910).

Diagnosis. — Test low, of moderate size; plates with rigid sutures; areoles large, sunken; primary tubercles large, non crenulate, non perforate, except for some immature ones; primary spines glandiform, cylindrical or bottle shaped, without coarse thorns (T. MORTENSEN, 1928; H. B. FELL, 1966).

2.1.1.1. Tylocidaris clavigera (KÖNIG in MANTELL, 1822)

(Pl. 1, fig. 1-5; Pl. 2, fig. 1-3)

1811 — *Cidaris papillata* var. *spinis claviculatis*, J. PARKINSON, pl. 4, fig. 1 + 21.
* . 1822 — *Cidaris clavigera*, KÖNIG in G. MANTELL, p. 194, pl. 17, fig. 11 + 14.
v . 1836 — *Cidaris clavigera*, L. AGASSIZ, p. 188 (pro parte).
v . 1840 — *Cidaris clavigera*, L. AGASSIZ, p. 10 (pro parte).
1840 — *Cidaris clavigera*, W. HISINGER, pl. 26, fig. 5-6.
1843 — *Cidaris clavigera*, J. MORRIS, p. 49.
v . 1846 — *Cidaris clavigera*, L. AGASSIZ & E. DESOR, p. 327.
. 1846 — *Cidaris clavigera*, A. E. v. REUSS, p. 57, pl. 22, fig. 17-20 (non fig. 21).
. 1848 — *Cidaris clavigera*, H. G. BRONN, p. 298.
1850 — *Cidaris clavigera*, L. SORIGNET, p. 1.
1850 — *Cidaris clavigera*, E. FORBES in F. DIXON, p. 338, pl. 25, fig. 10-11, 14, 18-20, 22.
. 1850 — *Cidaris clavigera*, H. GEINITZ, p. 90.
1852 — *Cidaris clavigera*, C. G. GIEBEL, p. 318.
. 1855 — *Cidaris clavigera*, E. DESOR, p. 12-13, pl. 6, fig. 15.
* v . 1855 — *Cidaris heberti*, E. DESOR, p. 12.
v . 1862 — *Cidaris clavigera*, G. COTTEAU, p. 285-293, pl. 1069, 1070, 1071 fig. 1-4.
. 1864 — *Cidaris clavigera*, T. WRIGHT, p. 48-51, 71-75, pl. 4, 5, fig. 1-15.
1874 — *Cidaris clavigera*, G. COTTEAU, p. 640.
. 1875 — *Cidaris clavigera*, F. QUENSTEDT, p. 185-186, pl. 68, fig. 42-44.

. 1878 — *Cidaris clavigera,* G. COTTEAU, p. 434-437, pl. 77, fig. 6-9.
(1881) — *Cidaris clavigera,* M. MOURLON, p. 91.
. 1885 — *Cidaris clavigera,* F. QUENSTEDT, p. 873, pl. 68, fig. 57.
1887 — *Cidaris clavigera,* V. GAUTHIER, p. 252.
. 1892 — *Tylocidaris clavigera,* C. SCHLÜTER, p. 45-52, pl. 14, fig. 1-5.
. 1910 — *Tylocidaris clavigera,* J. LAMBERT & P. THIERY, p. 156.
. 1911 — *Tylocidaris clavigera,* J. LAMBERT, p. 61, pl. 2, fig. 28.
. 1928 — *Tylocidaris clavigera,* T. MORTENSEN, p. 485-486, fig. 151, 153.
v . 1928 — *Tylocidaris clavigera,* J. LAMBERT & A. JEANNET, p. 145, 149, 209.
(1933) — *Tylocidaris clavigera,* E. MAILLIEUX, p. 146.
v . 1935 — *Cidaris vesiculosa,* J. SMISER, p. 16-17 (pro parte).
1939 — *Tylocidaris clavigera,* R. KONGIEL, p. 15, pl. 2, fig. 8-9.
. 1953 — *Tylocidaris clavigera,* H. TERMIER & G. TERMIER, p. 890.
(1964) — *Cidaris (Tylocidaris) clavigera,* H. ARNOLD, p. 310.
. 1966 — *Tylocidaris clavigera,* H. B. FELL, p. U339, fig. 252, 2.
1968 — *Tylocidaris clavigera,* V. A. HYNDA, p. 200, pl. 40, fig. 19.
. 1970 — *Cidaris clavigera,* R. BLACK, p. 109, fig. 63.
(1970) — *Tylocidaris clavigera,* A. BLASZKIEWICZ, e.a., p. 159.
1974 — *Tylocidaris clavigera,* O. V. SAVCHINSKAYA, p. 309, pl. 94, fig. 3.
1979 — *Cidaris clavigera,* D. FOURNIER, p. 9.
non 1840 — *Cidaris clavigera,* F. A. ROEMER, p. 28, pl. 6, fig. 7.
non 1928 — *Tylocidaris clavigera,* J. LAMBERT & A. JEANNET, p. 128.

Locus typicus. — Lewes, Co. Sussex, England.
(*Cidaris heberti* : Vendôme, Loir-et-Cher, France).

Stratum typicum. — « White Chalk », presumably Lower Santonian.
(*Cidaris heberti* : « Craie chloritée », Cenomanian).

Designation of a neotype (*).

When the species was originally described by KÖNIG, it was based on isolated radioles. These specimens seem to be lost. The designation of a neotype, showing both the corona and the radioles, is therefore required. A very suitable specimen was figured by E. FORBES (1850) (pl. 25, fig. 10). This will be the neotype of *Tylocidaris clavigera.*

(*) Recently (September 1980), a very fine topotype specimen was discovered in Lower Santonian beds, at Tarring Neville, near Lewes, Sussex, by Mr. A. Gale.

The neotype's particulars are :

Locality : Gravesend, Kent, England.

Stratum : Foraminiferal Assemblage zone D, Upper *Coranguineum*-Zone, Lower Santonian (according to H. W. BAILEY, in letter, who kindly examined the foraminifers, obtained from the fossils matrix).

Collection : British Museum (Natural History), n° BM 39998.

Other occurrences outside the Mons Basin.

Great Britain : « White Chalk » of Kent, Sussex, Wiltshire, Dorset (T. WRIGHT, 1862).

France : « Senonian » of Seine-Maritime, Somme, Eure, Oise, Seine-et-Oise, Eure-et-Loire (G. COTTEAU, 1862); « Craie à *Holaster planus*, à *Micraster cortestudinarium* et à *Micraster coranguineum* » of Yonne (G. COTTEAU, 1878); Santonian of Aude (J. LAMBERT, 1911).

Germany : Lower Senonian of the Hannover-district (C. SCHLÜTER, 1892; H. ARNOLD, 1964).

Sweden : Campanian of Scania (W. HISINGER, 1840).

U. S S. R. : Upper Turonian of W. Ukrainia (R. KONGIEL, 1939); Turonian of the Don Basin (V. A. HYNDA, 1968).

Figured specimen in the K.B.I.N. collection.

N° IST 10184, figured herein, Pl. 1, fig. 4-5, and Pl. 2, fig. 1-2.

Belgian specimens studied.

Dièves deposit, at Chercq, Hainaut, Belgium : 1 interambulacrum, with parts of neighbouring ambulacrum.

Dimensions.

h = 21.7 mm;
width of the interambulacrum at the ambitus : 25.7 mm;
diameter of ambital scrobicules : 17.4 mm;
diameter of ambital primary tubercles : 2 8 mm;
width of ambulacrum at the ambitus : 3.4 mm.

Description.

Medium sized *Tylocidaris*.

The peristome is not sunken; gill slits are absent.

Ambulacra are very narrow and slightly sinuous. Poriferous zones are depressed. The pores are circular and large. The pore pairs are subhorizontal. Between the pores of a pair, a small granule is present, limited to the adoral side by a distinct neural furrow. Four series of granules occur on the interporiferous area. The outer granules, near the pores, are better develloped than the inner ones. At the ambitus, an interambulacral plate is bordered by 12 or 13 ambulacral plates.

Interambulacral primary tubercles are 5 or 6 in a series. They are non crenulate, non perforate. The mamelons are quite large and hemispherical. The areoles are smooth and not very deep. Scrobicular rings consist of 15 or 16 scrobicular tubercles. The areoles are non confluent, except in the immediate vicinity of the peristome. Interradial extrascrobicular surfaces are, at the ambitus, as wide as the scrobicules. On the uppermost interambulacral plate, the primary tubercle and its areole are rudimentary. As the tubercles in the vicinity of the apex were damaged, it was not possible to establish whether they were perforate like those of *Tylocidaris clavigera*. Interradial extrascrobicular surfaces are covered with a coarse, dense and irregular granulation. Near the apical system, the interradial suture is visible as a narrow groove. The suture is nowhere sunken.

Discussion.

A few related species are compared below. *T. bowerbanki* (E. FORBES in F. DIXON, 1850) (Cenomanian of England) has six rows of granules in its ambulacrum, instead of four; its interambulacral miliary surfaces are wider than in *T. clavigera*.

T. ramondi (LEYMERIE, 1851) (« Senonian » of S. W. France) is larger, has more primary tubercles in an interambulacral series (6-7) and has wider miliary surfaces with finer granulation.

T. balthica (SCHLÜTER, 1892) (Maastrichtian of N. Germany) has smaller primary tubercles than *T. clavigera* and these are separated from the adradial suture by a narrow granulated area.

T. vexiliferum (SCHLÜTER, 1892) (Maastrichtian of N. Germany) has a coarser granulation on its interambulacral extrascrobicular surfaces; its areoles are deeper and its interradial suture is depressed.

T. velifera (BRONN, 1835) (Cenomanian of W. Europe) is characterised by having perforate primary tubercles on its adapical side.

Many records of *T. clavigera* are based on finds of isolated radioles. Though the radioles have certain diagnostic features, characteristic to each species, identification based on spines alone remains more or less hazardous and must be treated with utmost caution.

Cidaris heberti DESOR, 1855 has already been recognized as a synonym of *T. clavigera* by G. COTTEAU (1862).

J. SMISER (1935) identified the specimen from Chercq as *Cidaris vesiculosa* (GOLDFUSS, 1826). This is obviously an error : *Cidaris vesiculosa* belongs to *Stereocidaris,* a genus easy to distinguish from *Tylocidaris.*

Specimen n° 86 from Agassiz' collection is clearly not a *Tylocidaris* : it has perforate tubercles. Hence, AGASSIZ (1836, 1840) and J. LAMBERT & A. JEANNET (1928) were mistaken.

2.2. Fragmental material of Cidaroid Echinoids

Cidaroids Echinoids are rarely found as complete or nearly complete coronas. Isolated spines and coronal plates are far more widespread

(P. M. KIER, 1977). In both cases the taxonomic value of such fragmental material is limited. It is rarely possible to attribute small fragments of Cidaroid Echinoids to definite species. Still less justified is the establishment of new species, merely based on such fragments, as has been done on various occasions in the past.

Fragments of Cidaroid Echinoids were found in Turonian strata in Belgium, but they are not very numerous. Their state of preservation does not permit a specific identification, yet it is possible to recognize two readily distinguishable entities. Both types described in the next paragraphs are completely arbitrary units. Therefore I avoid calling them « species ».

2.2.1. Cidaroid type 1
(Pl. 3, fig. 6)

Figured specimen in the K.B.I.N. collections.

N° IST 10185, figured herein, Pl. 3, fig. 6.

Specimens studied.

Dièves deposit, at Chercq, Hainaut : 3 fragments.

Description.

Ambulacra are sinuous and narrow. The interporiferous area shows four series of granules, the outer of which are larger. The inner granules, near the perradial suture, are less well developed and inconspicuous. The pores are large, circular and close together, separated by a very narrow, slightly elevated interporal partition. A neural groove is clearly visible with each pore pair. The pairs have an inclination of about 30°. The poriferous areas are not depressed. The largest interambulacral plate is faced by 14 ambulacral plates.

Interambulacral primary tubercles are perforate, non crenulate. Areoles are smooth and not very deep. Scrobicular rings consist of 30 scrobicular tubercles. The rings are continuous and touch the adradial suture. Scrobicules are not confluent. Extrascrobicular areas are covered with a dense, very coarse granulation. The horizontal and the interradial sutures are marked by deep sutural depressions.

Discussion.

The plates bear some likeness to those of « *Cidaris* » *forchhammeri* AGASSIZ & DESOR, 1846 (G. COTTEAU, 1862, pl. 1078). The scrobicular tubercles of the latter are however coarser and less numerous.

Owing to the presence of deep sutural grooves, the « type 1 » could belong to *Stereocidaris*.

Stereocidaris sceptrifera (MANTELL, 1822) has plates not unlike those here described. Its pores are wider apart and the pairs are less inclined.

2.2.2. Cidaroid type 2
(Pl. 3, fig. 1)

Figured specimen in the K.B.I.N. collections.

N° IST 10186, figured herein, Pl. 3, fig. 1.

Specimens studied.

Maisières Chalk, at Maisières, Hainaut, Belgium : 2 fragments.

Description.

Ambulacra are relatively wide. The poriferous zones are not sunken. The pores are oval. A wide interporal partition separates the members of a pore pair and bears a low granule. Conspicuous neural grooves surround these granules adorally. Pore pairs are subhorizontal. The interporiferous zones are wide and show 6 series of granules, which loose importance towards the perradial suture, the innermost series of granules being almost rudimentary. One interambulacral plate is faced by 16 ambulacral plates.

Interambulacral primary tubercles are perforate, non crenulate. The areoles are smooth and not very deep. The scrobicular ring consists of 20 small tubercles, hardly discernable from the granules covering the miliary surfaces. The ring is continuous and does not touch the adradial suture. The scrobicules are not confluent. Extrascrobicular areas are covered with a dense and coarse granulation, growing slightly finer towards the sutures. The presence of sutural grooves cannot be established.

Discussion.

As the features of these fragments merely show family characteristics, I did not attempt to assign them to a given genus or species.

3. Ordo SALENIOIDA DELAGE & HEROUARD, 1903

Familia *SALENIIDAE* AGASSIZ, 1838

Subfamilia SALENIINAE AGASSIZ, 1838

3.1. Genus Salenia GRAY, 1835

Type-species. — *Cidarites scutigera* MÜNSTER in GOLDFUSS, 1826, by original designation

Diagnosis. — Differs from *Salenocidaris* and *Salenidia* only in its ambulacra which consist throughout of bigeminate plates, each with one primary tubercle and two pore pairs; pore zones do not widen in

the vicinity of the peristome (T. MORTENSEN, 1935; H. B. FELL & D. L. PAWSON, 1966).

3.1.1. Salenia cherei nov. sp.
(Pl. 3, fig. 2-5; Pl. 4, fig. 1)

v . 1980 — *Salenia* nov. sp., J. F. GEYS (b), p. 42.

Stratum typicum. — Dièves deposits, Turonian.

Locus typicus. — Chercq (Cornet quarry), Hainaut, Belgium.

Holotype. — N° IST 10187, conserved at the K. B. I. N. in Brussels, figured herein, Pl. 3, fig. 2-5 and Pl. 4, fig. 1.

Derivatio nominis. — From Chereum, latinized form of the type locality Chercq, mentioned in a charter of 1145.

Specimens studied.

Dièves deposits, at Chercq, Hainaut :1 specimen (the holotype).

Dimensions.

D = 13.2 mm

h = 8.7 mm; h/D = 0.66;

dsI = 7.9 mm; dsI/D = 0.60;

dp = 5.6 mm; dp/D = 0.42.

Description.

The apical system is convex, but not conical. The peristome is very slightly sunken, the adoral side of the test being nearly flat. The peristome is subcircular in outline. Gill slits are small but inconspicuous, and surrounded by ridges, narrow adradially, wide and triangular interradially. Girdle features are not visible.

The apical system is of moderate size. The 11 plates are separated by well marked sutures and a large number of sutural depression. It is subpentagonal in outline. The ocular plates are triangular, with slightly convex distal borders and a small, wide axial extension. The distal borders of the genitals are smoothly convex. Large genital pores are situated in the middle of the plates. Genital 2, the madreporite, shows a slit-like poriferous depression, from the center of the plate towards its suture with ocular III. All the plates are covered with a uniform, dense, irregular granulation; no other ornamentation is present on the apical system. The periproct is triangular; its borders are slightly raised and sharp.

Interambulacral tubercles are crenulate, non perforate. Each series consists of 4 or 5 primary tubercles. The areoles are large, smooth and conical, but never confluent. Rings of 7 scrobicular tubercles are open towards the adradial suture. The interradial extrascrobicular surfaces are of moderate width. They show a coarse, but rather thin granulation.

At the ambitus, each interambulacral plate is faced by six ambulacral plates. The ambulacra are narrow and slightly sinuous. Non crenulate, non perforate primary tubercles are arranged in series of 17 or 18. The largest tubercles do not occur at the ambitus, but, strangely enough, adorally. The ambulacra have their maximum width at the same spot : about at the fourth primary tubercle from the peristome. Along the perradial suture the granulation is sparse. One zig-zag line of coarse granules is present. This granulation attains its maximal density again in the vicinity of the fourth primary tubercles from the peristome. Ambulacral plates are regularly bigeminate. Pore pairs have an inclination of about 45°.

Discussion.

Very few Salenioid species have a granulation of this kind on their apical system.

The granulation is coarser, the apical system more regularly pentagonal and smaller, the sutural depressions larger, the poriferous zones less sinuous, the ambulacral tubercles more numerous, etc. in *Salenia rugosa* ARCHIAC, 1846 (G. COTTEAU, 1861 : pl. 1035) (Cenomanian of France).

In *S. obnupta* (SCHLÜTER, 1892) (pl. 19, fig. 1-6) (Maastrichtian of N. Germany) the interradial extrascrobicular surfaces are granulated in a different fashion, the apical system covers the complete adapical side, sutural depressions are absent, ambulacral tubercles are considerably smaller, etc.

S. granulosa FORBES, 1850 (T. WRIGHT, 1872 : pl. 43, fig. 1) (Turonian of W. Europe) has a finer and more dense interradial extrascrobicular granulation. Its apical system shows almost no sutures and no sutural depressions. Its ambulacral tubercles are less numerous.

The plates of the apical system of *Salenidia scabra* NESTLER, 1965 (p. 988, fig. 7) (Maastrichtian of the G. D. R.) show radiating wavy ridges; the genital pores are displaced towards the suranal plate; the inclination of the pore pairs is steeper; the ambulacral plates are simple and the species belongs to a different genus.

Trisalenia janeti (COTTEAU, 1886) (pl. 24, fig. 1-5) (Campanian of N. France) is characterized by radiating ridges on the plates of the apical system, straight poriferous zones, less numerous ambulacral tubercles, a circular periproct and trigeminate ambulacral plates.

Since none of the described species I have traced, resemble the specimen under discussion, I have considered it to be a new species.

4. Ordo PHYMOSOMATOIDA MORTENSEN, 1904

Familia *PHYMOSOMATIDAE* POMEL, 1883

4.1. Genus Gauthieria LAMBERT, 1888

Type-species. — *Cyphosoma radiata* SORIGNET, 1850, by original designation.

Diagnosis. — Low, flattened test; polyporous ambulacral plates; poriferous zones simple throughout; apical system extending into interambulacrum V, monocyclic but with supplementary polygonal periproctal plates (T. MORTENSEN, 1935; H. B. FELL & D. L. PAWSON, 1966).

4.1.1. Gauthieria radiata radiata (SORIGNET, 1850)
(Pl. 4, fig. 2-5)

* . 1850 — *Cyphosoma radiatum*, L. SORIGNET, p. 28.
? 1854 — *Cyphosoma simplex*, E. FORBES in J. MORRIS, p. 74.
. 1862 — *Cyphosoma perfectum*, G. COTTEAU & J. TRIGER, p. 375.
v . 1864 — *Cyphosoma radiatum*, G. COTTEAU, p. 609-614, pl. 1147, fig. 10-14, pl. 1148, fig. 1-10 (non pl. 1148, fig. 11-14).
. 1869 — *Cyphosoma radiatum*, G. COTTEAU & J. TRIGER, p. 401.
v . 1871 — *Cyphosoma radiatum*, T. WRIGHT, p. 142, pl. 29, fig. 2-3.
v . 1876 — *Cyphosoma radiatum*, G. COTTEAU, p. 313, pl. 71, fig. 3-8.
1877 — *Cyphosoma radiatum*, A. FRIČ, p. 147.
1879 — *Cyphosoma radiatum*, G. COTTEAU, P. PERON & V. GAUTHIER, p. 109.
. 1881 — *Cyphosoma radiatum*, J. GOSSELET, p. 250, pl. 21, fig. 7.
. 1883 — *Phymosoma radiatum*, C. SCHLÜTER, p. 12.
1883 — *Cyphosoma radiatum*, A. FRIČ, p. 129.
1887 — *Cyphosoma radiatum*, V. GAUTHIER, p. 253-254.
. 1888 — *Gauthieria radiata*, J. LAMBERT, p. 8-9.
. 1889 — *Phymosoma radiatum*, A. FRIČ, p. 98, fig. 125.
1893 — *Phymosoma radiatum*, A. FRIČ, p. 109.
1897 — *Gauthieria radiata*, R. LEONHARD, p. 40.
1905 — *Gauthieria radiata*, A. VALETTE, p. 16-19, fig. 1-10.
. 1910 — *Gauthieria radiata*, J LAMBERT & P. THIERY, p. 222.
1913 — *Gauthieria radiata*, H. SCUPIN, p. 250.
1931 — *Gauthieria radiata*, J. LAMBERT, p. 157.
1934 — *Gauthieria radiata*, H. ANDERT, p. 73.
. 1935 — *Gauthieria radiata*, T. MORTENSEN, p. 478, fig. 278.

v . 1935 — *Gauthieria radiata*, J. SMISER, p. 30-31 (pro parte), pl. 2, fig. 8.
. 1939 — *Gauthieria radiata*, R KONGIEL, p. 29 & 51, pl. 3, fig. 15-17.
. 1964 — *Gauthieria radiata*, V. HYNDA, p. 142-144, fig. 1-2.
. 1966 — *Gauthieria radiata*, H. B. FELL & D. L. PAWSON, p. U398, fig. 296.1.
. 1968 — *Gauthieria radiata*, V. HYNDA, p. 201, pl. 41, fig. 1-7.
. 1968 — *Gauthieria radiata*, V. HYNDA, pl. 1, fig. 2.
(1970) — *Gauthieria radiata*, A. BŁASZKIEWICZ e.a., p. 158.
. 1974 — *Gauthieria radiata*, O. V. SAVCHINSKAYA, p. 312, pl. 95, fig. 1-5.
. 1974 — *Gauthieria radiata*, M. KAEVER e.a., p. 278, pl. 2/5.
v . 1980 — *Gauthieria radiata radiata*, J. F. GEYS (b), p. 43.

Locus typicus. — Eure dept., France.

Stratum typicum. — Turonian.

Other occurrences outside the Benelux.

France : Turonian of Sarthe, Calvados, Seine-Maritime, Loir-et-Cher (G. COTTEAU, 1864) and Pas-de-Calais (J. GOSSELET, 1880); Coniacian of Seine-Maritime, Eure and Yonne (G. COTTEAU, 1864); Santonian (?) of Marne (V. GAUTHIER, 1887).
Great Britain : « Lower Chalk » of Kent (T. WRIGHT, 1871).
Fed. Rep. of Germany : Turonian of the Hannover district and Westphalia (C. SCHLÜTER, 1883).
German Democratic Republic : Turonian « Pläner » of Saxony (C SCHLÜTER, 1883).
Czechoslovakia : Turonian of N. Bohemia (A. FRIČ, 1877).
Poland : Turonian of Silesia (C. SCHLÜTER, 1883).
U. S. S. R. : Turonian of Wolhynia, Ukrainian S. S. R. (R. KONGIEL, 1939); Turonian of Don Basin, Russian S. F. S. R. (V. A. HYNDA, 1968).
Algeria : Turonian of Aumale (G. COTTEAU, P. PERON & V. GAUTIER, 1879).

Specimens studied.

Maisières Chalk, at Ville-sur-Haine, Hainaut : 1 specimen;
Maisières Chalk, at Maisières, Hainaut : 3 specimens;
Maisières Chalk, at St. Vaast, Hainaut : 1 specimen;
Dièves deposit (?), at Tournai, Hainaut : 1 specimen.

Figured specimens in the K.B.I.N. collections.

N° IST 10188, figured herein, Pl. 4, fig. 2-5.
The specimen figured by J. SMISER (1935) pl. 2, fig. 8a-c is lost.

Dimensions.

D : 15.6 - 18.6 mm;
h : 7.9 - 9.6 mm; mean h/D = 0.51;
dsI : 6.4 - 7.9 mm; mean dsI/D = 0.45;
dsII : 5.9 - 7.0 mm; mean dsII/dsI = 0.90;
dp : 5.5 - 7.2 mm; mean dp/D = 0.37.

Description.

Medium sized *Gauthieria* with flattened test.

The aboral surface is slightly convex. The peristome is subpentagonal and sunken. None of the specimens do permit a close examination of gill slits and girdle.

The apical system fails in all the specimens. It leaves a pentagonal opening in the apex and penetrates deeper into interambulacrum V than in the other interambulacra.

Ambulacra consist of polyporous, compound plates of phymosomatoid type, with 5 components and 5 pore pairs. Each ambulacrum shows two series of 9 or 10 crenulate, non perforate primary tubercles. Areoles are non confluent, but separated by several horizontal rows of densely packed granulae. The areoles are radially grooved all around, at least in their deeper parts. The bosses are more or less smooth. The perradial extrascrobicular areas are very narrow. A single row of granulae, which can be interrupted at several places, separates the scrobicules. The poriferous zones are simple and gently undulating throughout.

Interambulacra are 1.5 times wider than the ambulacra. Two series of 9 crenulate, non perforate primary tubercles are present. The scrobicules are sculptured with radial grooves, which are conspicuous in the lower parts of the areoles, but which fade out gradually upwards on the bosses. The scrobicules are non confluent but separated by one or two horizontal rows of granulae. The interradial extrascrobicular surfaces are narrow and granulated.

Discussion.

Gauthieria radiata is a readily recognisable, well known species, needing little discussion. The existence of a « Senonian » subspecies *G. radiata broecki* (LAMBERT, 1897) has been discussed in a previous paper (J. GEYS, 1980a). This subspecies differs from the nominal subspecies, by the coarser granulation on its interradial extrascrobicular surfaces and by its more sunken peristome.

Since G COTTEAU (1864) recognised the fact, it is generally agreed that *Cyphosoma simplex* FORBES, 1854 is a junior synonym of *G. radiata*. Since neither description, nor figure are given by its author, it is difficult to know what kind of echinoid FORBES actually had in mind.

G. COTTEAU & J. TRIGER (1862) misidentified a specimen of *G. radiata* as *Cyphosoma perfectum*. They recognised their error in the next issue of their monograph, some years later (G. COTTEAU & J. TRIGER, 1869).

5. SPECIES REPRESENTED BY RADIOLES ONLY

5.1. « *Cidaris* » *hirudo* SORIGNET, 1850 : « Turonian » at Autreppe, Hainaut.

5.2. « *Cidaris* » *pseudosceptrifera* HEBERT, 1875 : Craie de Maisières at Maisières, Hainaut.

5.3. *Balanocidaris sorigneti* DESOR, 1856 : Dièves deposits at Tournai, Autreppe, Chercq and Estinnes, Hainaut.

These three species were reported by J. SMISER (1935). The names are listed here merely for completeness and these records are not discussed.

6. SPECIES NOT REPRESENTED IN THE K. B. I. N. COLLECTIONS

6.1. *Cidaris vesiculosa* GOLDFUSS, 1826 is reported by G. COTTEAU (1874) from the Dièves at Montignies-sur-Roc. The K. B. I. N. possesses specimens from Cenomanian beds (Tourtia) at the same locality.

6.2 *Cidaris sorigneti* DESOR, 1856, is mentioned by G. COTTEAU (1874) from the Dièves, at Montignies-sur-Roc and at Chercq.

6.3. *Cidaris vendocinensis* AGASSIZ, 1846 is reported by M. MOURLON (1881) from the Dièves. The species is given in a list without comments and without mentioning a locality.

6.4. *Cyphosoma tenuistriatum* AGASSIZ, 1846 is mentioned by G. COTTEAU (1874) from the Maisières Chalk at St-Vaast.

7. ACKNOWLEDGEMENTS

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EXPLANATIONS OF PLATES

PLATE I

Fig. 1. — *Tylocidaris clavigera* (KÖNIG *in* MANTELL, 1822);
Tarring Neville, Sussex, England; Lower Santonian;
Coll. A. S. Gale.
Adoral view; × 1.

Fig. 2. — The same. Small radiole; × 6.

Fig. 3. — The same. Lateral view; × 2.

Fig. 4. — *Tylocidaris clavigera* (KÖNIG *in* MANTELL, 1822);
Chercq, Hainaut, Belgium; Dièves deposit;
Coll. K. B. I. N. nº IST 10184.
Lateral view; × 2.5.

Fig. 5. — The same. Detail of corona at the ambitus; × 5.

PLATE II

Fig. 1. — *Tylocidaris clavigera* (KÖNIG *in* MANTELL, 1822);
Chercq, Hainaut, Belgium; Dièves deposit;
Coll. K. B. I. N. nº IST 10184.
Adapical view; × 2.5.

Fig. 2. — The same. Adoral view; × 2.5.

Fig. 3. — *Tylocidaris clavigera* (KÖNIG *in* MANTELL, 1822);
Gravesend, Kent, England; Lower Santonian;
Coll. B. M. (N. H.) nº BM 39998 (the neotype).
Adoral view; × 2.

PLATE III

Fig. 1. — Cidaroid « type 2 »;

Maisières, Hainaut, Belgium; Maisières Chalk;
Coll. K. B. I. N. nº IST 10186.
Isolated coronal plate; × 5.

Fig. 2. — *Salenia cherei* nov. sp.;
Chercq, Hainaut, Belgium; Dièves deposit;
Coll. K. B. I. N. nº IST 10187 (the holotype).
Lateral view; × 4.

Fig. 3. — The same. Adapical view; × 4.

Fig. 4. — The same. Adoral view; × 4.

Fig. 5. — The same. Detail of ambulacrum V, with parts of interambulacra 1 and 5, at the ambitus; × 16.

Fig. 6. — Cidaroid « type 1 »;
Chercq, Hainaut, Belgium; Dièves deposit;
Coll. K. B. I. N. nº IST 10185.
Fragment of corona; × 5.

PLATE IV

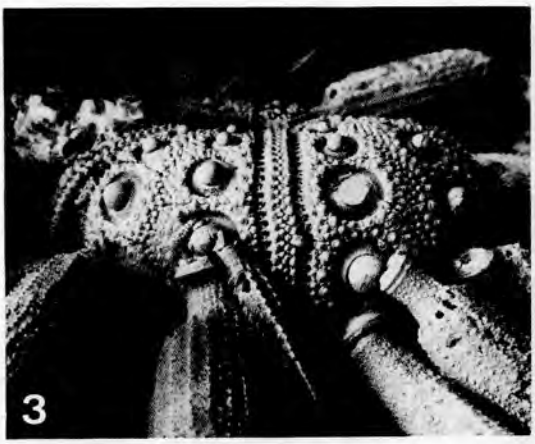
Fig. 1. — *Salenia cherei* nov. sp.;
Chercq, Hainaut, Belgium; Dièves deposit;
Coll. K. B. I. N. nº IST 10187 (the holotype).
Detail of apical system with madreporite, genital plate 3, ocular plates III and IV and suranal plate; × 10.

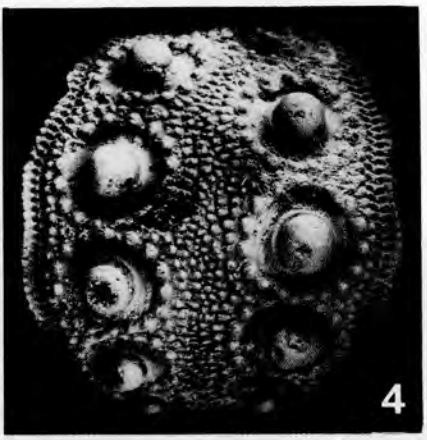
Fig. 2. — *Gauthieria radiata radiata* (SORIGNET, 1850);
St. Vaast, Hainaut, Belgium; Maisières Chalk;
Coll. K. B. I. N. nº IST 10188.
Adapical view; × 3.5.

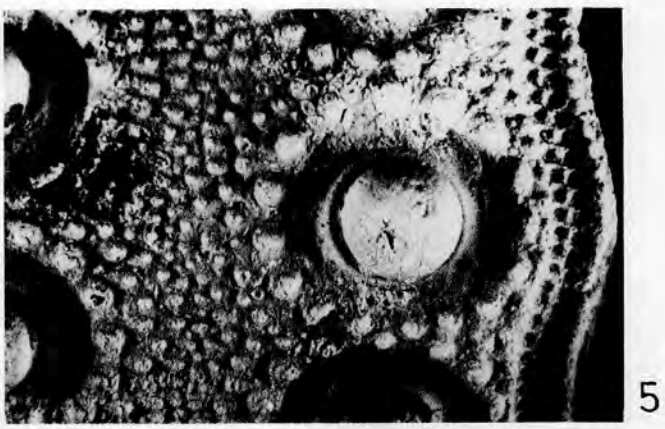
Fig. 3. — The same. Adoral view; × 3.5.

Fig. 4. — The same. Lateral view; × 3.5.

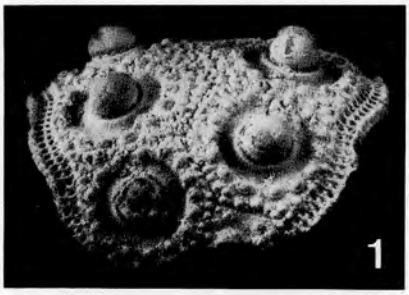
Fig. 5. — The same. Detail of ambulacrum and adjacent part of interambulacrum at the ambitus; × 10.

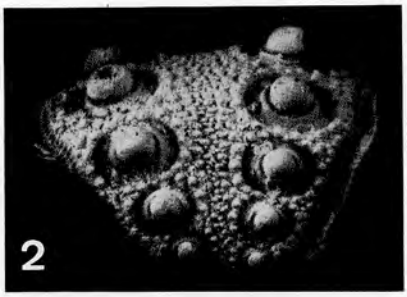


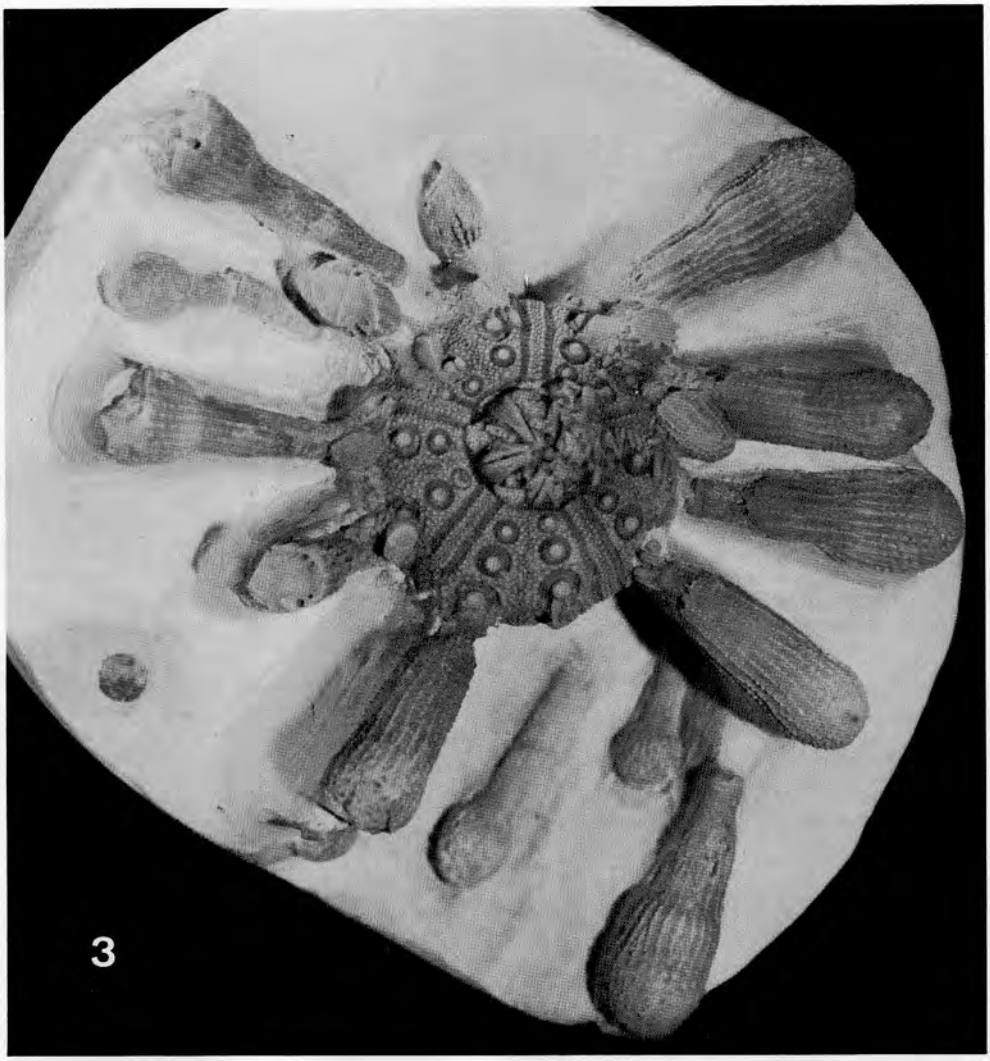




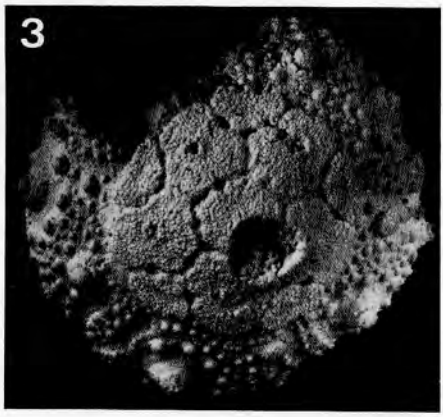
J. F. GEYS. — Regular Echinoids from the Turonian and the Coniacian (Upper Cretaceous) of the Mons Basin (Belgium)

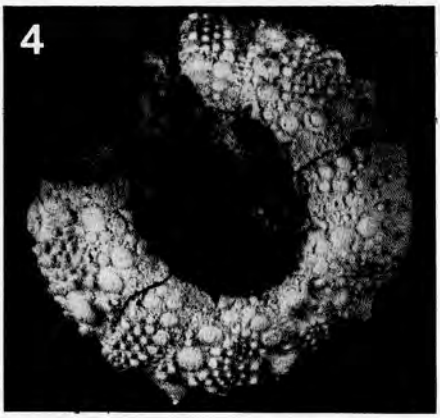


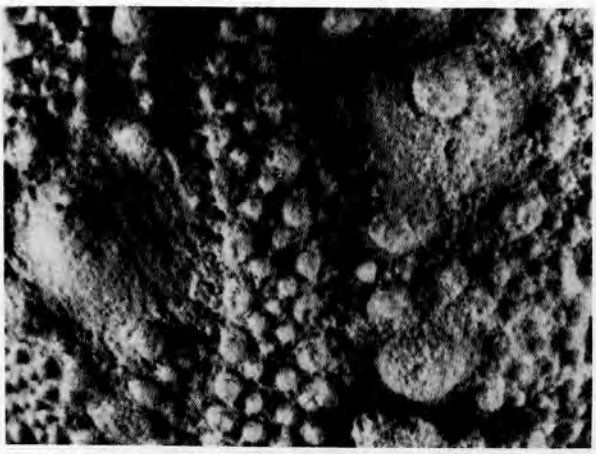


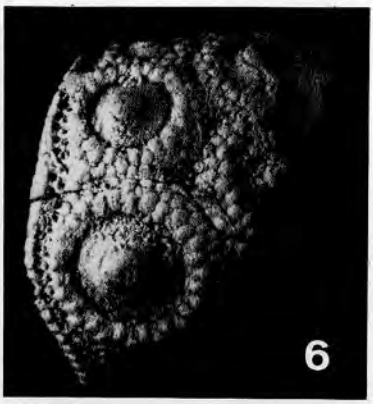


J. F. GEYS. — Regular Echinoids from the Turonian and the Coniacian (Upper Cretaceous) of the Mons Basin (Belgium)

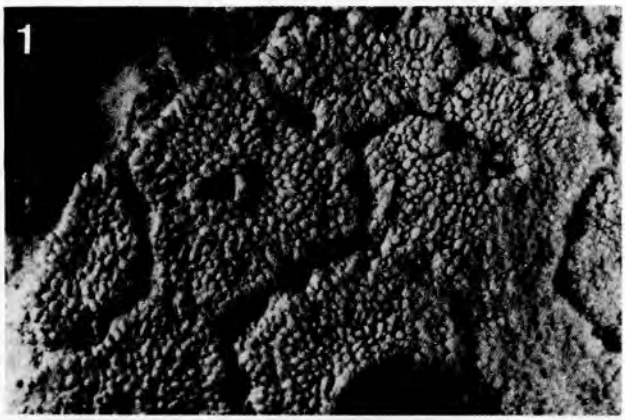


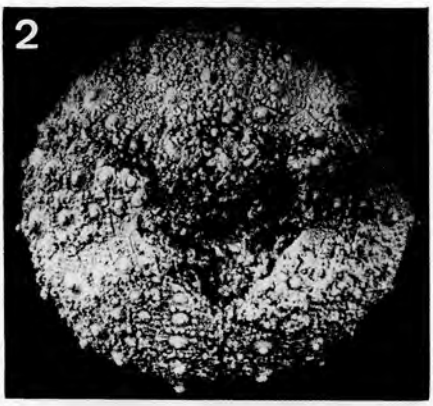


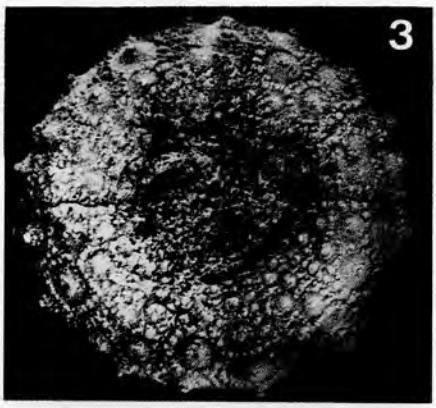


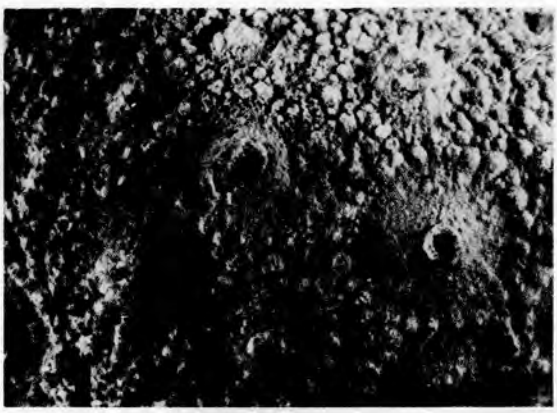


J. F. GEYS. — Regular Echinoids from the Turonian and the Coniacian (Upper Cretaceous) of the Mons Basin (Belgium)









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