

ECHINOID ZONATION OF THE UPPER CRETACEOUS ROCKS IN NORTH BULGARIA

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Abstract

This study is the first attempt to subdivide the sediments of the epicontinental Upper Cretaceous in North Bulgaria into biostratigraphical zones on the basis of echinids. These echinoid zones are correlated with the existing zonal schemes from Central and Eastern Europe. The proposing echinoid biostratigraphy is associated with foraminifers and nanofossil zonal schemes. Nine echinoid zones are recognized in the Upper Cretaceous sediments: *Micraster cortestedinarium* (Upper Turonian-Lower Coniacian), *Micraster coranguinum* (Upper Coniacian), *Micraster rogae* (Early Santonian), *Hemiaster angustipneustes* (Upper Santonian), *Micraster schroederi* (Lower Campanian), *Micraster glyphus* (the lowest part of the Upper Campanian), *Galeola papillosa* (Upper Campanian), *Coraster vilanovae* (Lower Maastrichtian) and *Hemipneustes striato-radiatus* (Upper Maastrichtian).

Introduction

Sediments of the epicontinental type Upper Cretaceous crop out in the Moesian platform and the Fore-Balkan at several localities in North Bulgaria. They are represented mainly by limestones, chalk, sandstones and marls. Echinids are very often represented in these rocks. This study aims to establish an echinoid zonation and to compare it with the existing zone schemes made on the basis of microfossils- nannoplankton and foraminifera. Samples have been collected from 15 outcrops on the territory of the Moesian platform and 4 from the Fore-Balkan.

Echinoid Zonation

Nine echinoid biostratigraphical zones are recognized and described. The selection of the index-species was based on the following criteria: (1) wide latitudinal distribution, which gives the possibility to make correlation with other parts of

Europe. (2) easy taxonomic identification and fast evolution (3) short vertical distribution. Some of the most important stratigraphical markers are the representatives of the genus *Micraster*. Some of these fossils are very rare in Bulgaria. This is the reason that other species are used, which are encountered in great numbers in sediments.

The echinoid zones and their correlation with the microfossil zones and classical stage boundaries are given in fig.1. In plate 1 and plate 2 are shown the index species.

Micraster cortestedinarium Zone

Author: Rowe, 1899

Index species *Micraster cortestedinarium* (Goldfuss, 1826)

Definition: Interval from the first occurrence of *Micraster cortestedinarium* to the first occurrence of *Micraster coranguinum*

Age /stratigraphical extension /: Late Turonian-Early Coniacian.

Zonal association: *Echinocorys gravesi*, *Tylocidaris clavigera* and *Conulus aff. subconicus*.

Distribution: In Bulgaria this zone is established in the sediments of the Upper Cretaceous at Kaspican (Dobrindol Formation), Komunari (in the foundation of the Dobrindol Formation) and Venchan (Venchan Formation-stratum 1)

Correlation: The index species is described as a characteristic marker for Upper Turonian-Lower Coniacian in France (Stokes, 1975), Germany (Ernst & Schulz, 1974), Russia-Crimea and Kaukaz (Poslavskaja & Moskvina, 1959), Kopet-Dag (Djabarov, 1964)

Micraster coranguinum Zone

Author: Rowe, 1904

Index species: *Micraster coranguinum* (Klein, 1734)

Definition: The interval from the first occurrence of the index species to its disappearance or the first occurrence of *Micraster rogae* Nowak.

Age: Late Coniacian.

Zonal association: *Ech. gravesi*, *Conulus subconicus*, *C. castanea*.

Distribution: The zone is observed at the top of the Dobrindol Formation in the sections at Komunari, Shoumen area, Varna area.

Correlation: This species is specified as a character marker for Upper Coniacian-Lower Santonian for France, Poland, Germany, Russia, Ukraine.

Remarks: The upper boundary is unclear, mainly because the rarity and bed preservation of *M. rogate*.

Micraster rogate Zone

Author: Ernst, 1963

Index species: *Micraster rogate* Nowak 1909

Definition: Interval between disappearance of *Micraster coranguinum* (Klein) and the first appearance of *Hemiaster angustipneustes* Desor.

Age: Early Santonian.

Zonal association: *Ovulaster gauthhiery* (Cotteau), *Ech. sulcata* Leske

Distribution: In Bulgaria this zone is recognized in the chalk of the Venchan formation-Shoumen, Pleven (Novachene) and Varna area.

Correlation: This zone is recognized in Central and Eastern Europe- Germany, Poland, Ukraine.

Remarks: The first occurrence of the index species served as a marker of Coniacian-Santonian boundary.

Hemiaster angustipneustes Zone

Author: This zone is defined for the first time in this article.

Index species: *Hemiaster angustipneustes* Desor, 1853

Definition: Interval from the first occurrence of the index species to its disappearance.

Age: Late Santonian.

Zonal association: *Phymosoma magniplicum* Agassiz, *Salenia scutigera*, *Munster*, *Pyrina ovulum* (Lamark), *Holotypus turonensis* Desor, *Lambertechinus arnaudi* (Cotteau), *Pyrina sphaerica*, *Tzankov*, *Nucleopigus coravium*, *Nucleopygus minor* Defrance.

Distribution: This zone is present in the upper part of the Shoumen Formation in every outcrop in NE and Central Bulgaria.(Shoumen and Varna area).

Correlation: This zone corresponds to *Uintacrinus* zone(Ernst,1963). The index species is common in France.

Remarks: The correlation of this zone of the basis of other echinids is very difficult, because it is defined at this study for the first time.

Micraster schroederi Zone

Author: Poslavskaya & Moskvina, 1959

Index species: *Micraster schroederi* Stolley, 1892

Definition: Interval from the first occurrence of *Micraster schroederi* Stolley to the first occurrence of the *Micraster glyphus* Schluter.

Age: Early Campanian

Zonal association: *Echinocorys turritus* Lambert, *Catopygus conformis* Desor, *Conulus angulatus* Tzankov, *Porosoma meandrum* Geys.

Distribution: This zone covers a close stratigraphical interval including the uppermost part of Shoumen formation and the lowest part of Novachene Formation in Central North Bulgaria (Novachene, Shoumen)

Correlation: *M. schroederi* is a biostratigraphical marker for Early Campanian in all Central and Eastern European countries- Germany, Hungary, Poland, Georgia, Ukraine, Russia.

Micraster glyphus Zone

Author: Poslavskaya & Moskvina, 1959

Index species: *Micraster glyphus* Schluter, 1869

Definition: The lower limit is set on the first occurrence of the index species. The upper limit is put on the appearance of the *Galeola senonensis*.

Age: The earliest Late Campanian.

Zonal association: *Echinocorys fonticola* Arnaud, *Catopygus conformis* Desor, *Nucleopygus coravium* Defrance, *Galeola senonensis*.

Distribution: The zone covers Nicopol formation in Central part of the Moesian platform Pleven area- Novachene, Shumen, Nicopol.

Correlation: *M. glyphus* is a character marker for Upper Campanian for Germany, Poland, France, Belgium, Russia, Ukraine, Georgia,

This zone coincides with *Galeola senonensis* Zone in Germany (Ernst, 1963)

Galeola pupillosa Zone

Author: Ernst, 1963

Index species: *Galeola pupillosa* Klein, 1734.

Definition: Interval from the first occurrence of the index species to the first appearance of the *Coraster vilanovae* Cotteau.

Age: The Latest Campanian.

Zonal association: *Echinocorys pyramidatus* Portl., *Conulus magnificus* (d'Orb.), *C. angulatus* Tzankov, *Ech. marginatus* (Goldfuss), *Ech. conoideus* (Goldf), *Ech. ovatus* (Leske), *Cyclaster integer* (Seunes).

Distribution: This zone is observed at the uppermost part of the Nicopol formation in the West Fore-Balkan and Central Moesian Platform.

Correlation: This zone is recognized in Germany and Ukraine. The index species is described in Crimea, Kaukaz, Russia.

Coraster vilanovae Zone

Author: This is the first definition of this zone.

Index species: *Coraster vilanovae* Cotteau

Definition: The interval from the first appearance of the index species to the first

occurrence of the *Hemipneustes striato-radiatus* Leske.

Age: Early Maastrichtian.

Zonal association: *Echinocorys conoides* (Goldfuss), *Ech. ovatus* (Leske), *Conulus magnificus* (d'Orb), *Homoaster tunetanus* Pomel

Distribution: This zone is recognized everywhere in the range of the Mezdra formation in Central and NE Bulgaria (Nicol area, Plevna area, West and Central Fore-Balkan).

Correlation: The index species is a character fossil for the Early Maastrichtian in West Europe.

Remarks: It is described as a typical Late Maastrichtian species in Russia (Crimea and Caucasus (Poslavskaja & Moskvina, 1959)).

Hemipneustes striato-radiatus Zone

Author This zone is defined here for the first time.

Index species: *Hemipneustes striato-radiatus*

Definition: The interval between the first appearance of the index species to its disappearance.

Age: Late Maastrichtian.

Zonal association: *Conulus vulgaris* Lamb., *Echinocorys arnaldi* Seunes, *Stereocidaris* sp. indent.

Distribution: This zone is available almost in all sections in Plevna, Shoumen, Nicol and Varna area.

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Stage	Substage	Echinoid zones /present study/	Other echinofauna	Foraminifera zones /af Vaptzarova 1980/	Nannofossil zones /af Sinnyov- ski, 1988/
Maestrichtian	Upper	Hemipneustes striato- radiatus	Conulus vulgaris Ech. arnaudi Stereocidaris sp. indet.	Anomalina complanata	Arkhangel- skiella cymbiformis
	Lower	Coraster vilanovae	Ech. conoideus Ech. marginatus Homoeaster tenuitanus Cyclaster integer Orn. cordiformis		
Campanian	Upper	Galeola papillosa	Ech. pyramidatus Ech. fonticola Ech. ovatus Galeola senonensis	Globorotalites aculeus	Tetrslithus trifidus
		Micraster glyphus	Catopygus conformis Conulus magnificus		Ceratolitoides aculeus
	Lower	Micraster schroederi	Conulus angulatus Catopygus conform. Porosoma meandrum Ech. sp. indet. Micraster minor	Globotruncana elevata	Broinsonia parca
					Zigodiscus spiralis
Santonian	Upper	Hemiaster angusti- pneustes	Phym. magnificum Salenia scutigera Pyrina ovulum	Pseudoval- vulineria thalmanni	Reinhardtites anthophorus
	Lower	Micraster rogale	Ech. sulcata Ovul. gauthieri Offaster sp. indet.		Micula staurophora
Con.	Up	Micraster coranguinum	Ech. gravesi Conulus castenea	Cavelinella kelleri	Lucianorhab- dus maleformis
	L.				E. eximius
Turonian	Upper	Micraster cortestedi- narium	Ech. gravesi Phymosoma sp. ind.		Q garthneri

Fig.1 Correlation of the Upper Cretaceous echinoid zones with the stage boundaries, foraminifera and nannofossil zonation in North Bulgaria.

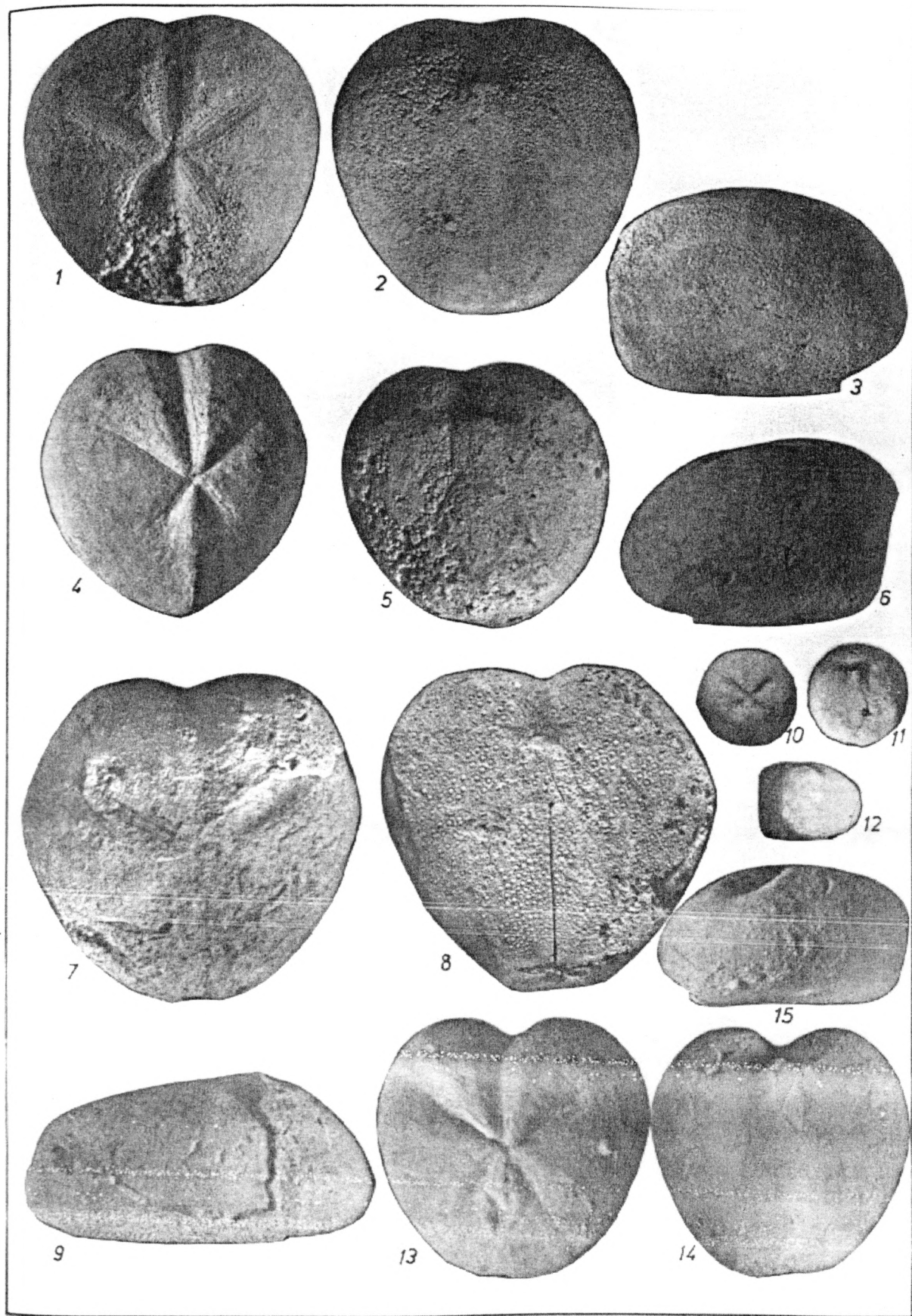


Plate I

Fig. 1-3 *Micraster cortestedinarium* (Goldfuss, 1826); Fig. 4-6 *Micraster coranguinum* (Klein, 1734);
 Fig. 7-9 *Micraster rogale* Nowak, 1909; Fig. 10-12 *Hemiaster angustipneustes* Desor, 1853; Fig. 13-15
Micraster schroederi Stolley, 1892

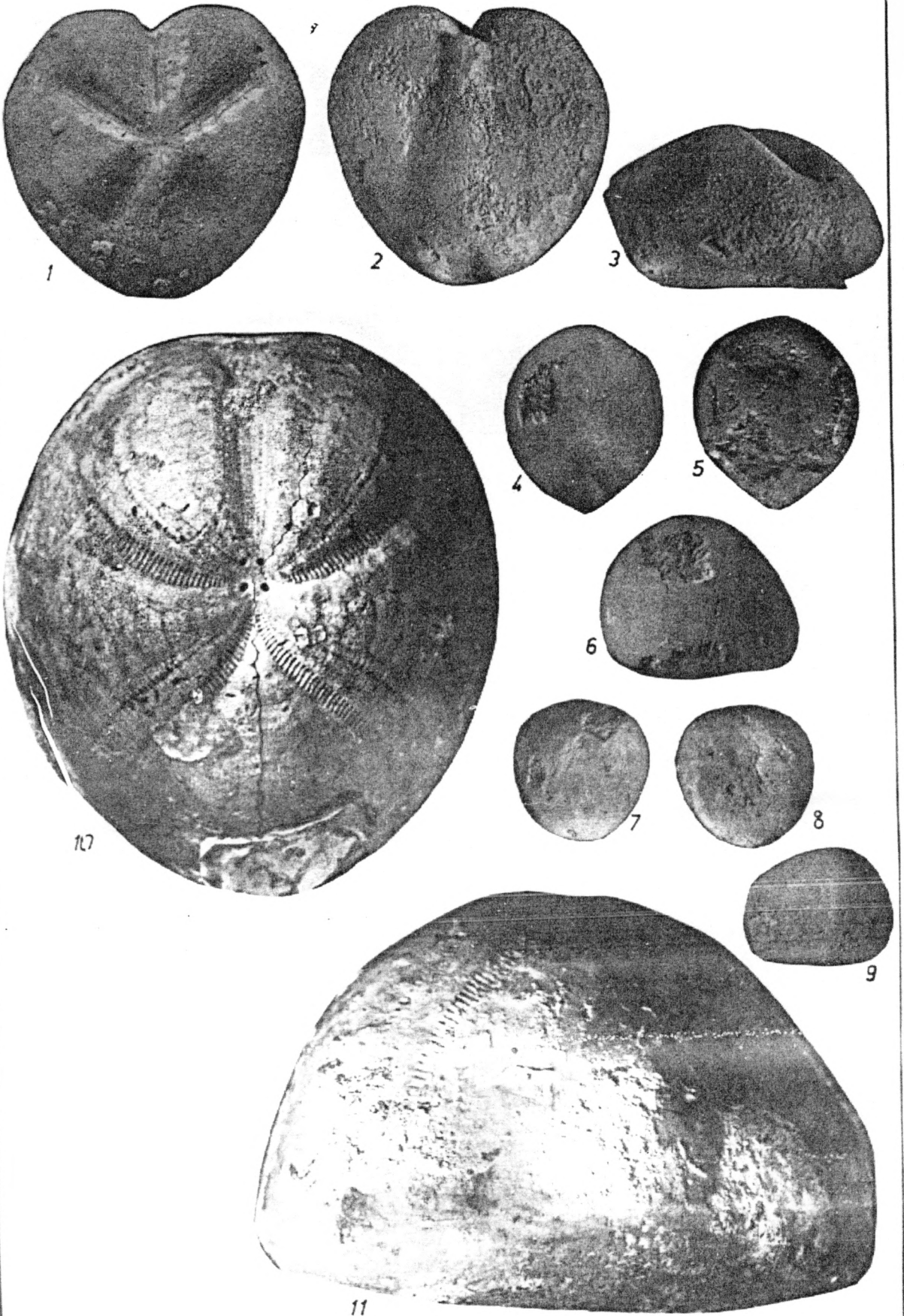


Plate II

Fig 1-3 *Micraster glyphus* Schluter, 1869; Fig.4-6 *Galeola papillosa* Klein, 1734; Fig.7-9 *Coraster vilanovae* Cotteau, 1886; Fig.10-11 *Hemipneustes striato-radiatus* (Leske, 1778).