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ON A NEW GALEROPYGID GENUS (ECHINOIDEA) FROM THE JURASSIC (UPPER LIAS) OF MOROCCO

Abstract. — Considered as holectypoid (Gnathostomata) *Pygaster microstoma* Lambert, 1933 from the Toarcian of Morocco is actually the most primitive galeropygid (Atelostomata) for which the new genus *Eogaleropygus* is proposed. Incipient "irregular" position of the periproct and very shallow anal groove are in sharp contrast with much more advanced evolutionary changes such as small size and unnotched peristome (external manifestations of the loss of dental apparatus and gills) as well as dense and unordered tuberculation. The morphology of *Eogaleropygus* suggests that galeropygids became atelostomate probably long before they became bilateral.

INTRODUCTION

Liassic episode of echinoid evolutioin, so crucial for the post-Paleozoic history of the group, remains poorly known as a result of three main factors: echinoids of that age are rare, usually of small size and most often poorly preserved. Until some fortunate finding yields more abundant and better preserved material, the reexamination of classical collections may be still a valuable source of data on this subject.

This paper brings the results of the restudy of material from Lambert Collection (formerely housed at Laboratoire de Paléontologie, Sorbonne-presently moved to Université Pierre-et-Marie-Curie, Collection de Paléntologie, Paris).

Working on origin of irregular echinoids I was especially interested in morphology of Liassic representantives of the group. This led me to *Pygaster microstoma* described by Lambert (1933: 54; pl. 3:12 — not fig. 13 as indicated on p. 54) from the Toarcian of Morocco. From two specimens mentioned by Lambert only one was found in Lambert Collection. In spite of remarkable general likeness to pygasterids that specimen presents several characters unknown in this group. Especially the small peristome, the lack of gill notches and dense unordered tuberculation are suggestive of merely galeropygid affinities of the species. However the

almost "regular" position of periproct and very shallow anal groove are not reconcilable even with the morphology of *Galeropygus*, the most primitive genus of the Galeropygidae, therefore new genus *Eogaleropygus* is proposed.

Eogaleropygus microstoma (Lambert 1933) seems to be very rare. It was recorded by G. Dubar (Termier in Lambert 1933) and later on it was only mentioned by Petitot (1959: 55, fig. 165; Tab. 14) and Colo (1961: 101). Those mentions seem to be based on Lambert's data and it is very probable that a new material has not been found as yet. According to Termier (*l.c.*: 9) and Colo (*l.c.*: 101) the grey limestone with *E. microstoma* is of Middle Toarcian age. That fossiliferous deposit contains numerous bivalves, brachiopods and rather rare ammonites. The echinoids are there represented by *E. microstoma, Psephechinus renzi* Jeannet and *Trochotiara* sp.

It is not clear why Lambert having two specimens at his disposal chose the one whose upper and the only ilustrated side, (*l.c.*: pl. 3:12) is badly weathered, so that the test is completely lacking. However, the description of the species seems to be based on both specimens. Lambert (*l.c.*: 55) rightly stressed two important characters: the almost "regular" position of periproct and the small size of peristome. This latter character, so unusual in pygasterids, had in Lambert's opinion only specific rank what he pointed out in choosing "*microstoma*" as a specific name. Otherwise he seemed to have no doubts as to the assignement of his new species to the Pygasteridae. This however is untenable when all characters of this form are taken under consideration.

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This paper has been made at the Institut of Paleobiology, Polish Academy of Sciences in Warsaw.

DISCUSSION

The Toarcian representative of *Eogaleropygus* gen. n. in spite of its incompletness (the lack of apical system, badly weathered test) brings some valuable data on the evolution of galeropygids, considered to be the ancestors of all atelostomate irregular echinoids.

Until now, one could hardly imagine the regular atelostomate echinoid. With the Moroccan species one is tempted to try to do it. Judging from

the contour of apical system the periproct in *E. microstoma* was only slightly displaced, not more than in some regular echinoids showing the tendency to the migration of periproct (pl. 14:A). Unfortunately, no one apical system plate is preserved so we can only speculate that the genital 5 could be still present and functionning. The similar situation was found in the most primitive representative of the gnathostomate irregular *Plesiechinus hawkinsi* Jesionek-Szymańska (1970: 414, fig. 1A) from Sinemurian, where very reduced genital 5 bears a genital pore. As it is known, a quite conspicuous though nonfunctional genital 5 has been found in Bajocian representative of galeropygids (Jesionek-Szymańska 1968: 55, fig. 7B).

Very little advanced bilateralism of *E. microstoma* is in sharp contrast with other important characters; the small, unnotched peristome indicates that the dental apparatus and gills were already absent. Moreover, the dense and unordered tuberculation points to the specialisation of spines to a new function (pl. 14:D). Incipient but distinct petals proove that the respiratory function of tubefeet was developing (pl. 14:14B). Thus we can assume that the bilateralism in galeropygid stock was introduced relatively late, when other evolutionary changes, undoubtedly adaptative to new feeding and breathing habits, already developed. In other words- galeropygids became atelostomate probably long before they became irregular. At this point they substantially differ from gnathostomate irregular echinoids where the migration of periproct, at the onset of the history of group, was the only "novelty" affecting the perfectly regular model of the morphology of test.

Further steps toward irregular condition of apical system were in galeropygids intimately connected with the developing anal groove. It has to be stressed that from the beginning the gradually sinking posterior interambulacrum modified its structure to accomodate the new function as a conduit for excreta. This modification is expressed by the streching and bending downwards of interambulacral plates so as to form initially very shallow depression. At the same time the posterior part of apical system sinks together with the surrounding area thus starting a new event in the course of periproct breakout: the direction of migration changes from initially backwards to downwards. In a more advanced representative of the family — the *Galeropygus*, the anal groove is fully developed. The posterior part of apical system, strongly bent downwards forms its anterior border.

In contrast with that, the migration of periproct in gnathostomate irregular echinoids accomplishes flush with the test and is not accompanied by any major change in the structure of posterior interambulacrum. Periproct, considerably larger than that of atelostomate echinoids, is just "cut out" in the test. Only in some geologically younger pygasterids

a sligth depression around the periproct, especially at its posterior border, is present.

The function of anal groove in petals-bearing echinoids as a conduit restricting the flow of excreta is obvious (Hawkins 1943: 71). In galeropygids its development was remarkably fast. By the Toarcian all representatives of that family (except for *Eogaleropygus* gen. n.) have had a deep anal sulcus. *Eogaleropygus* though found in Middle Toarcian deposits seems to be a survivor of the very first galeropygids and we can expect to find other representatives of this genus in the strata older than Toarcian.

The developing depression in posterior interambulacrum certainly modified not only the test but the internal organs as well. This may be a reason why in atelostomate echinoids the genital opening in genital 5 never reappeared as it is observed in some holectypoids. Probably the formation of anal groove so much disturbed internal organs (genital ring?) that the reconstitution of 5th gonad was not possible.

To the everlasting question of why some echinoids became irregular (*int. al.* Kier 1974: 33) the *Eogaleropygus* gen. n. seems to bring some clarity at least as to the sequence of evolutionary changes. The response to the fundamental change of feeding (the loss of dental apparatus) and breathing habits (formation of petals) was the development of anal groove what in turn induced the rear-downwards migration of periproct.

This explanation however cannot be applied to gnathostomate irregular echinoids where several factors important for atelostomate echinoid evolution are lacking. No apparent change in feeding habit can be assumed, strongly developed gill notches and lack of petals suggest that the usual for regular echinoids type of breathing was still present. In spite of this the holectypids were the fastest in excluding periproct from apical system and bringing it into immediate vicinity of peristome and gills! Why this did not impair feeding and breathing of those echinoids — remains a puzzle.

DESCRIPTION

Superorder **Atelostomata** Zittel, 1879
Order **Cassiduloida** Claus, 1880
Family **Galeropygidae** Lambert, 1911

Kier (1962: 23) restricted the family contents to two genera: *Galeropygus* Cotteau, 1856 and *Hyboclypus* L. Agassiz, 1830. *Eogaleropugus* gen. n. certainly here belongs, in spite of its shallow anal groove.

Genus *Eogaleropygus* gen. n.

Type species: *Pygaster microstoma* Lambert, 1933.

Derivation of the name: *eos* (Gr.) dawn — genus considered to be the very first galeropygid.

Diagnosis: medium size galeropygid, apical system slightly irregular, anal groove very shallow, phyllode incipient.

Species assigned: *Eogaleropygus microstoma* (Lambert, 1933).

Geographical and stratigraphical occurrence: as for the species (see below).

Remarks. — The new genus is very close to *Galeropygus* Cotteau, 1856 from which it differs in less advanced migration of periproct, much shallower anal groove and more simple phyllode.

Eogaleropygus microstoma (Lambert, 1933)

(pls 13, 14)

1933. *Pygaster microstoma* Lambert: 54—55, pl. 3:12 (not 13).

Material. — Paratype — unnumbered specimen from Lambert Collection.

Dimensions in mm:

Specimen	l	w	h	diam: of perys.	No of IA & AM pl.
holotype (from Lambert 1933)	35.0	38.0 (1.09)	17.0 (0.48)	6.0	—
paratype	36.5	38.8 (1.06)	16.1 (0.44)	4.0	~1,300

Description. — Test of medium size, wider than long, marginal outline weakly pentagonal; upper side domed, border of test rounded, oral side flat. Apical system 10 mm long, 7 mm wide, not preserved. Judging from the contour its anterior part was arranged in semicircle; periproct only slightly displaced, situated at the anterior border of very shallow anal groove (pl. 14:A). Ambulacra narrow, 4 mm wide at ambitus (20 percent as wide as interambulacra), narrowing in proximity of peristome. Petals incipient but distinct, extending almost to margin; outer pores elongated, inner round (pl. 14:B). Phyllode simple, triserial arrangment of pores indistinct (pl. 14:C). Peristome situated centrally, very small (4 mm in diameter) with invaginated borders. Tuberculation homogenous: small and equal sized, numerous tubercles, not arranged in any pattern (pl. 14:D).

Occurrence. — Morocco: Middle Toarcian: Middle Atlas, vicinity of Donirat locality, E slope of Jebel Ousilagh.

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O NOWYM PRZEDSTAWICIELU RODZINY GALEROPYGIDAE LAMBERT, 1911 (ECHINOIDEA) Z LIASU MAROKA

Streszczenie

Opisany przez Lamberta (1933: 54, pl. 3:12) *Pygaster microstoma* (Irregularia — Gnathostomata) jest w rzeczywistości przedstawicielem bezszczękowych (Atelostomata) jeżowców nieregularnych z rzędu Cassiduloida. Budową pancerza zbliża się najbardziej do rodzaju *Galeropygus* Cotteau, 1856, od którego różni się słabym wykształceniem bruzdy analnej oraz znacznie mniej zaawansowanym stopniem migracji peryproktu. Cechy te stanowią podstawę wyróżnienia nowego rodzaju *Eogaleropygus*, który reprezentuje ważne ogniwo w ewolucji jeżowców bezszczękowych. Świadczy on bowiem, że utrata aparatu szczękowego oraz skrzel (oznaki radykalnej zmiany sposobu odżywiania i oddychania) znacznie wyprzedziły migrację peryproktu. Zgodnie z powyższymi obserwacjami należy stwierdzić, że w grupie prymitywnych jeżowców bezszczękowych migracja peryproktu nałożyła się wtórnie na już silnie zmieniony model morfologii pancerza i miała zapewne związek z powstaniem bruzdy analnej.

ВАНДА ЕСЁНЭК-ШИМАНЬСКА

О НОВОМ ПРЕДСТАВИТЕЛЕ СЕМЕЙСТВА GALEROPYGIDAE LAMBERT, 1911 (ECHINOIDEA) ЛЕЙАСА МАРОККО

Резюме

Описанный Ламбертом (1933, п. 54, пл. 3, фиг. 12) *Pygaster microstoma* (Irregularia — Gnathostomata) из лейаса (тоара) Марокко в действительности является представителем безчелюстных неправильных морских ежей (Atelostomata) отряда Cassiduloida. Строение его панциря наиболее близко к роду *Galeropygus* Cotteau, 1856, и отличается от него слабо выраженной анальной бороздой, а также значительно меньшей степенью миграции перипрокта. Эти черты являются основой для выделения нового рода — *Eogaleropygus*, который представляет собой важное звено в эволюции безчелюстных морских ежей. Он показывает, что потеря челюстного аппарата, а также жабер (черты радикального изменения образа жизни) опередили миграцию перипрокта. Согласно вышеприведённым наблюдениям следует утверждать, что в группе ранних Cassiduloida миграция перипрокта вторично накладывается на сильно изменённую модель панциря и та миграция, вероятно, имела непосредственную связь с образованием анальной борозды.

EXPLANATION OF THE PLATES

Plate 13

Eogaleropygus microstoma (Lambert, 1933)

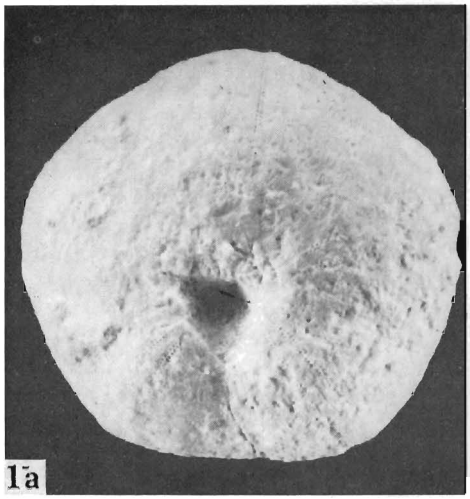
Middle Toarcian, Morocco, Middle Atlas, vic. of Donirat, E slope of Jebel Ousilagh.

1. paratype (unnumbered specimen from Lambert Collection) *a* adapical, *b* adoral, *c* posterior views, × 1.5., *d* anterior view showing the density of ambulacral pores (not their form which is altered by weathering), × 2, *e* peristomial area, × 3. Photo: D. Serrette (Mus. Hist. Nat., Paris).

Plate 14

Eogaleropygus microstoma (Lambert, 1933)

Middle Toarcian, Morocco, Middle Atlas, vic. of Donirat, E slope of Jebel Ousilagh; paratype — unnumbered specimen from Lambert Collection. *A* contour of apical system, *B* fragment of ambulacrum III, *C* phyllodial part of ambulacrum II, *D* size and arrangment of areoles (tubercles rased) on interambulacral plate from oral side. All figures slightly restored.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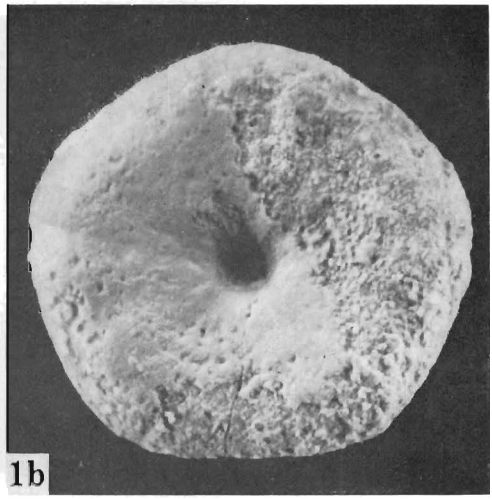
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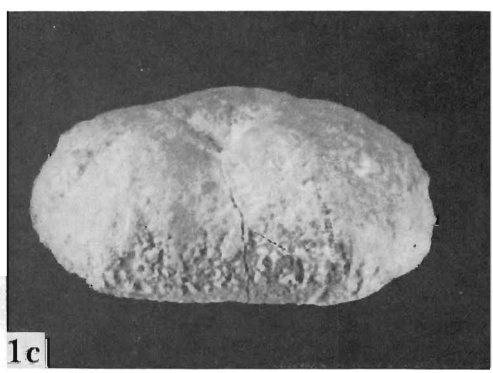
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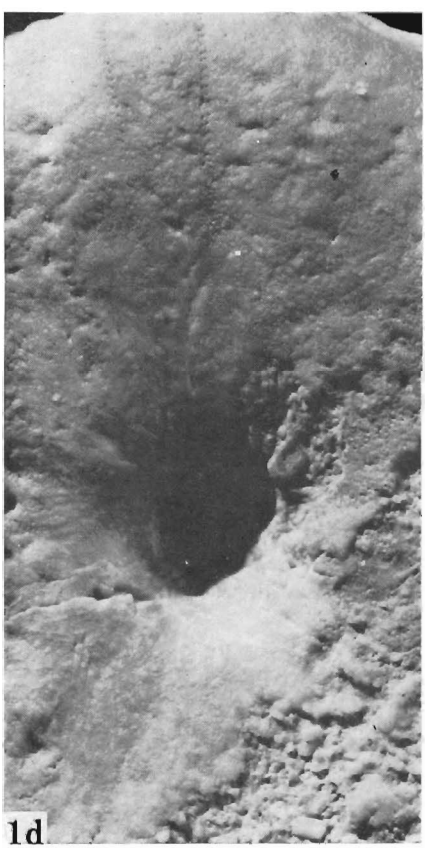
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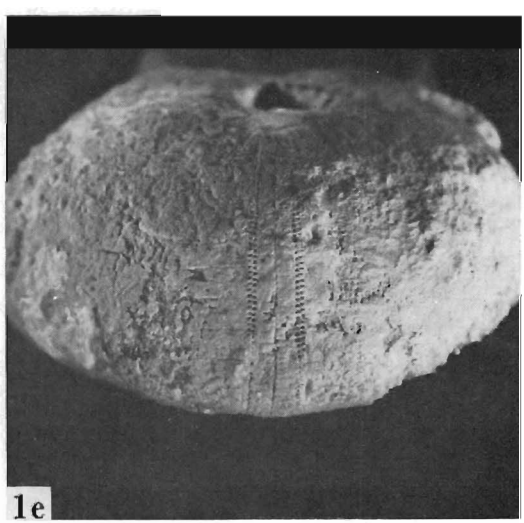
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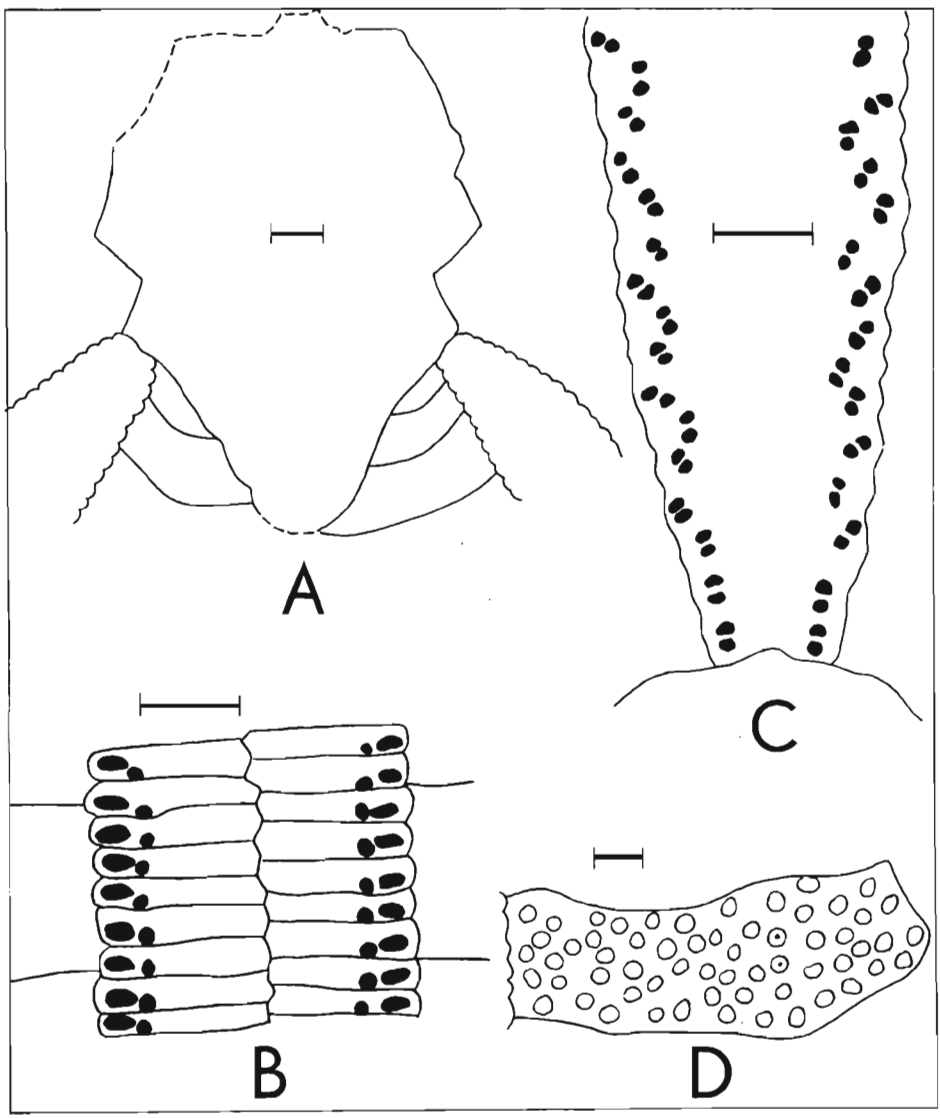
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