Echinolampas (*Heteroclypeus*) *hungaricus* Vadász, 1915:
Holotype: MAFI Ech 219; housed at the Museum of the Hungarian Geological Survey
Locus typicus: Mátraverebély, Nógrád, Hungary
Age: Early Badenian (Langhian), Middle Miocene

Hypsoheteroclypus vicinoconoideus Szörényi, 1953:
Holotype: the specimen figured by Szörényi (1953: pl. 6, figs. 2, 2a-b); collection of the University Lwów, Ukraine, specimen no. 44 [not seen]
Locus typicus: Pod'yarkov (= Podjarków), near Lwów, Western Ukraine
Biozone: Lower lagenid zone
Age: Early Badenian (Langhian), Middle Miocene (written comm. Anna Wysocka & Andrzej Radwański, 02.04.2004)

Echinolampas (*Hypsoclypus*) *vadaszi* Roman, 1965:
Type-material: see above under *hungaricus* Vadász, 1915
Remarks: this name was established by Roman (1965: 309) because *E. hungaricus* Vadász, 1915 is a junior homonym of *E. hungaricus* (Dornyay, 1913).

Material:
Early Badenian (Langhian) – Retznei [Weissenegg Fm., Lafarge quarry (formerly Perlmoser)], Styria, Austria
NHMW: 3 specimens (NHMW 2003z0007/0001-3)
Wanzenböck coll.: 1 specimen (W16)
Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
NHMW: 2 specimens (NHMW 2003z0008/0002-3)
Wanzenböck coll.: 3 specimens (W12-14)

Foreign material for comparison:
Middle ? Miocene – Cannetto, Corsica, France
NHMW: 1 specimen (NHMW 2002z0181/0004)
Early Badenian (Langhian) – Mátraverebély, Nógrád, Hungary
MAFI:1 specimen [MAFI Ech 219 (**holotype** of *E. hungaricus* Vadász, 1915)]
? Late Badenian (Early Serravallian) – Tótmarokháza, Nógrád, Hungary
MAFI:1 specimens [MAFI Ech 269 (reference material of *E.* cf. *elegans* in Vadász, 1915)]

Description (based on the Austrian specimens)**:**
Size and shape: The test is large with up to 14.5 cm test length. The outline is slightly oval, antero-posteriorly elongated. The anterior margin is rounded, the posterior margin bluntly pointed. The maximum width lies slightly posterior of the apical disc, about halfway along the long axis of the test. The profile is high conical with slightly inflated slopes. The apical angle is wider around the apical disc but becomes more acute at about one fifth of the test height (i.e. there is a kink in the slopes). The ambitus is thin and rounded and it lies very low on the test. The oral surface is nearly flat.
Apical disc: The apical disc lies slightly anterior of the centre, about 44 to 46 % TL from the anterior margin. The apical disc is monobasal with four large, circular gonopores and five small ocular pores. The madreporite is pentagonal in outline and moderately swollen (not as strong as in *C. subpentagonalis*) and bears numerous small hydropores, as well as small tubercles.
Ambulacra: The ambulacra are semi-petaloid on the aboral surface. They consist of two slightly diverging rows of closely spaced, slightly oblique conjugated anisopores in each ambulacrum. The poriferous zones of the "petals" are nearly flush with the interambulacra and interporiferous zones. In the paired ambulacra, the poriferous zones are of slightly different length: they are longer in the posterior half of the anterior paired ambulacra (IIa and IVb) and the anterior half of the posterior paired ambulacra (Ib and Va). The "petals" extend about 65 to 80% of the corresponding test radius. Beyond, the ambulacra bear only minute unipores with sunken attachment area and adorally positioned neural canal. The tuberculation on the aboral interporiferous zones is not very dense. The spacing between the primary tubercles is about one and a half to two times their diameter. There are between five to six tubercles across the interporiferous zone (halfway along TH). Miliary tubercles are loosely spread among them. In the poriferous zones, only small miliary tubercles are present, they are situated on the ridges between adjacent pore pairs.
On the oral side the ambulacra are depressed around the peristome and form well developed phyllodes. They consist of three series of unipores in each half-ambulacrum. The adradial and perradial series are rather closely spaced. The middle series is loosely spaced. In the adoral third of the phyllodes there is a double row of shallow pits running along the central suture (sphaeridial pits). The tuberculation of the ambulacra on the oral surface is very similar to those on the interambulacra.
Interambulacra: Around the apex the interambulacra are distinctly inflated between the petals, but not as strong as in *C. subpentagonalis*. The tuberculation on the aboral side is fairly homogenous. The primary tubercles are small and widely spaced. Their mean distance is about one and a half to three times their diameters. Miliary tubercles are loosely spread among them. Directly at the ambitus the spacing of the primary tubercles becomes very closely suddenly, with the areoles of the tubercles nearly touching each other. On the oral side the spacing of the primaries is more widely again, except near the margin. Along the central suture of interambulacrum 5 there is a zone of especially widely spaced tubercles [similar to the "naked zone" Kier (1962) noted in many species of *Echinolampas*]. The primary tubercles of the oral side are about one and a half to two times larger than those of the aboral surface. Data on the tubercle density can be found in Tab. 10. On the oral side the interambulacra are highly inflated around the peristome and along their interradial sutures, forming well developed bourrelets.
Peristome: The peristome lies slightly anterior of the centre. It is oval (transversely elongated) to slightly subpentagonal in shape. It is always smaller than the periproct, being about 10-11 % TL wide. Inside the test, no auricles are present.
Periproct: The periproct is situated very close to the margin in interambulacrum 5 and lies fully on the oral surface. It is large, being 12-14 % TL wide. The shape of the peristome is oval, transversely elongated and it is slightly rostrate.

Differential diagnosis:
See above under *C. subpentagonalis*.

Discussion:
Stefanini (1908: 370) considered *Conoclypus montesiensis* Mazzetti, 1882a to be a senior synonym of *Heteroclypus elegans* Airaghi, 1900. The figured specimen of Mazzeti (1882a), however, is rather poorly preserved and the present author is not able to decide on base of this illustration and description if *C. montesiensis* is really conspecific with *elegans* and thus prefers to keep Airaghi's name until the identity of the two species can be established or rejected on base of a re-examination of the type specimen or topotypic material.

Occurrence:
Austria: Early Badenian (Langhian); ? Late Badenian (Early Serravallian)
Vienna Basin: ? Müllendorf (Mühlendorfer Kreide AG quarry), Bgld {Tollmann, 1955 [probably refers to a GBA specimen from Eisenstadt (oldest label; probably locality Großhöflein, near Eisenstadt; certainly not from the Hartl Fm. in Eisenstadt city) erroneously labelled as coming from Müllendorf in younger labels]}; Stotzing (sandpit Mayer), Bgld (pp Kazár, 2002; [NHMW])
Styrian Basin: Retznei (Weissenegg Fm., Lafarge quarry), Styria (Hiden, 1993; [NHMW])

Paratethys (non-Austrian occurrences): Early Badenian (Langhian); ? Late Badenian (Early Serravallian)

Great Hungarian Basin (Pannonian Basin): Mátraverebély, Nógrád, Hungary (Vadász, 1915; [MAFI]); Nógrád, Hungary (Roman, 1965); ? Tótmarokháza, Nógrád, Hungary (Vadász, 1915; [MAFI])

Fore-Carpathian Basin: Pod'yarkov (= Podjarków), near Lwów, western Ukraine (Szörényi, 1953); Poland (Roman, 1965)

Zala, Sáva and Dráva Basins: Mesarski Brijeg, near Daruvara, Psunj Mts., Croatia (Poljak, 1938)

Mediterranean: Middle (?) Miocene

Western Mediterranean: Cannetto, Corsica, France ([NHMW]); Porto Torres, Sardinia, Italy (Airaghi, 1900, 1905a; Roman, 1965); Ozieri, Sardinia, Italy (Airaghi, 1905a);

Central Mediterranean: Molasse di Contese, Italy (Stefanini, 1908c); Molassa di Serra de' Guidoni, Bologna, Italy (? Manzoni, 1881; Stefanini, 1908c); ? Montese, Italy (Manzoni, 1880a; Mazzetti, 1882a); ? San Marino (Manzoni, 1880a); ? S. Maria Vigliana, Italy (Manzoni, 1880a; Stefanini, 1908c)

Conolampas cf. *subpentagonalis* (Gregory, 1891)

(Pl. 61, Figs. 1a-e)

? 1908c *Echinolampas plagiosomus* (Agass.) De Loriol 1880. – Stefanini: 363-366; pl. 12, figs. 1a-c

v. 1998 *Echinolampas subpentagonalis* (Gregory) – Schultz: 118; pl. 53, fig. 3

Material:

Late Badenian (Early Serravallian) – Hornstein, Bgld, Austria
NHMW: 1 specimen (NHMW 1970/1396/898)

Description:

Size and shape: The test is large with 113 mm test length. The outline is oval (antero-posteriorly elongated) with rounded anterior and posterior end. The maximum width and height coincide with the position of the apical disc. The profile is domed, with inflated slopes, being nearly hemispherical. The ambitus is thin and rounded and it lies very low on the test. The oral surface is flattened.

Apical disc: The apical disc lies subcentrally and is monobasal with four large, subcircular gonopores. The ocular pores are indistinct. The madreporite is highly swollen (knob-shaped) and bears numerous small hydropores.

Ambulacra: The ambulacra are semi-petaloid on the aboral surface. They consist of two slightly diverging rows of closely spaced conjugated anisopores pores in each ambulacrum. Both poriferous and interporiferous zones are distinctly depressed adapically. The poriferous zones of the "petals" are very slightly depressed. The poriferous zones Ia, IIb, IVa and Vb are slightly shorter than their counterparts. The frontal petal is slightly curved towards the left and extends about 65 % of the corresponding test radius (measured along the slope of the test, not in planar view). The anterior paired petals extend c. 68 % of the corresponding test radius, the posterior paired petals c. 72.5 %. The tuberculation on the aboral interporiferous zones is not very dense. The spacing of the primary tubercles is about one to three times their diameter. Miliary tubercles are loosely spread among them. In the poriferous zones, only small miliary tubercles are present, they are situated on the ridges between adjacent pore pairs. Halfway along the test height there are six primary tubercles across the interporiferous zones. On the oral side the ambulacra are depressed around the peristome and form well developed phyllodes, very similar to those of *C. subpentagonalis* (see above).

Interambulacra: Around the apex the interambulacra are distinctly inflated. The tuberculation on the aboral side is fairly homogenous. The primary tubercles are small and widely spaced. Their mean distance is about one to three times their diameters. Miliary tubercles are loosely spread among them. The "naked zone" along the central suture of interambulacrum 5 is not very pronounced, being more a zone of especially widely spaced tubercles. Tubercle densities of the oral surface are similar to those in *C. subpentagonalis*. Those of the aboral surface are much significantly higher than in *C. subpentagonalis* (compare Tab. 10). Adorally the interambulacra form well developed bourrelets.

Peristome: The peristome lies slightly anterior of the centre and is distinctly subpentagonal.

Periproct: The periproct is situated very close to the margin in interambulacrum 5, but lies fully on the oral surface. It is larger than the periproct and distinctly oval (transversely elongated).

Discussion:

A single specimen from the Late Badenian of Hornstein differs from the typical *C. subpentagonalis* of the Early Badenian by its hemispherical profile, higher tuberculation density, shorter petals and even more inflated madreporite. It is similar to the specimen figured as *Echinolampas plagiosomus* by Stefanini (1908c: pl. 12, figs. 1a-c).

The specimen comes from calcareous marls with abundant larger foraminifers (*Planostegina* and *Amphistegina*) outcropping at the western slopes of the Leith Mts., around the village Hornstein. Siehl (1957: 70) dated these sediments as belonging to the Late Badenian *Bolivina/Bulimina* zone.

When the present specimen is added to the data-set used for the PCA employed to explore the differences between *C. elegans* and *C. subpentagonalis* (see above under the discussion of the latter species) only two factors are extracted from the data set. Like in the earlier analysis factor 1 is controlled by all variables except the tubercle density, factor 2 is controlled mainly by tubercle density and posterior petal width. The resulting scatter plot shows that the specimen of *C.* cf. *subpentagonalis* lies well outside the morphospace occupied by *C. elegans* and *C. subpentagonalis*, but the distinction between the latter is even more blurred (Fig. 57). As stated above, larger data-sets are necessary to enhance the success of such analyses.

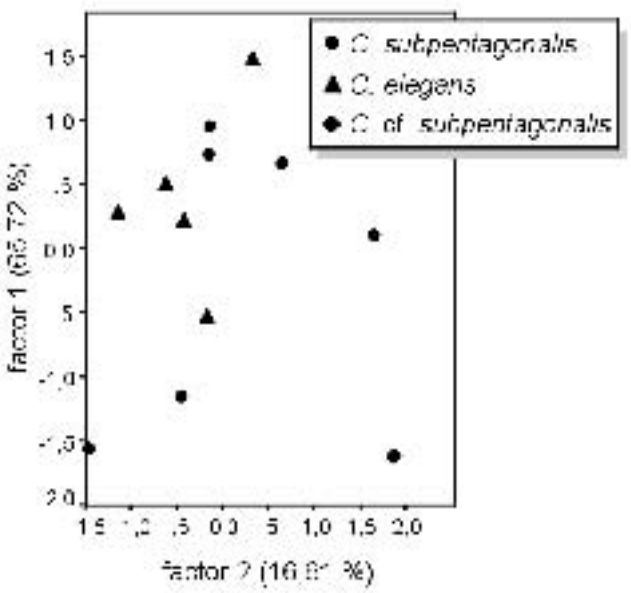

Figure 57: PCA of *Conolampas*: scatter plot of the two factors calculated by the PCA [using the same variables as in the previous analysis (Fig. 55) but with the inclusion of *C.* cf. *subpentagonalis*). Factors 1 and 2 explain 82.33 % of the variance in the present sample.

Occurrence:

Austria: Late Badenian (Early Serravallian)
Vienna Basin: Hornstein, Bgld (Schultz, 1998; [NHMW])

Conolampas ? sp. indet.

pp	1873	*Conoclypus plagiosomus*, Agass – Manzoni: 10-11, 20 [Paratethyan material]
	1882	*Conoclypus semiglobus* Des. – Hilber: 237
	1887b	*Conoclypus plagiosomus*, Agiss. – Koch: 269-270
	1891	*Conoclypus plagiosomus* Ag. – Roth von Telegd: 151
	1892	*Conoclypus plagiosomus* Ag. – Schafarzik: 196
	1905	*Conoclypus plagiosomus*, Ag – Gaál: 344, 362
	1905	*Conoclypus*, sp. indet., Ag – Gaál: 344
	1926	*Conoclypeus* sp. – Strausz: 213, 368
	1953	*Hypsoheteroclypus acuminatus* (Abich), 1882. – Szörényi: 32, 82; pl. 6, figs. 1, 1a-b
	1969	*Echinolampas ugolinii* Stef. – Mitrović-Petrović: 124; pl. 3, fig. 2
	1981	*Conoclypeus* sp. – Halmai: 106
	1981	*Echinolampas plagiosomus* Ag. – Halmai: 106
	1988a	*Hypsoheteroclypus* sp. – Kókay: 264

Material:
Badenian (Langhian-Serravallian) –Teischl quarry, (? Hartl Fm., Eisenstadt, Burgenland), Austria
NHMW: 1 test fragments (NHMW 2004z0001/008d)

Discussion:
In the literature a number of potential *Conolampas* records exist that lack sufficient information for attribution to either of the species discussed above. They are listed here under *Conolampas* ? sp. for sake of completeness.

Occurrence:

Austria: Badenian (Langhian-Early Serravallian)
Eisenstadt-Sopron Basin: Eisenstadt (Hartl hill), Bgld ([NHMW]); Großhöflein, Bgld (Manzoni, 1873)
Styrian Basin: Zirknitz, Styria (Manzoni, 1873)

Paratethys (non-Austrian occurrences): Karpatian (Late Burdigalian) to Badenian (Langhian-Early Serravallian)
Great Hungarian Basin (Pannonian Basin): borehole at Alcsútdoboz, near Budapest, Hungary (Kókay, 1988a); Fót, Hungary (Halmai, 1981); Fót (Somlyó Mt.), Hungary (Strausz, 1926); Hor. Strháre (= Felsö-Esztergály), Slovak Republic (Roth von Telegd, 1891; Gaál, 1905); Sámsonháza, Hungary (Schafarzik, 1892); Tótmarokháza, Hungary (Gaál, 1905)
Fore-Carpathian Basin: Podjarków, Ukraine (Szörényi, 1953); Stulsko valley, E of Mykolaiv (= Mikołajów), Ukraine (Hilber, 1882)
Transylvanian Basin: Felsö-Orbó, Romania (Koch, 1887b; Gaál, 1905)
Zala, Sáva and Dráva Basins: Vujići, Bosnia & Herzegovina (Mitrović-Petrović, 1969)

Family Pliolampadidae Kier, 1962
Genus *Pliolampas* Pomel, 1888

Type-species: *Echinolampas gauthieri* Cotteau, 1880, by monotypy.
Diagnosis: Medium sized cassiduloid with elongated test; apical disc monobasal with three (or sometimes four) gonopores. Petals well developed, open, with broad, equal poriferous zones. Periproct inframarginal; peristome anteriorly displaced and elongated. Bourrelets well developed. Phyllodes broad with few large pores. No naked zone in adoral interambulacrum 5 (Kier, 1962).
Distribution: Eocene to Pliocene – circum-Mediterranean, Malay Archipelago (Kier, 1962)

Pliolampas vassalli (Wright, 1855)

(Fig. 58; Pl. 62, Figs. 1-2)

?	1854	*Echinolampas Elongatula*, Millet. – Millet: 178; no. 393 [*nomen nudum*]
*	1855	*Pygorhynchus Vassalli*, Wright, n. sp. – Wright: 271-272
	1858	[*Echinanthus*] *Vassalli* Syn. *Pygorhynchus Vassalli* Wright – Desor: 296
	1864	*Pygorhynchus Vassali*, Wright. – Wright: 479; pl. 22, figs. 6a-c
? #	1865	*Echinolampas elongatula* – Millet: 611, no. 270 [reference not seen; cited from Cottreau, 1912]
?	1866	*Echinolampas elongatula* – Millet: 35, no. 270 [reference not seen; cited from Cottreau, 1912]
non	1877	*Pygorhynchus collombi*, Desor, 1857 – Cotteau in Locard: 284-286; pl. 11, figs. 6-10
non	1877	*Pygorhynchus Vassali*, Wright. – Duncan: 51, 67
?	1883	*Echinolampas elongatula* Millet, 1854. – Cotteau: 29-31; pl. 4, figs. 6-8
pp	1891	*Breynella vasalli* (Wright), 1855. – Gregory: 602
non	1895	*Pliolampas Vassali* (*Plesiolampas*), (Wright) Pomel, 1888. – Cotteau: 38
	1909	*Tristomanthus Vassali* Wright (*Pygorhynchus*) – Lambert: 134
?	1912	*Echinolampas elongatula* Millet, 1854. – Cottreau: 256, 256a-b; 15 figs. [includes photographs of the holotype]
	1913a	*Tristomanthus Vassali* Wr. (*Pygorynchus*). – Cottreau: 23
	1913a	[*Pliolampas*] *M.*[*illetia*] *Vassali* Wright (Rygorhynchus). – Cottreau: 66
v pp	1915	*Milletia angulosa* Mazz. sp. – Vadász: 218; pl. 9 (3), figs. 12-13
	1921	*P.*[*liolampas*] *Vassali* Wright (*Pygorhynchus*) – Lambert & Thiéry: 372
	1948a	*Breynella Vassali* (Wright) – Mortensen: 248; figs. 234a-c
?	1941	*Pliolampas angulosus* Mazetti. – Meznerics: 91
?	1953	*Pliolampas vassalli* (Wright), 1855. – Szörényi: 21, 69-70; pl. 3, figs. 5, 5a-b
?	1953	*Tristomanthus podjarkovi* n. sp. – Szörényi: 25-261, 74-75; pl. 4, figs. 4, 4a-b
	1962	*Pliolampas vassalli* (Wright) – Kier: 195-196; pl. 37, figs. 1-4; text-fig. 164
?	1969	*Echinolampas aequizonatus* Gregory – Mitrović-Petrović: 124; pl. 3, figs. 1, 1a-b
	1974b	*Pliolampas vassalli* – Rose: 353; fig. 3 [table]
	1975	*Pliolampas vassalli* (Wright) – Rose: 79; tab. 12
	1980	*Pliolampas vassalli* (Wright) – Challis: 168-170; pl. 62, figs. A-C; pl. 63, figs. A-C

Type-material:
Pygorhynchus vassalli Wright, 1855:
Lectotype: designated by Gregory (1891: 602); British Museum of Natural History (Geology) E 1581 (figured in Challis, 1980: pl. 6, figs. a-c)
Locus typicus: Maltese Islands
Stratum typicum: *Globigerina* Limestone
Age: Aquitanian to Langhian (Early or Middle Miocene)

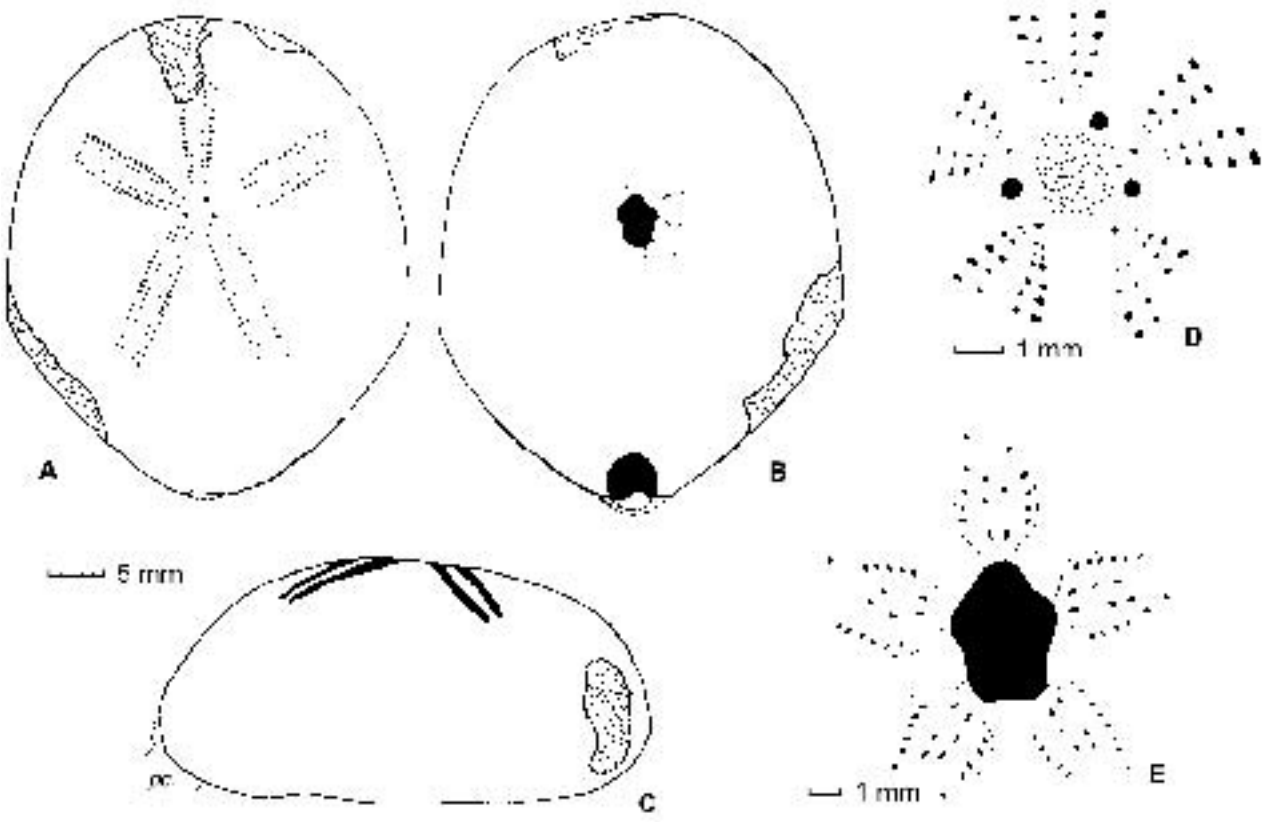

Figure 58: *Pliolampas vassalli* (Wright, 1855): aboral (A), oral (B), and lateral (C) view (damaged areas hatched), detail of the apical disc (D) and the floscelle (E) (sandpit Mayer, Stotzing, Bgld, Wanzenböck coll. W 25); pc. = periproct.

Material:
Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
Wanzenböck coll.: 1 specimen (W25)

Foreign material for comparison:
Early Badenian (Langhian) – Pod'yarkov (= Podjarków), near Lwów, western Ukraine
NHMW: 1 specimen (NHMW 1859.XLV.557)
Early Badenian (Langhian) – Mátraverebély (Meszestetö), Nógrád, Hungary
MAFI: 2 specimens [MAFI Ech 438 (reference material of *Milletia angulosa* Mazz. in Vadász, 1915)]

Dimensions (in mm)**:**

Inv. No.	TL	TW	TH
Wanzenböck coll. W25	41.1	34.6	20.4
NHMW 1859.XLV.557	35.8	26.6	18.1

Description:
Size and shape: Test of medium size, elongated, with rounded anterior and pointed posterior end. In profile the test is distinctly inflated with rounded anterior and steeply sloping posterior end. The maximum height lies slightly posterior of the centre on a weakly developed keel in interambulacrum 5. The maximum width lies posteriorly, coinciding with the end of the posterior petals in the present specimens. The adoral surface is depressed around the peristome. The width is about 84.2 % of TL, the height about 49.6 %.
Apical disc: The apical disc lies anteriorly, about 41 % from the anterior margin. It is monobasal, with 3 circular gonopores and 5 small ocular pores (Fig. 58.D). There is no genital pore 3 developed. The madreporite has a pentagonal shape and is crowded by numerous small madreporic pores.
Ambulacra: Adapically the ambulacra are petaloid, straight, open distally and relatively small. They consist of conjugate anisopores, with rounded inner and elongated, teardrop-shaped outer pores. Adjacent pores are separated by low ridges bearing a single row of small tubercles. The interporiferous zones are about as wide as a single poriferous zone. Outside the petals only small, slit-like, vertically elongated unipores are present. The anterior petals are slightly flexed anteriorly.
The frontal petal extends about half the corresponding test radius, whereas the paired petals extend about two third of the corresponding test radius. The anterior paired petals form an obtuse angle of about 115°, the posterior paired petals an acute angel of about 50°. Adorally the ambulacra form broad phyllodes consisting of large rounded unipores, arranged in two series in each half ambulacrum, an outer series consisting of 5-6 pores and an inner series consisting of 1-2 pores (Fig. 58.E).
Interambulacra: The interambulacra are loosely covered by perforate, crenulate primary tubercles in sunken areoles. Between them dense secondary/miliary tuberculation is present. The aboral tubercle density is about 150/cm², orally the tubercles are larger, showing a mean density of 110/cm². The size of the tubercles increases from the ambitus towards the peristome. Around the peristome, between the phyllodes, the primary tubercles are very widely spaced. Adorally the ambulacra form moderately well developed bourrelets.
Peristome: The peristome is pentagonal, elongated anteroposteriorly and lies anterior of the centre, about 43 % TL from the anterior margin. It is about 4.6 mm long and 3.2 mm wide in the 41.1 mm test length specimen.
Periproct: The periproct lies inframarginally in interambulacrum 5 and is strongly overhanging. It is distinctly rostrate. Only the posterior/aboral margin of the periproct reaches nearly halfway up the ambitus but is still visible in oral view (due to the

rostrate nature). The periproct has an oval, vertically elongated shape and is 5.5 mm long and 4.2 mm wide in the 41.1 mm TL specimen. Below the periproct there is a slight subanal depression.

Differential diagnosis:
This species differs from *P. gauthieri* (Cotteau, 1880) from the Burdigalian of Saint-Restitut, France, the type species of *Pliolampas*, by its smaller petals, larger test width (TW of *P. gauthieri* = 77 % TL), slightly less anterior position of the apical disc, position of maximum height (coincides with the apical disc in *P. gauthieri*) and profile outline (gently sloping posterior end in *P. gauthieri*) (compare Cotteau, 1880: 227-228, pl. 32, figs. 5-8; and Kier, 1962: 194-195, pl. 36, figs. 1-3, text-fig. 162).

P. pioti Gauthier in Fourtau, 1900 from the Late (?) Burdigalian of Gebel Geneffe, Egypt differs by its longer (but see below in discussion) and broader petals, distinctly oval outline (the characteristic kink between the anterior and posterior margin is not developed) more central position of the peristome and the position of the periproct which lies higher on the ambitus than in *P. vassalli* (compare Gauthier in Fourtau, 1900: 712-714, pl. 3, figs. 7-10; Fourtau, 1920: 62, pl. 4, figs. 5, 5a-b; Kier, 1962: pl. 36, figs. 4-7).

"*Echinanthus*" *marginatus* Mazzetti, 1882 and "*E.*" *angulosus* Mazzetti in Mazzetti & Pantanelli, 1883 (for "*Echinanthus*" sp. figured in Mazzetti, 1882a) from the Middle Miocene of Northern Italy are based on material of such poor preservation that a comparison is impossible.

Pliolampas titanensis Nelli, 1907 from the Miocene of San Marino is very similar to *P. vassalli* (compare Nelli, 1907: 2268-269; pl. 9, figs. 10, 10a-b). According to Nelli (1907: 269) it differs from the latter by its longer posterior paired petals and the higher number of pores within the petals.

Studeria corsica (Cotteau, 1877) which co-occurs with *P. vassalli* in the locality Stotzing (Bgld), differs from that species by its ovoid outline, broader petals, marginal periproct, which is visible only in posterior view and central position of the peristome.

Discussion:
The studied specimen is very similar to the lectotype of *Pliolampas vassalli* (Wright, 1855) and differs only slightly from that specimen. In the lectotype the gonopores are larger [could easily be related to sexual dimorphism or other intraspecific variation; in the very similar *P. elongatula* specimens with both, large and small gonopores are known (see Cottreau, 1912)] and the frontal and anterior paired petals extend farther to the ambitus (about three quarters corresponding test radius). This may be due to the fact, that the studied specimens are larger (TL = 41.1 and 35.8 mm respectively) than the lectotype (TL = 29.3 mm) and since all other features are virtually identical, the Austrian specimens is placed into the species *P. vassalli*.

Cotteau (in Locard, 1877: 284-286) placed *P. vassalli* into the synonymy of *Pygorhynchus collombi* Desor, 1857. As Gregory (1891: 602) already pointed out, this cannot be accepted, since *P. collombi* is clearly not conspecific, moreover, not even congeneric with *P. vassalli*, since the former species has a distinct naked zone in interambulacrum 5, a non-rostrate periproct, which is visible only in posterior view, a different outline and different petal morphology. On the other hand, Gregory's (1891: 602) statement that "*Echinanthus*" *corsicus* Cotteau, 1877 belongs into the synonymy of *P. vassalli* is also dubious (see also Lambert, 1907a: 58). "*E.*" *corsicus* has a marginal periproct, lying higher on the ambitus than in *P. vassalli*, it is only very slightly rostrate and the shape of the test in profile is also different [judging by the description and illustration given by Cotteau (1877: 282-284, pl. 11, figs. 1-5)].

The specimens figured as *P. vasalli* by Airaghi (1905b: 49-50; pl., fig. 7-10) are not conspecific with Wright's type-material according to Lambert (in Cottreau, 1913a: 66, under *Tristomanthus corsicus*) and probably belong to "*Echinanthus*" *corsicus* Cotteau, 1877.

P. vassalli has also been reported from the Early Badenian of the Ukraine (Szörényi, 1953), however, the description and figures are not sufficient to decide, whether or not the described specimen belongs into the species. Moreover, Szörényi (1953) reports two species of *Pliolampas* and seven of *Studeria* (under the junior synonym *Tristomanthus*), including two new ones, from the same locality, each represented by a single specimen. As Philippe (1998: 105) pointed out, the high number of closely related species reported from a single locality is rather surprising and a revision of this material is urgently needed. A specimen from the Early Badenian of Pod'yarkov (= Podjarków, near Lwów, western Ukraine) in the collection of the Naturhistorisches Museum Wien (NHMW 1859.XLV.557) is clearly conspecific with *P. vassalli*.

Part of the material referred to *Milletia angulosa* Mazz. by Vadász (1915: 218) belong to the species discussed here (two specimens from the Early Badenian of Mátraverebély (Meszestetö), Nógrád, Hungary; MAFI Ech 438). The remaining reference material of Vadász (1915) including the figured specimen [MAFI Ech 246 from Mátraverebély and MAFI Ech 449 from Tótmarokháza (= Márkháza), both in Nógrád, Hungary], as well as the material referred to as *Pliolampas* sp. by Vadász (1915) (MAFI Ech 305 from Mátraverebély) are poorly preserved and could not be referred to any definitive species or genus.

Pliolampas elongatula (Millet, 1865) from the Serravallian ["facies Savignéen" in Cottreau, 1912; dated as Serravallian by Demarq (in Steininger et al., 1985: vol. 1: 26, vol. 2: 55, area no. 309 Loire-Bretagne)] of western France, the type-species of *Milletia* Duncan, 1877 (a genus considered as junior synonym of *Pliolampas* by Kier, 1962: 196-197), is remarkably similar to *P. vassalli*. The type-material of this species was re-illustrated by Cottreau (1912), who gave 1854 as publication date. In Millet (1854), the species is only mentioned without description or illustration and thus represents a *nomen nudum*. According to Cottreau (1912) it was first described in Millet (1865: 611), contrary to the statement of Kier (1962: 196), who maintained that in this publication there is no description in that paper either. *P. elongatula* differs from *P. vassalli* by its slightly longer posterior paired petals (as far as can be judged from the photographs in Cottreau, 1912), the more posterior position of the characteristic kink between anterior and posterior margin, as well as the less pointed posterior end. As these features show high intraspecific variation (and, in fact, the topotype figured by Cottreau, 1912 is nearly indistinguishable from a typical *P. vassalli*), it is likely that the two species are conspecific or at least closely related.

Cotteau (1877: 284) listed *P. vassalli* in the synonymy of the taxon "*Pygorhynchus collombi* Desor, 1857". Besides being the younger name anyway (thus *P. vassalli* would have priority, if they were conspecific), this "*Pygorhynchus collombi*" is very different from *P. vassalli*, and not even congeneric. If Cotteau's figures and descriptions are correct [and correspond to the type material (in Desor, 1855-1858 there is only a very short description)] this species has a transversely elongated periproct (not known in any pliolampadid), a well developed naked zone along the central suture of adoral interambulacrum 5 (also missing in most pliolampadid genera) and petals which are closing distally and consist of numerous, closely spaced pores (a condition very different from that observed in *Pliolampas, Studeria* and most other pliolampadid genera).

Occurrence:

Austria: Early Badenian (Langhian)
Vienna Basin: Stotzing (sandpit Mayer), Bgld ([Wanzenböck coll.])

Paratethys (non-Austrian occurrences): Early Badenian (Langhian)
Great Hungarian Basin (Pannonian Basin): ? Márkháza, Nógrád, Hungary (Meznerics, 1941); Mátraverebély (Meszestetö), Nógrád, Hungary (pp Vadász, 1915; [MAFI])

Fore-Carpathian Basin: Pod'yarkov (= Podjarków), near Lwów, western Ukraine (? Szörényi, 1953; [NHMW])
Zala, Sáva and Dráva Basins: ? Vujići, Bosnia & Herzegovina (Mitrović-Petrović, 1969)

Mediterranean: ? Aquitanian, ? Burdigalian, Langhian [in her revision Challis (1980) was not able to ascertain pre-Langhian occurrences]
Central Mediterranean: *Globigerina* Limestone, Maltese Islands (Wright, 1855; Desor, 1858; pp Gregory, 1891; Lambert, 1909; Cottreau, 1913a, Kier, 1962); "nodular beds" (= phosphate conglomerates) within the *Globigerina* Limestone, Maltese Islands (Wright, 1864); Lower (?) to Middle *Globigerina* Limestone, Maltese Islands (Rose, 1974b, 1975); Xwieni conglomerate bed Islands (= C_2 phosphate conglomerate of Pedley et al., 1976), Upper *Globigerina* Limestone, Maltese (Challis, 1980)

Atlantic Ocean: Serravallian [under the name *P. elongatula* (Millet, 1865)]
Bretagne – Loire Basin: ? Briand, Maine-et-Loire, western France (Cottreau, 1912); ? Chavagnes, Maine-et-Loire, western France (Millet, 1854, 1865, 1866; Cotteau, 1883; Cottreau, 1912); ? Doué-la-Fontaine, Maine-et-Loire, western France (Millet, 1854, 1865, 1866; Cotteau, 1883; Cottreau, 1912); ? Martigné, Maine-et-Loire, western France (Millet, 1854, 1865, 1866; Cotteau, 1883; Cottreau, 1912); ? Saumurois, Maine-et-Loire, western France (Cottreau, 1912)

Genus *Studeria* Duncan, 1889

Type-species: *Catopygus elegans* Laube, 1869; by monotypy (Duncan, 1889: 185).
Diagnosis: Small pliolampadid, with anteriorly eccentric monobasal apical disc with three pores; no pore in left anterior genital plate; petals long, straight and open, adjacent pore pairs widely spaced; peristome antero-posteriorly elongated; periproct vertically elongated and situated marginally; bourrelets strongly developed, phyllodes slightly widened; no "naked zone" in interambulacrum 5 (summarised from Kier, 1962).
Distribution: Oligocene to Miocene – Europe and Australia (Kier, 1962); Recent – Arafura Sea, south of Papua New Guinea (Kier, 1962; Mooi, 1990a)
Remarks: The genera *Pliolampas* Pomel, 1888 and *Studeria* Duncan, 1891 are very similar. *Studeria* differs from the former by its marginal periproct and more strongly developed bourrelets (Kier, 1962: 217). Several authors suggested that the two genera should be regarded as synonymous (e.g. Lambert & Thiéry, 1921: 371-372; Pomel, 1888: 446). Lately Philippe (1998: 102) expressed his doubts if the two genera should really be separated. Here the classification of Kier (1962) is followed, since that question must be investigated at a broader scale and cannot be decided on base of the limited material discussed here. For *Studeria recens* (Agassiz, 1879), the species most closely related (in morphological terms) to the species discussed below, a separate genus (*Hypselolampas*) was established by Clark (1917: 104), but this genus was synonymised with *Studeria* by Kier (1962: 217). Lately Mooi (1990a: 82) stated that "... there is some uncertainty that *S. recens* is a *Studeria*, ...". In a recent paper on the cassiduloid ancestry of the clypeasteroids by Smith (2001) indeed some evidence turned up that *S. recens* is not congeneric with the fossil members of this genus and that Clark's genus might be justified. In Smith's cladistic analysis *Studeria recens* (Ag.) and *S. elegans* (Laube) do not form a monophyletic group. *S. recens* is a sister taxon to a clade including *Oolopygus*, *S. elegans*, *Notolampas*, *Oligopodia* and *Neolampas* (Smith, 2001: fig 2, semistrict consensus tree). Its phylogenetic position, however, is not well resolved, depending on the taxa included in the analysis *Studeria* is either closer to the echinolampadids and cassidulids or the neolampadids (see Suter, 1994b; Smith, 2001: fig. 3).

Studeria corsica ? (Cotteau, 1877)

(Fig. 59; Pl. 62, Figs. 3-4)

?	1840b	[*Pygorhynchus*] *subcylindricus* Ag. – Agassiz: 5 [*nomen nudum*]
? *	1847a	[*Pygorhynchus*] *subcylindricus* Agass. – Agassiz in Agassiz & Desor: 161 [*nomen dubium*]
?	1858	[*Pygorhynchus*] *subcylindricus* Agass. – Desor: 298
*	1877	*Echinanthus corsicus*, Cotteau, 1876 – Cotteau in Locard: 282-284; pl. 11, figs. 1-5
	1895	*Pliolampas Vassali* (*Plesiolampas*), (Wright) Pomel, 1888. – Cotteau: 38
	1907a	*Tristomanthus corsicus* Cotteau (*Echinanthus*), 1877. – Lambert: 58
?	1921	[*Pliolampas*] *S.*[*tuderia*] *subcylindrica* Agassiz (*Pygorhynchus*) – Lambert & Thiéry: 373

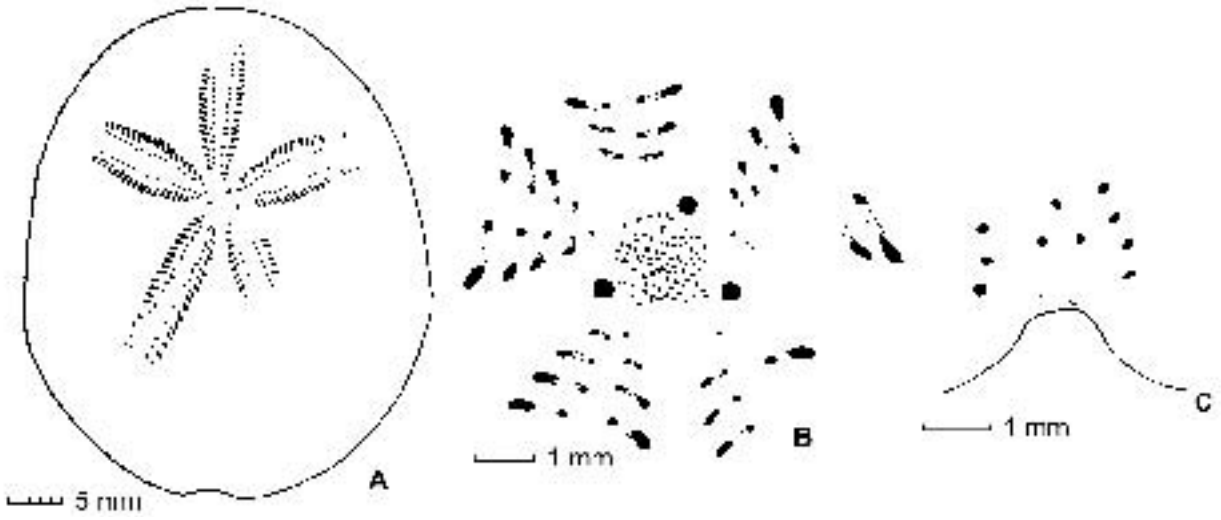

Figure 59: *Studeria corsica* ? (Cotteau, 1877): aboral view (A), detail of the apical disc (B) and phyllode (C) (Lafarge quarry, Retznei, Stmk, NHMW 2002z0173/0001).

? 1928 *Tristomanthus subcylindricus* Agassiz (*Pygorhynchus*) – Lambert & Jeannet: 154; pl. 1, figs. 1-4
? 1905b *Pliolampas Silvestrii* n. sp. – Airaghi: 51-52, pl., figs. 1-4
non 1953 *Tristomanthus subcylindricus* (Agassiz), 1846. – Szörényi: 23, 71-72; pl. 5, figs. 4, 4a-b

Type-material:
Echinanthus corsicus Cotteau, 1877:
Syntypes: collection of Peron and Cotteau; current whereabouts unknown
Locus typicus: Bonifacio, Corsica, France
Age: Late Burdigalian to Serravallian [based on the dating by Orszag-Sperber (in Steininger et al., 1985: Vol. 1: 27, Vol. 2: 57, area 20b Corsica, Bonifacio Basin)]

Material:
Early Badenian (Langhian) – Retznei [Weissenegg Fm., Lafarge quarry (formerly Perlmoser)], Styria, Austria
NHMW: 1 specimen (NHMW 2002z0173/0001)
Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
Wanzenböck coll.: 1 deformed specimen (W26)

Foreign material for comparison:
Late Burdigalian to Serravallian – Monte Balistro, near Bonifacio, Corsica, France
NHMW: 1 slightly crushed specimen (NHMW 1857.XV.124)

Dimensions (in mm)**:**

Inv. No.	TL	TW	TH
NHMW 2002z0173/0001	41.4	34.6	21.2
Wanzenböck coll. W26	~ 45	~38	24.2

Description:
Size and shape: Test of medium size, antero-posteriorly elongated, with distinctly ovate outline. Posterior margin indented by the groove of the periproct. In profile the test is distinctly inflated with rounded anterior and obliquely truncated posterior margin. The maximum height lies centrally, the maximum width of the test lies posteriorly, approximately at the point, where the posterior petals end. The adoral surface is strongly depressed around the peristome. The width is about 83.5 % of TL, the height about 51.2 %.
Apical disc: The apical disc lies anteriorly, about 35 % TL from the anterior margin. It is monobasal, with 3 relatively small gonopores. Genital pore 3 is not developed (Fig. 59.B). The madreporite has a pentagonal shape and is crowded by numerous small madreporic pores. The ocular pores are small and rounded.
Ambulacra: Adapically the ambulacra are petaloid, straight and open distally. They consist of conjugate anisopores, with rounded inner and elongated, teardrop-shaped outer pores. Adjacent pores are separated by low ridges. Adapically the pores are quite closely spaced, in the most distal part of the petals, they become increasingly less closely spaced. The interporiferous zones are smaller than a single poriferous zone. In the anterior paired petals alone they may be nearly as wide as a single poriferous zone. Outside the petals only small unipores are present.

The frontal petal extends about two third of the corresponding test radius, whereas the paired petals extend about half of the corresponding test radius to the ambitus. The anterior paired petals form an obtuse angle of about 135°, the posterior paired petals an acute angel of about 50°. Adorally the ambulacra form broad phyllodes consisting of large rounded unipores, arranged in two series in each half ambulacrum, an outer series consisting of four to five pores and an inner series consisting of one to two pores (Fig. 59.C).
Interambulacra: The interambulacra are covered by perforate, crenulate primary tubercles in sunken areoles. Between them a dense secondary/miliary tuberculation is developed. The aboral tubercle density is about 180/cm², orally the tubercles are larger, showing a mean density of 140/cm². Adorally the ambulacra form weakly developed bourrelets.
Peristome: The peristome is sub-pentagonal, and lies in a moderately deep depression in the centre of the oral surface. It is about 3.7 mm wide in the specimen from Retznei (NHMW 2002z0173/0001).
Periproct: The periproct lies marginally in interambulacrum 5 and is visible only in posterior view. It is situated halfway up the ambitus at the end of a shallow groove connecting it with the oral surface. The periproct has an oval, vertically elongated shape and is 5.4 mm long and 4.1 mm wide in specimen NHMW 2002z0173/0001.

Differential diagnosis:
S. aremorica (Bazin, 1884) from the Miocene of the Bretagne differs by its longer petals, which nearly extend up to the ambitus and its less anteriorly positioned apical disc (compare Bazin, 1884: 40-41, pl. 1, figs. 26-30).

S. caralitana (Lambert, 1907) from the Early or Middle Miocene of Sardinia, differs from this species by its strongly anteroposteriorly elongated outline (TW ~ 70 % of TL), high, cylindrical profile (TH ~ 60 % TL), narrow petals, anteriorly eccentric peristome, posteriorly eccentric maximum height, pronounced keel in aboral interambulacrum 5 and position of the periproct, which lies lower on the ambitus (compare Lambert, 1907a: 37-38, pl. 3, figs. 8-11).

S. elegans (Laube, 1869), the type-species of the genus *Studeria* (not *S. recens*, see Kier, 1962: 217), from the Miocene of Southern Australia, differs from this species by its less elongated outline (width is about 90 % TL), its longer petals, which extend nearly up to the ambitus, its pointed posterior end, and its less anterior positioned apical system (about 40 % TL from the anterior margin) (compare Laube, 1869b: 190-191; figs. 8, 8a).

S. meslei (Gauthier in Cotteau, 1877) from the Burdigalian of the Rhône Basin differs from this species by less elongated shape (width is about 85 to 88 % TL), its longer petals, which extend nearly up to the ambitus, its pointed posterior end, its less anterior positioned apical system (about 40 % TL from the anterior margin), its slightly wedge shaped test profile, with lower ambitus and the position of its peristome, which is inframarginal and visible in oral view [compare the description and illustrations of Cottreau (1913a: 112, pl. 12, figs. 11, 11a-c), and Philippe (1998: 102-104; pl. 19, figs. 1-4)].

S. pantanellii (Stefanini, 1908) from the Middle Miocene of northern Italy, which is similar to *S. spratti* (see below) differs by its small, regularly oval outline, subcentral maximum width and its slightly overhanging periproct [compare Stefanini, 1908b: 76-77, pl. 13 (1), figs. 6a-b].

S. recens (Agassiz, 1879) an extant species from the Arafura Sea between Papua New-Guinea and Australia, differs by its even more anterior positioned apical system (about 30 % TL from the anterior margin), its highly inflated test (test height about 70 % TL), its distinct keel in aboral interambulacrum 5 and its wider interporiferous zone of the frontal petal (compare Agassiz, 1881: 123-124, pl. 20, figs. 17-21, Mooi, 1990a: 82, fig. 10d).

S. silvestrii (Airaghi, 1905) from Miocene of S. Maria Tiberina (Umbria, western Italy) differs from the present specimen by its less anteriorly situated maximum width, less ovoid outline, anteriorly eccentric peristome and its periproct which lies lower on the ambitus.

S. spratti (Wright, 1964) from the Burdigalian to Langhian Middle and Upper *Globigerina* Limestone of Malta differs by its pointed posterior end, sub-centrally to anteriorly positioned maximum width, anteriorly eccentric peristome, slightly overhung periproct and regular spacing of the pore pairs within the petals [compare Wright, 1864: 490, pl. 21, figs. 6a-d (only figured); Cottreau, 1913a: 113, pl. 11, figs. 8, 8a, 9-10; Challis, 1980: 173-176, pl. 66, figs. a-c, pl. 67, figs. a-c].