

1914b); south of Rif, Leben valley, Morocco (LAMBERT, 1931); Santa Christobal, Menorca, Balears, Spain (HERMITE, 1879); Santa Manza, Corsica, France (MICHELIN, 1861; LAUBE, 1871); Santa-Maria near Ronca, Italy (MICHELIN, 1861; LAUBE, 1871); Sedini e Castelsardo, Sardinia, Italy (LOVISATO, 1914b); St. Pau d'Ordal, Catalonia, Spain (LAMBERT, 1927a); Vence, Alpes-Maritimes, France (LAMBERT, 1912);

Central Mediterranean: Faehiat, Cyrenaica, Libya (CHECCHIA-RISPOLI, 1927b); Ragusa, Sicily, Italy ([NHMW])

Eastern Mediterranean: Gebel Geneffé, Eastern Desert, Egypt (FOURTAU, 1901, 1902, 1920; LAMBERT, 1931); Geneifa (= Geneffé) massif, Eastern Desert, Egypt (FOURTAU, 1920); Morea (= Morée), Greece (PICTET, 1857)

Atlantic Ocean: Early-Middle Miocene

Aquitaine Basin: Caupian and Léognan, France (LAMBERT, 1927b; CHAVANON, 1974)

Clypeaster sp. indet.

- ? 1807 *Echinus rosaceus* – STÜTZ: 75-76
 1831 *Clypeaster* (*Echinanthus marginatus* (?) of LESKE) – SEDGWICK & MURCHISON: 391, 419
Clypeaster – ROLLE: 583, 592
 1856 *Clypeaster* – MÜRLE: 333
 1867 *Clypeaster* – FUCHS: 597
 1868 *Clypeaster* – FUCHS: 59; No. 112
 1875 *Clypeaster* div. sp. – FUCHS: 667
 1877 *Clypeaster* – HILBER: 265
 1877 *Clypeaster* sp. – KARRER: 78, 168, 229, 242, 262
 1877 *Clypeaster* div. sp. – KARRER: 303
 1882 *Clypeaster* sp. – HILBER: 236
 1893 *Clypeaster* sp. – TOULA: 288
 1894 Többsféle *Clypeaster* töredéke. – LÖRENTHEY: 61
 1900 *Clypeaster* – FUCHS: 882
 1902 *Clypeaster* – FUCHS: 351, 355
 1903a *Clypeaster* – FUCHS: 7
 1903 *Clypeaster* – HOERNES: 955
 1903 *Clypeaster* – HOERNES: 957, 964, 965, 1095
 1905 *Clypeaster* – FABIAN: 20
 1906 *Clypeaster* – SCHAFFER: 78, 90
 1907 *Clypeaster* – SCHAFFER: 25, 26
 1908 *Clypeaster* sp. – SCHAFFER: 46
 1908 *Clypeaster* sp. – SCHAFFER: 85
 1912b *Clypeaster* – SCHAFFER: 45, 47, 53
 1915 *Clypeaster* sp. – MÁJER: 36, 89
 1924 *Clypeaster* – ABEL: 60
 1924a *Clypeaster* – SCHAFFER: 43, 46, 51
 1924b *Clypeaster* – SCHAFFER: 485
 1927a *Clypeaster* – SCHAFFER: 78
 1928 *Clypeaster* – SCHAFFER: 202
 1930 *Clypeaster* sp. – BOBIES: 26
 1930 *Clypeaster* sp. – VENDL: 77
 1938 *Clypeaster* sp. – POLJAK: 191-192
 1942 *Clypeaster* – SCHAFFER: 128, 142
 1943 *Clypeaster* – JANOSCHEK in SCHAFFER: 441, 443, 445, 447
 1951 *Clypeaster* – JANOSCHEK in SCHAFFER: 559, 561, 563, 565
 1953b *Clypeaster* sp. – SIEBER: 194
 1955 *Clypeaster* – THENIUS: 110-111; pl. 13, fig. 33
 1955 *Clypeaster* sp. – TOLLMANN: Tab. 5b
 1958a *Clypeaster* sp. – SIEBER: 152
 1961 *Clypeaster* – SCHAFFER: 149
 1961 *Clypeaster* – WESSELY: 319
 1962 *Clypeaster* – PAPP & THENIUS in KÜHN: 145
 1962 *Clypeaster* – THENIUS: 108-109; pl. 8, fig. 33
 1965 *Clypeaster* sp. (flache Art) – KOLLMANN: 541
 1965 *Clypeaster* – KOLLMANN: 549

- 1965 *Clypeaster* – FUCHS: 169
 1968 *Clypeaster* – FLÜGEL & HERITSCH: 35, 99
 1968 *Clypeaster* sp. – SCHMID: Anhang
 1969 *Clypeaster exscentricus* VAD. – MITROVIĆ-PETROVIĆ: 136; pl. 25, figs. 1, 1a-b
 1970 *Clypeaster* – THENIUS: p. 215
 1970 *Clypeaster* – THENIUS: p. 216
 1974 *Clypeaster* sp. – THENIUS: 70-71; fig. 13/24
 1974 *Clypeaster* sp. – VÄVRA: 345
 1977 *Clypeaster* sp. – EBNER & GRÄF: 161
 1978 *Clypeaster* sp. – KOLLMANN & RÖGL: 165
 1978b *Clypeaster* – PAPP et al.: 33
 1979 *Clypeaster* sp. – THENIUS: 52; pl. 3, fig. 24
 1980 *Clypeaster* sp. – BRIX: 44; pl. 6, fig. 23
 1982 *Clypeaster* – FENNINGER & WASSERMANN: 50
 1983 *Clypeaster* – DULLO: 19
 1983 *Clypeaster* sp. – THENIUS: 119; pl. 7, fig. 24
 1984 *Clypeaster* sp. – KÓKAY et al.: 290
 1985 *Clypeaster* sp. indet. – MIHÁLY: 238
 1985 *Clypeaster* – TOLLMANN: 501
 1985 *Clypeaster* – TOLLMANN: 564
 1987 *Clypeaster* sp. – MAČZYŃSKA: 146, 148; pl. 4, figs. 6a-b
 1988 *Clypeaster* sp. – BRIX: 35
 1989 *Clypeaster* sp. – NEBELSICK: 15
 1990 *Clypeaster* sp. – FRIEBE: 245, 254
 1991a *Clypeaster* sp. – NEBELSICK et al.: 88
 1991b *Clypeaster* – NEBELSICK et al.: 119
 ? 1993 *Echinolampas* sp. – MAČZYŃSKA: 111-112; pl. 2, figs. 6, 6a-b
 1997 *Clypeaster* sp. – MAJCN et al.: 106; pl. 6, fig. 2
 1998 *Clypeaster* sp. – HIDEN: pl. 1, figs. 6
 1999 *Clypeaster* sp. – ROHATSCH: 23; fig. 6 [probably a *C. campanulatus*]
 2000 *Clypeaster* – PILLER: 87
 2001 *Clypeaster* sp. – MIKUŽ & MITROVIĆ-PETROVIĆ: 53-54; pl. 2, figs. 1, 1a, 3, 3a
 2002 *Clypeaster* sp. – KAZÁR: 153; fig. 1
 2002 *Clypeaster* – WEIDERT: 141, fig.
 v. 2002b *Clypeaster* sp. – KROH: 12
 v. 2002 *Clypeaster* sp. – PLÖCHINGER & KARANITSCH: 161, fig. 332
 v. 2002 *Clypeaster* sp. – PLÖCHINGER & KARANITSCH: 165, fig. 353

Remarks: In the case of *Clypeaster* sp. international references are omitted from the synonymy. In some cases non-Austrian Paratethyan references, if accompanied by a description or illustration are included.

Material:

Late Eggenburgian (Early Burdigalian) – Eggenburg (train station, Zogelsdorf Fm.), NÖ, Austria
 NHMW: 2 specimens (NHMW 1981/55/1)
 Late Eggenburgian (Early Burdigalian) – Limberg (Zogelsdorf Fm., Hengl quarry), NÖ, Austria
 NHMW: 2 specimens (NHMW 2004z0042/0006-7)
 Early Badenian (Langhian) – Gainfarn, NÖ, Austria
 NHMW: 1 fragment (NHMW 2004z0076/0068)
 Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
 NHMW: 1 specimen (NHMW 2004z0093/0024)
 Early ? Badenian (Langhian) – Rauchstallbrunngraben, near Baden, NÖ, Austria
 NHMW: 2 specimens (NHMW 1846.37.962, 1846.37.963)
 Badenian (Langhian-Early Serravallian) – Baden, NÖ, Austria
 NHMW: 1 specimen (NHMW 2003z0054/0002 to 0003)
 Badenian (Langhian-Early Serravallian) – Bad Fischau, NÖ, Austria
 NHMW: 1 specimen (NHMW 1860.XIX.4/1861.I.527 [two inv. nos., one specimen])

Badenian (Langhian-Early Serravallian) – Mannersdorf, Bgld, Austria

NHMW: 1 specimen (NHMW A3158)

Badenian (Langhian-Early Serravallian) – Devínska Nová Ves, Slovak Republic

NHMW: 1 specimen (NHMW 1852.II.1552)

Badenian (Langhian-Early Serravallian) – Oslip, Bgld, Austria

NHMW: numerous fragments (NHMW 2003z0083/0004)

Badenian (Langhian-Early Serravallian) – Perchtoldsdorf, NÖ, Austria

NHMW: 2 specimens (NHMW 2003z0052/0002-0003)

Badenian (Langhian-Early Serravallian) – Sooss, near Baden, NÖ, Austria

NHMW: 1 specimen (NHMW 1855.XLV.991)

Badenian (Langhian-Early Serravallian) – Steinebrunn (formerly Steinabrunn), NÖ, Austria

NHMW: 8 specimens (NHMW 1846.37.956, 1846.37.956.b

[*Clypeaster*-demipyramids])

Badenian (Langhian-Early Serravallian) – Wöllersdorf, NÖ, Austria

NHMW: 1 specimen (NHMW 2003z0061/0001)

Late Badenian (Early Serravallian) – Müllendorf (quarry of the Mühlendorfer Kreidewerke AG), Bgld, Austria

NHMW: 5 fragments (NHMW 2004z0112/0008)

Late Badenian (Early Serravallian) – Stiefingbach (old mill, Pesendorf 16), Styria, Austria

NHMW: 1 specimen (NHMW 2004z0114/0001)

Discussion:

Being easily recognisable, the genus *Clypeaster* has often been reported in the geological/palaeontological literature of Austria. Most of the records do not state a specific species and come without description and or illustration. Thus they cannot safely be referred to any of the species discussed above and are therefore listed here as *Clypeaster* sp. indet. to provide complimentary information on the distribution of this genus in the Neogene of Austria. Additionally specifically undeterminable *Clypeaster* specimens in the collection of the Naturhistorisches Museum Wien are listed, which document the occurrence of this genus in previously not mentioned localities. Most of these specimens certainly belong to the species discussed above. Some of them, however, like the specimen from Stiefingbach might represent other species, not reported from Austria up till now. The poor preservation of the material, however, does not warrant discussing them separately.

The fragments figured as *Echinolampas* sp. by MAČZYŃSKA (1993: pl. 2, figs. 6, 6a-b) belong to the genus *Clypeaster*, this is indicated by the size-relation of interambulacral and ambulacral plates, as well as by the presence of an internal buttress system.

The record of *Echinus rosaceus* by STÜTZ (1807: 75-76) from the Calvariberg near Baden (NÖ) most probably refers to a *Clypeaster* species.

Occurrence:

Austria: Late Eggenburgian (Early Burdigalian), Badenian (Langhian-Early Serravallian)

Molasse Zone: Eggenburg (Brunnstube), NÖ (NEBELSICK et al., 1991a); Kühnring valley, near Eggenburg (FUCHS, 1868); Limberg (Hengl quarry), NÖ (NEBELSICK et al., 1991b); Schmidabach, near Eggenburg (FUCHS, 1900); Zogelsdorf Fm., region of Eggenburg, NÖ (NEBELSICK, 1989)

Vienna Basin: Baden, NÖ ([NHMW]); Baden (Calvariberg), NÖ (STÜTZ, 1807); Bad Fischau, NÖ (ROHATSCH, 1999; [NHMW]); Brunn am Steinfeld, NÖ (KARRER, 1877); Gainfarn (KROH, 2002b; PLÖCHINGER & KARANITSCH, 2002); Grinzling (Villa Schöller), Vienna (FUCHS, 1875; SCHAFFER, 1906); Hainburg hills, NÖ (WESSELY, 1961); Hainburg an der Donau, NÖ (MÜRLE, 1867); Hasenberg, NÖ (KARRER, 1877); Hornstein, Bgld (TOLLMANN, 1955); Jadlkogel between

Baden and Gumpoldskirchen, NÖ (KARRER, 1877); Kaisersteinbruch (Leitha Limestone), Bgld (SCHAFFER, 1908); Kaisersteinbruch (as reworked clasts in Sarmatian sediments), Bgld (FUCHS, 1902); Kalksburg, Vienna (HOERNES, 1903; JANOSCHEK in SCHAFFER, 1943, 1951; THENIUS, 1955, 1962, 1974, 1979; 1983); Leitha Mountains (JANOSCHEK in SCHAFFER, 1943, 1951; SCHMID, 1968; TOLLMANN, 1985); Lindabrunn, NÖ (SCHAFFER, 1942; BRIX, 1980); Mannersdorf, NÖ ([NHMW]); Mödling, NÖ (KARRER, 1877); Möllersdorf, NÖ (KARRER, 1877); Müllendorf (Mühlendorfer Kreide AG quarry), Bgld (SCHAFFER, 1908; SCHAFFER, 1961; DULLO, 1983); Müllendorf (Fenk quarry), Bgld (TOLLMANN, 1955); Nußdorf (Grünes Kreuz), Vienna (SCHAFFER, 1906); Perchtoldsdorf, NÖ (KARRER, 1877); Pötzleinsdorf, Vienna (SIEBER, 1953b; THENIUS, 1970); Rauchstallbrunngraben, near Baden (FUCHS, 1903a; SCHAFFER, 1907, 1912b; ABEL, 1924; SCHAFFER, 1924a; BOBIES, 1930; SCHAFFER, 1942; VÁVRA, 1974; BRIX, 1988; PLÖCHINGER & KARANITSCH, 2002; [NHMW]); Sooss, near Baden, NÖ (KARRER, 1877; [NHMW]); Steinebrunn, NÖ (SIEBER, 1958a; [NHMW]); Stotzing (sandpit Mayer), Bgld (KAZÁR, 2002); Vienna (THENIUS, 1970); Vienna Basin (HOERNES, 1903; SCHAFFER, 1924b, 1927a, 1928), Wöllersdorf, NÖ ([NHMW])

Eisenstadt-Sopron Basin: Burgenland (WEIDERT, 2002); Eisenstadt (Gloriette), Bgld (TOLLMANN, 1955); Eisenstadt (Johannesgrotte), Bgld (PILLER, 2000); between Großhöflein and Kleinhöflein, Bgld (TOLLMANN, 1955); Oslip, Bgld (FUCHS, 1965; DULLO, 1983)

Styrian Basin: Altenberg, Styria (HIDEN, 1998); Eckberg, near Gamlitz, Styria (HILBER, 1877); mid-styrian ridge, between Wildon and Ehrenhausen, Styria (FLÜGEL & HERITSCH, 1968; TOLLMANN, 1985); hills of Neurath and Muggenau, Styria (ROLLE, 1856); Pinkafeld, Bgld (HOERNES, 1903); Retznei [Lafarge quarry (formerly Perlmoser)], Styria (FLÜGEL & HERITSCH, 1968; FRIEBE, 1990); between St. Georgen and Pichla, Styria (KOLLMANN, 1964); Stiefingbach, Pesendorf, near Wildon, Styria (KOLLMANN & RÖGL, 1978; [NHMW]); Sukdull, Styria (FABIAN, 1905); Weitendorf, Styria (EBNER & GRÄF, 1977; FENNINGER & WASSERMANN, 1982); Wiesfleck, Styria (KOLLMANN, 1964); Wildon-Weißeneegg, Styria (FRIEBE, 1990); Zirknitz valley, Styria (SEDGWICK & MURCHISON, 1831)

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

Fore-Carpathian Basin: Korytnica Clays, Korytnica, Central Poland (MAČZYŃSKA, 1987); Lackie małe, [Zloczow (= Zolochiv) county], Ukraine (HILBER, 1882); Mykolaiv (= Mikolajów), S of Lwów, Ukraine (HILBER, 1882); Pińczów, Central Poland (MAČZYŃSKA, 1993)

Molasse Zone: Kralice nad Oslavou (= Kralitz), Moravia, Czech Republic (TOULA, 1893)

Vienna Basin: Devínska Nová Ves, Slovak Republic ([NHMW])

Eisenstadt-Sopron Basin: Fertőrákos, near Sopron, Hungary (VENDL, 1930)

Great Hungarian Basin (Pannonian Basin): Budapest, Hungary (KÓKAY et al., 1984; MIHÁLY, 1985); Kemence (Gombhegy), Pest, Hungary (MÁJER, 1915)

Styrian Basin: Šentilj in Slovenske gorice; NE Slovenia (MIKUŽ & MITROVIĆ-PETROVIĆ, 2001)

Transylvanian Basin: Gârbova de Sus (= Felső-Orbó), Romania (LÖRENTHEY, 1894)

Zala, Sáva and Dráva Basins: Zrinj, Croatia (POLJAK, 1938); Bosanska Kostajnica, Bosnia & Herzegovina (MITROVIĆ-PETROVIĆ, 1969)

Clypeasteridae indet.

1978b *Clypeasteridae* – PAPP et al.: 31

1978 *Clypeasteriden* – PAPP & STEININGER: 140

1978 *Clypeasteriden* – STEININGER & PAPP: 199

Discussion:

In most cases these records will probably be based on fragments of *Clypeaster*, the most common Miocene echinoid in Austria.

Occurrence:

Austria: Badenian (Langhian-Early Serravallian)

Vienna Basin: Müllendorf (Fenk quarry), Bgld (STEININGER & PAPP, 1978); Rauchstallbrunngraben, near Baden (PAPP & STEININGER, 1978)

Suborder Laganina MORTENSEN, 1948b

Family Fibulariidae GRAY, 1855

Genus *Echinocyamus* VAN PHELSUM, 1774

Type-species: *Spatangus pusillus* MÜLLER, 1776, by subsequent designation (ICZN 1954a, opinion 207, p. 350, 8th March 1954)

Diagnosis: Test moderately flattened; monobasal apical disc with a single hypopore, which is not located in a groove; periproct round or transversely elongated, situated between 1st and 2nd pair of coronal plates; development of petals variable ranging from poorly developed with few pore pairs to well developed with 7 or more pore pairs in each column; pore pairs usually strongly oblique; no spicules in the tube feet; accessory podia arranged in long lines along circumferential sutures; 5 pairs of internal radial partitions (one pair in each interambulacrum); periproct transversely oval; few small plates in periproctal membrane; plates in periproctal membrane without spine tubercles; some species show sexual dimorphism in genital pore size and position (compare KIER, 1967, 1969). (modified from DURHAM, 1966 and MOOI, 1989)

Distribution: Eocene to Recent – cosmopolitan (except polar regions; see MIRONOV & SAGIDACHNY, 1984: figs. 9, 10)

Remarks: In 1891 LAMBERT (1891: 749) proposed to interchange the names *Echinocyamus* and *Fibularia*, completely reversing the usage from that of all former authors. The echinoderm research community split into two fractions on this issue. While a large number of authors (e.g. CAPEDER, COTTEAU, COTTREAU, DE LORIOU, ...), among them most of those working with extant echinoid rejected LAMBERT's proposal, many palaeontologists followed him (e.g. AIRAGHI, CHECCHIA-RISPOLI, JEANNET, VADÁSZ, SZÖRÉNYI, ...). Despite the clarifying statements of MORTENSEN (1948b: 172) and the "Treatise of Invertebrate Paleontology" (DURHAM, in MOORE, 1966), and the ICZN decision (opinion 207, 1954) there were still authors who follow LAMBERT's opinion. Until now no true *Fibularia* has been recorded from the Central Paratethys, all reported and newly collected specimens belong into the genus *Echinocyamus* (*sensu* MORTENSEN, 1948b).

More than 110 nominal species, 11 of which are extant, of *Echinocyamus* have been described until now (compare LAM-

BERT & THIÉRY, 1909-1925 [under *Fibularia*, see above]; KIER & LAWSON, 1978; MIRONOV & SAGIDACHNY, 1984). Most of these taxa have not been described and illustrated in a modern way, only very few were examined using SEM techniques. Furthermore, the morphological plasticity of extant fibulariid taxa remains yet to be investigated and consequently very different features were regarded as diagnostic at species level [e.g. CAPEDER (1906) considered the arrangement of genital and ocular pores as very significant, while MORTENSEN (1948b: 160), an authority on extant echinoids, disregarded it completely]. Therefore, interspecific comparison is very difficult and differential diagnoses are restricted to taxa occurring in (or reported from) the Central Paratethys in the present paper. Although often applied to material from the Central Paratethys, the species established by CAPEDER (1906) seem not to be conspecific with the Paratethyan material. Because of the problems outlined above and the fact that a world-wide revision on fossil and extant *Echinocyamus* and *Fibularia* is currently being prepared by Rich MOOI (pers. comm. 20. March 2001) the investigations on the fossil *Echinocyamus* species of Austria are mainly restricted to re-describing LAUBE's *Echinocyamus transylvanicus* and selecting a lectotype for that species. Based on the re-examination of the type material, it seems possible to attach all known specimens from the Badenian of Austria to *E. transylvanicus* and a second species. Additionally, a third *Echinocyamus* species from the Eggenburgian is described in open nomenclature and some remarks on other species reported from the Central Paratethys are given.

Echinocyamus transylvanicus LAUBE, 1869

(Figs. 30, 31.B, 32, 34.1; Pl. 36, Figs. 1-5; Pl. 37, Figs. 1-4)

- *v. 1869a *Echinocyamus Transylvanicus* LAUBE. – LAUBE: 182
- v. 1870 *Echinocyamus transsylvanicus* LBE. – LAUBE: 314
- v. 1871 *Echinocyamus transsylvanicus* LAUBE. – LAUBE: 61; pl. 16, fig. 4
- . 1877 *Echinocyamus transsylvanicae* LBE. – KARRER: 181
- 1887b *Echinocyamus transylvanicus*, LAUBE. – KOCH: 261
- non 1897 *Echinocyamus pusillus* MUELL. – VINASSA DE REGNY: 149
- ? 1905 *Echinocyamus transylvanicus*, LBE. ? – GAÁL: 357, 362
- non 1915 *Fibularia pusilla* MÜLL. sp. – VADÁSZ: 113-114; pl. 9 (3), figs. 7-9
- 1915 *Fibularia stellata* CAP. – VADÁSZ: 114; pl. 9 (3), figs. 5-6
- 1960 *Echinocyamus marioi* LOVISATO in COTTEAU 1895 – KOJUMDIEVA & STRACHIMIROV: 231; pl. 9, figs. 3a-c

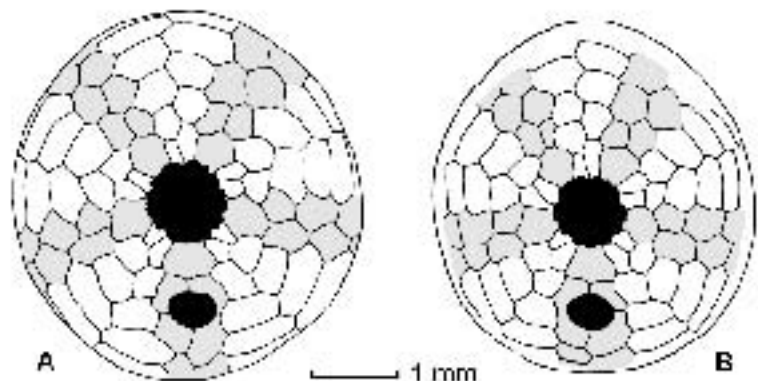


Figure 30: *Echinocyamus transylvanicus* LAUBE, 1869: oral plating [A: Lapugy, Romania (lectotypus, NHMW 1860.XL.529a); B: Baden, NÖ (NHMW 1852.II.1612a)].

- ? 1969 *Echinocyamus pusillus* (MÜLLER) – GÁBOS & GHIURCA: 88; pl. 2, figs. 3, 6 [? misidentified *E. transylvanicus*]
- ? 1969 *Echinocyamus* cfr. *stellatus* CAPEDEP – GÁBOS & GHIURCA: 88-89; pl. 2, fig. 1 [? misidentified *E. transylvanicus*]
- ? 1977 *Echinocyamus circularis* CAPEDEP, 1906 – MAĆZYŃSKA: 197; pl. 6, figs. 4-5
- ? 1987 *Echinocyamus circularis* CAPEDEP, 1906 – MAĆZYŃSKA: 148
- ? 1988 *Echinocyamus circularis* CAPEDEP, 1906 – MAĆZYŃSKA: 61; pl. 4, fig. 1-2

NHMW 2003z0084/0001n	3.28	2.83	1.72
NHMW 2003z0084/0001o	2.83	2.50	1.72
NHMW 2003z0084/0001p	2.78	2.44	1.44
NHMW 2003z0084/0001q	2.78	2.28	1.44
NHMW 2003z0084/0001r	2.22	1.89	1.22
NHMW 2003z0084/0001s	1.89	1.61	1.06

Lăpugiu des Sus (= Lapugy), Romania

NHMW 1859.XLV.615	2.02	1.79	1.29
NHMW 1860.XL.529a	4.33	4.12	2.75
NHMW 1860.XL.529c	3.98	3.57	2.08
NHMW 2003z0073/0001	3.79	3.42	2.25

Type-material:

Although no repository for LAUBE's types is given in any of his works (1869a, 1870, 1871) the majority of other specimens he investigated came either from the collection of the k. & k. Hofmuseum (now Naturhistorisches Museum Wien) or from the Geologische Reichsanstalt (now Geological Survey of Austria). Only in the former collection *Echinocyamus* specimens from the localities mentioned by LAUBE [Lăpugiu des Sus (= Lapugy), and Coșteiu de Sus (= Kosteĵ), both in Romania] could be located. Based on the acquisition numbers (acquired in the years 1859 and 1860) of the specimens we know that they were already in the collection at the time of LAUBE's investigations. These specimens, therefore, are regarded as syntypes.

Lectotype (designated herein): NHMW 1860.XL.529a (see Pl. 36, Figs. 1a-c)

Paralectotypes: NHMW 1859.XLV.615 (see Pl. 36, Figs. 3a-c), 1860.XL.529b (see Pl. 36, Figs. 2a-c)

Locus typicus: Lăpugiu des Sus (= Lapugy), Romania

Age: Early Badenian (Langhian, Middle Miocene)

Material:

Early Badenian (Langhian) – Baden Tegel, Baden, NÖ, Austria

NHMW: 2 whole coronas and several fragments [NHMW 1852.II.1612a-d (2 whole coronas, 1 fragment, 1 pyramid with attached tooth), 1 juvenile specimen (NHMW 2003z0079/0001)]

Foreign material for comparison:

Early Badenian (Langhian) – Coșteiu de Sus (= Kosteĵ), Romania

NHMW: 19 whole coronas and several fragments (NHMW 2003z0084/0001a-t)

Early Badenian (Langhian) – Lăpugiu des Sus (= Lapugy), Romania

NHMW: 4 whole coronas and several fragments [NHMW 1859.XLV.615, 1860.XL.529a-d (2 whole coronas, 1 pyramid with attached tooth and several fragments), 2003z0073/0001]

Dimensions (in mm):

Inv. No.	TL	TW	TH
Baden, Austria			
NHMW 1852.II.1612b	3.98	3.56	2.63
NHMW 1852.II.1612c	2.70	2.34	1.54
Coșteiu de Sus (= Kosteĵ), Romania			
NHMW 2003z0084/0001a	4.11	3.67	2.33
NHMW 2003z0084/0001b	4.28	3.50	2.22
NHMW 2003z0084/0001c	4.22	3.50	2.44
NHMW 2003z0084/0001d	3.33	2.78	1.78
NHMW 2003z0084/0001e	2.00	1.72	1.11
NHMW 2003z0084/0001f	3.17	2.83	1.72
NHMW 2003z0084/0001g	2.06	1.78	1.17
NHMW 2003z0084/0001h	4.50	3.61	2.67
NHMW 2003z0084/0001i	4.44	3.78	2.33
NHMW 2003z0084/0001j	4.28	3.50	2.17
NHMW 2003z0084/0001k	3.72	3.28	2.06
NHMW 2003z0084/0001l	3.39	2.83	2.00
NHMW 2003z0084/0001m	3.11	2.61	1.94

Description:

Size and shape: Test very small, usually less than 6 mm in length. Outline oval (antero-posteriorly elongated) to subcircular (test width ranges from 80.2 to 95.2 % TL, mean: 86.3 %). Maximum width slightly posterior of centre. In profile test is high arched to slightly conical with a tumid ambitus (test height ranging from 50.6 to 66.0 % TL, mean: 56.6 %). The maximum height coincides with the position of apical disc. The oral surface is flattened, without infundibulum.

Apical disc: The apical disc lies slightly anterior of the centre (~47 % of TL from the anterior margin) at the highest point of the test. Four moderately large subcircular genital pores are present. Gonopore size varies, probably due to sexual dimorphism as documented already for a number of extant and fossil species (MORTENSEN, 1948b; KIER, 1969). The five ocular pores are small and the anterior ones lie slightly outside the polygon formed by the genital pores. Only a single circular hydropore is present, it lies at the point where the imaginary lines drawn between genital pore 1 and 3, respectively 2 and 4 intersect (see Pl. 36, Fig. 5).

Ambulacra: Apically more or less well developed petals are present. They consist of 2 to 6 strongly oblique partitioned isopores in each column. The petals are straight, open distally, with parallel poriferous. The frontal petal is longest, the paired petals are subequal in length, c. 90 % of the frontal one. They extend about 50 to 55 % of the corresponding test radius (measured in planar aboral view). The interporiferous zones are as wide or slightly wider than a single poriferous zone. Outside the petals, distinct arcs of accessory pores (micro-unipores) which lie transversely to the axis of the ambulacra are found. The size of these accessory pores varies, but they are always distinctly smaller than the respiratory pores in the petals.

Interambulacra: The interambulacra are not inflated or depressed between the ambulacra. They are covered by small perforate tubercles, between which many militaries are found.

Peristome: The peristome is subcircular and rather large (~20 % of TL in diameter in adult specimens). It lies subcentrally on the oral surface.

Periproct: About half the size of the peristome (~10 % of TL wide), of oval size, transversely elongated. It lies halfway between the peristome and the posterior margin or slightly posterior. The position of the periproct coincides with the border between the first and second pairs of postbasicoronal plates (Fig. 30).

Internal support structures: Five pairs of internal radial partitions are present in the ambulacra (see Pl. 37, Fig. 3), proving the attribution to the genus *Echinocyamus*.

Differential diagnosis:

The Aquitanian to Langhian Maltese *Echinocyamus*, which has been referred to *E. stellatus* CAPEDEP, 1906 by various authors (e.g. CHALLIS, 1980) differs from *E. transylvanicus* by its larger petaloid area, its raised apical disc, and its slightly inflated, cushion-shaped coronal plates (see Figs. 34.6a-c).

Echinocyamus ovatus (MÜNSTER in GOLDFUSS, 1829) from the Late Oligocene of Germany differs by its rostrate posterior end, smaller petalodium with fewer ambulacral pores (in specimens of comparable size) and more anteriorly eccentric apical disc (see Figs. 34.4a-c).

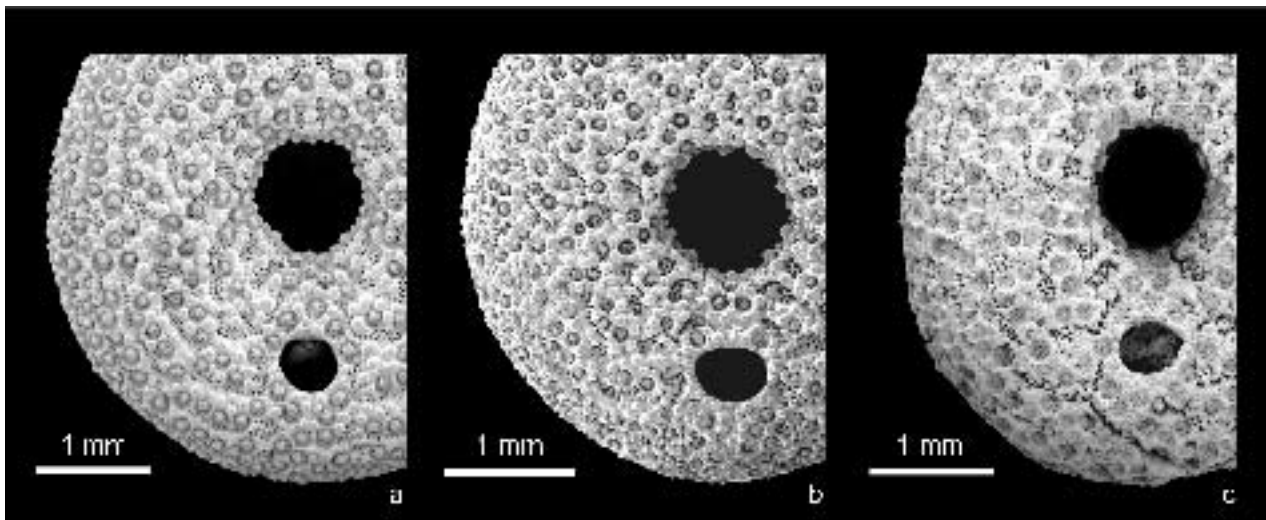


Figure 31: *Echinocyamus*, comparison of the distribution of the accessory pores [A: *E. pusillus* (MÜLLER, 1776), recent, Mediterranean Sea, Croatia (NHMW coll.); B: *E. transylvanicus* LAUBE, 1869, Badenian of Lapugy, Romania (NHMW 1860.XL.529a); C: *E. pseudopusillus* COTTEAU, 1895, Badenian of Gainfarn, NÖ (mirrored for easier comparison, NHMW 2004z0076/0045)].

The contemporaneous *Echinocyamus* species described under the name *Fibularia calariensis* from Hungary by VADÁSZ (1915) and as *Echinocyamus pseudopusillus* COTTEAU from Poland by MAĆZYŃSKA (1977) differs by its strongly elongated outline, "pointed" anterior margin and more flattened profile.

The common Polish species *Echinocyamus* sp. B [illustrated as *E. linearis* CAPEDE, 1906 by MAĆZYŃSKA (1977)] differs strongly by its elongated, often subpentagonal outline and the submarginal position of its periproct (see Figs. 34.5a-c).

Discussion:

Albeit few specimens of this species are known, they are rather well preserved and allow a good characterisation of this species. VINASSA DE REGNY (1897: 149) synonymised *E. transylvanicus* with the extant *E. pusillus*, an opinion that had been followed by VADÁSZ (1915: 113-114) and MORTENSEN (1948b: 182). Based on direct comparison (employing SEM techniques) of the type material of *E. transylvanicus* with extant specimens, the former seems to be well differentiated from the Pliocene to extant species *E. pusillus* (found throughout the Lusitanian bioprovince and the North Sea). Apart from the obvious differences in outline and profile, *E. transylvanicus* has a much smaller number of accessory pores per plate (compare Fig. 31) and fewer pore pairs in the petals (Figs. 34.3a-b).

Material from the Badenian of Poland ascribed to *Echinocyamus circularis* CAPEDE, 1906 by MAĆZYŃSKA (1977, 1987 and 1988) are very similar to *E. transylvanicus* and might be conspecific.

Occurrence:

Austria: Early Badenian (Langhian)

Vienna Basin: Baden Tegel, Baden, NÖ (LAUBE, 1871; KARRER, 1877; KOCH, 1887b; [NHMW])

Paratethys (non-Austrian occurrences): Early Badenian (Langhian)

Great Hungarian Basin (Pannonian Basin): Kishajmás (= Háromház), Baranya, Hungary (VADÁSZ, 1915); ? Nógrádszakál (= Szakall), Nógrád, Hungary (GAÁL, 1905)

Fore-Carpathian Basin: ? marly sands overlying the Korytnica Clays, Korytnica, Poland (MAĆZYŃSKA, 1977, 1987); ? Rybnice, Southern Poland (MAĆZYŃSKA, 1988)

Transylvanian Basin: ? Berchezoaia, Romania (GÁBOS & GHIURCA, 1969); ? Ciceu-Hâşmaş, Romania (GÁBOS &

GHIURCA, 1969); ? Ciolt, Romania (GÁBOS & GHIURCA, 1969); Coşteiu de Sus (= Kostěj), Romania (LAUBE, 1869a, 1871; KOCH, 1887b; ? GÁBOS & GHIURCA, 1969; [NHMW]); ? Gîrbova de Sus, Romania (GÁBOS & GHIURCA, 1969); Lăpuşiu des Sus (= Lapugy), Romania (LAUBE, 1869a, 1871; KOCH, 1887b; ? GAÁL, 1905; VADÁSZ, 1915; [NHMW]); ? Valea Satului, Romania (GÁBOS & GHIURCA, 1969); ? Văleni, Romania (GÁBOS & GHIURCA, 1969)

Lom Basin: Opansko bardo Northern Bulgaria (KOJUMDIEVA & STRACHIMIROV, 1960)

Echinocyamus pseudopusillus COTTEAU, 1895

(Figs. 31.C, 32, 33, 34.2, Pl. 37, Figs. 5-6; Pl. 38, Figs. 1, 3)

- | | | |
|-----|------|--|
| pp | 1915 | <i>Fibularia pusilla</i> MÜLL. sp. – VADÁSZ: 113-114; pl. 9 (3), figs. 7-9 |
| ? | 1927 | <i>Fibularia</i> aff. <i>pusilla</i> MÜLL. – HORUSITZKY: 25, 165 |
| ? | 1950 | <i>Fibularia pusilla</i> MÜLLER, 1776. – SZÖRÉNYI: 141-142; pl. 1, figs. 2, 2a, 3, 3a |
| | 1950 | <i>Fibularia pseudopusilla</i> COTTEAU, 1895. – SZÖRÉNYI: 142; pl. 1, figs. 4, 4a |
| | 1950 | <i>Fibularia lecointreae</i> LAMBERT, 1908. – SZÖRÉNYI: 143; pl. 1, figs. 5, 5a |
| ? | 1950 | <i>Fibularia stellata</i> CAPEDE, 1906. – SZÖRÉNYI: 143; pl. 2, figs. 2, 2a |
| | 1953 | <i>Fibularia lecointreae</i> LAMBERT, 1907. – SZÖRÉNYI: 60 |
| ? | 1953 | <i>Fibularia pseudopusilla</i> [COTTEAU], 1895. – SZÖRÉNYI: 60 |
| | 1960 | <i>Echinocyamus stellatus</i> CAPEDE 1906 – KOJUMDIEVA & STRACHIMIROV: 231; pl. 8, figs. 10a-c |
| ? | 1968 | <i>Echinocyamus stellatus</i> CAPEDE. – STANCU & ANDREESCU: 466, 468, tab.; figs. 78a-b |
| ? | 1977 | <i>Echinocyamus pusillus</i> (O. F. MÜLLER, 1776) – MAĆZYŃSKA: 196; pl. 5, figs. 1-4 |
| non | 1977 | <i>Echinocyamus pseudopusillus</i> COTTEAU, 1895 – MAĆZYŃSKA: 196; pl. 6, figs. 1-3 |
| ? | 1979 | <i>Echinocyamus pusillus</i> (O. F. MÜLLER, 1776) – MAĆZYŃSKA: 31, pl. 2, figs. 2-4 |
| non | 1987 | <i>Echinocyamus pseudopusillus</i> COTTEAU, 1895 – MAĆZYŃSKA: 148 |
| ? | 1987 | <i>Echinocyamus pusillus</i> (O. F. MÜLLER, 1776) – MAĆZYŃSKA: 146, 148; pl. 4, figs. 1-4 |
| ? | 1988 | <i>Fibularia pusilla</i> MÜLL. – KÓKAY: 264 |

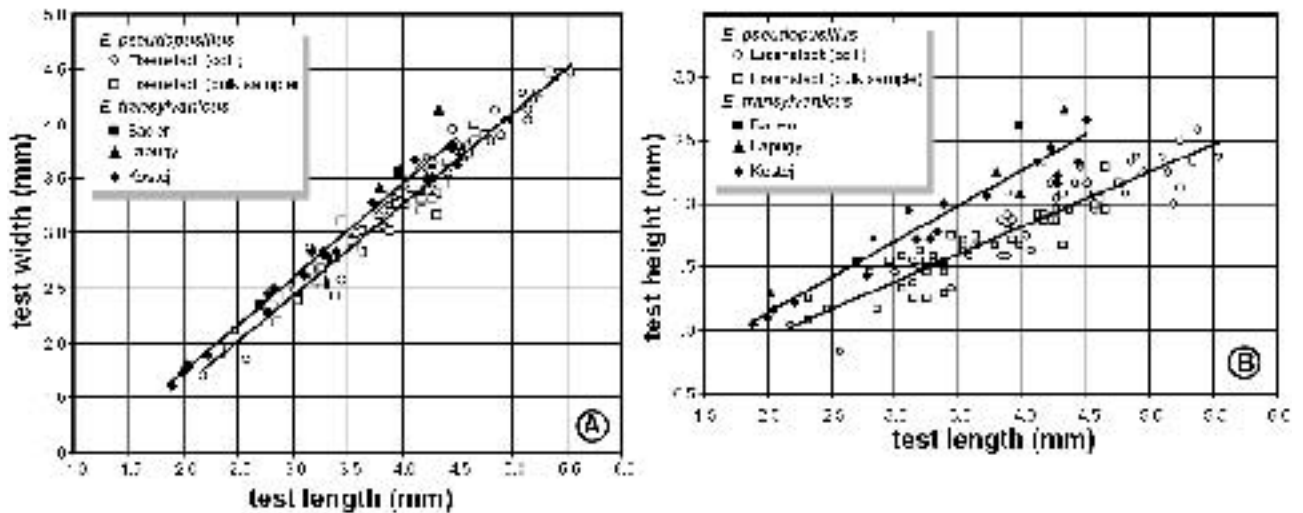


Figure 32: Morphometric comparison between *Echinocyamus transylvanicus* LAUBE, 1869 and *E. pseudopusillus* COTTEAU, 1895 (A: test length vs. test width; B: test length vs. test height).

- ? 1988 *Echinocyamus pusillus* (O. F. MÜLLER, 1776) – MAČZYŃSKA: 61; pl. 3, figs. 8a-c, 9a-c, 10a-c
- 1988 *Echinocyamus pseudopusillus* COTTEAU, 1895 – MAČZYŃSKA: 61; pl. 4, fig. 3a-c
- ? 1989 *Echinocyamus pseudopusillus* COTTEAU, 1895 – SCHMID: 7
- 1993 *Echinocyamus pusillus* (O. F. MÜLLER, 1776) – MAČZYŃSKA: 110-111; pl. 3, figs. 6-7
- ? 1996 *Echinocyamus pusillus* (O. F. MÜLLER, 1776) – MAČZYŃSKA: 41; pl. 1, figs. 5-7 [crushed specimens]
- v. 2002b *Echinocyamus* sp. – KROH: 12
- v. 2003 *Echinocyamus stellatus* CAPEDE – KROH et al.: 92
- ? 2004 *Echinocyamus pusillus* (O.F. MÜLLER, 1776) – RADWAŃSKI & WYSOCKA: 385

Dimensions (in mm):

Inv. No.	TL	TW	TH
Hartl. Fm., Hartllucke, Eisenstadt, Austria			
NHMW 2003z0072/0001/1	4.76	3.88	2.17
NHMW 2003z0072/0001/2	4.66	3.98	2.29
NHMW 2003z0072/0001/3	5.34	4.47	2.33
NHMW 2003z0072/0001/4	5.24	4.27	2.13
NHMW 2003z0072/0001/5	4.61	3.74	2.04
NHMW 2003z0072/0001/6	4.17	3.40	1.92
NHMW 2003z0072/0001/7	4.37	3.45	1.96
NHMW 2003z0072/0001/8	4.27	3.54	1.96
NHMW 2003z0072/0001/9	3.64	2.82	1.67
NHMW 2003z0072/0001/10	4.66	3.83	1.96
NHMW 2003z0072/0001/11	4.17	3.30	1.92
NHMW 2003z0072/0001/13	4.32	3.16	2.08
NHMW 2003z0072/0001/14	3.93	3.25	1.71
NHMW 2003z0072/0001/15	4.17	3.20	1.88
NHMW 2003z0072/0001/16	4.32	3.35	1.67
NHMW 2003z0072/0001/17	4.27	3.30	1.88
NHMW 2003z0072/0001/18	2.86	2.18	1.17
NHMW 2003z0072/0001/19	2.33	1.89	1.08
NHMW 2003z0072/0001/21	3.88	3.01	1.79
NHMW 2003z0072/0001/22	3.45	3.11	1.75
NHMW 2003z0072/0001/23	4.13	3.40	1.92
NHMW 2003z0072/0001/24	3.64	3.01	1.75
NHMW 2003z0072/0001/25	3.64	3.01	1.67
NHMW 2003z0072/0001/26	3.64	2.82	1.67
NHMW 2003z0072/0001/27	3.59	2.86	1.58
NHMW 2003z0072/0001/28	3.54	2.86	1.67
NHMW 2003z0072/0001/29	3.40	2.77	1.46
NHMW 2003z0072/0001/30	3.25	2.52	1.46
NHMW 2003z0072/0001/31	3.40	2.43	1.29
NHMW 2003z0072/0001/32	3.30	2.72	1.54
NHMW 2003z0072/0001/33	3.06	2.48	1.58
NHMW 2003z0072/0001/34	3.16	2.67	1.25
NHMW 2003z0072/0001/35	3.54	2.91	1.63
NHMW 2003z0072/0001/36	3.25	2.67	1.46
NHMW 2003z0072/0001/37	3.30	2.52	1.58
NHMW 2003z0072/0001/38	3.25	2.52	1.25
NHMW 2003z0072/0001/39	3.06	2.38	1.33
NHMW 2003z0072/0001/40	3.25	2.57	1.54
NHMW 2003z0072/0001/41	3.20	2.57	1.63
NHMW 2003z0072/0001/42	2.96	2.43	1.54
NHMW 2003z0072/0001/43	2.33	1.94	1.25
NHMW 2003z0072/0001/44	2.48	2.04	1.17
NHMW 2003z0072/0001/45	2.82	2.33	1.46

Material:

- Early Badenian (Langhian) – Gainfarn, NÖ, Austria
NHMW: 2 specimens (NHMW 2004z0076/0045-46)
Wanzenböck coll.: 30 specimens
- Early Badenian (Langhian) – Eisenstadt (Hartl Fm.), Bgld, Austria
NHMW: 47 whole coronas and several fragments [NHMW 1859.L.800 (45 whole coronas and several fragments), 1859.L.800a-b (2 whole coronas)]
- Early Badenian (Langhian) – Eisenstadt (Hartl Fm., Hartllucke), Bgld, Austria
NHMW: 45 whole coronas and several fragments (NHMW 2003z0072/0001/1-45)
- Early ? Badenian (Langhian) – Rauchstallbrunngraben (bryozoan marl), near Baden, NÖ
NHMW: 1 specimen (NHMW 2004z0121/0051)
- Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
NHMW: 1 specimen (NHMW 2004z0050/0030)
- Badenian (Langhian-Early Serravallian) – Brunn am Steinfeld, NÖ, Austria
NHMW: 3 specimens (NHMW 1997z0178/1585)
- Badenian (Langhian-Early Serravallian) – old sandpit between Großhöflein and Kleinhöflein, Bgld, Austria
NHMW: 3 specimens (NHMW 2003z0081/0015, .../0043-44)

Foreign material for comparison:

- Early Badenian (Langhian) – Buituri (= Bujtur), Romania
NHMW: 2 specimens (NHMW 1852.II.1603g)