protrusions in the spines of *E. desmoulinsi*. The areoles are well separated by a row of scrobicular tubercles on each interambulacral plate, whereas in *E. zeamays* they are less well separated and may be confluent occasionally. The median zone of the interambulacra is wider in *E. desmoulinsi* than in *E. zeamays*.

Discussion:
The description is based on disarticulated material, since no whole coronas could be obtained from the various outcrops studied. A number of outcrops e.g. the bryozoan marls of Rauchstallbrunngraben near Baden in NÖ, however, yielded only this cidaroid species and thus it was possible to relate all cidaroid skeletal elements found in samples from these outcrops to this species. Even skeletal elements of the Aristotle's lantern and the apical disc, which bear only few or no features diagnostic on species level and which are thus normally not determinable could be associated with this species. This offers the unique chance to study the morphology of nearly all skeletal elements, except the pedicellariae, of a fossil *Eucidaris* species

Primary spine ornamentation varies from relatively slender spines with several (usually between one and three) whorls of coarse thorns to stout spines without whorls (see Plate 6). Spines similar to the latter have been attributed to *Eucidaris* aff. *tribuloides* by Philippe (1998). In the bulk samples examined for the present paper, however, all intermediate morphs between the morph with whorls and that without could be recovered from single samples in several outcrops (e.g. Niederleis, Lapugy, Forchtenau,...). This variation in spine ornamentation is thus interpreted as function of the position on the test and/or an environmental signal (although all intermediates are present in nearly all samples, different morphs are most common in different samples/settings).

Mączyńska's (1987: pl. 1, figs. 4-7 and pl. 2, figs. 1a-d; 1993: pl. 1, figs. 3-4; pl. 6, fig. 1c) erroneously determined test fragments of this species as *Cyathocidaris avenionensis*. The record from the Aquitanian/Burdigalian-transition in Gozo, Maltese Islands is based on a single spine found in the C_1-Phosphorite bed by the author.

Occurrence:

Austria: Early to Late Badenian (Langhian-Early Serravallian)
- Molasse Zone: Grund Fm., Grund, NÖ (Kroh, 2003a; [NHMW])
- Vienna Basin: Bad Vöslau, NÖ ([NHMW]); Bruck an der Leitha, NÖ ([NHMW]); Gainfarn, NÖ (Kroh, 2002b; [NHMW]); Kaisersteinbruch, Bgld ([NHMW]); Müllendorf (Mühlendorfer Kreide AG quarry), Bgld ([NHMW]); Niederleis, NÖ (Kroh, 2003a; [NHMW]); Rauchstallbrunngraben near Baden (bryozoan marls), NÖ ([NHMW]); Steinebrunn, NÖ ([NHMW]); Stotzing (sandpit Mayer), Bgld ([NHMW])
- Eisenstadt-Sopron Basin: Eisenstadt (Hartl Fm.), Bgld (Kroh et al., 2003; [NHMW]); Forchtenau, Bgld ([NHMW]); between Großhöflein and Kleinhöflein, near Eisenstadt, Bgld ([NHMW])
- Danube Basin: Winden, Bgld ([NHMW])
- Oberpullendorf Bay: Wiesfleck, Bgld ([NHMW])
- Styrian Basin: Pöls, near Wildon, Styria ([NHMW]); Wagna (brickyard Wagna), Styria ([NHMW]); Retznei (Weissenegg Fm., Lafarge quarry), Styria ([NHMW])

Paratethys (non-Austrian occurrences): Karpatian (Late Burdigalian) to Late Badenian (Early Serravallian)
- Molasse Zone: Lysice, Moravia, Czech Republic ([NHMW]); Nový Rybik (= Portzteich), near Sedlec, W Lednice, Czech Republic ([NHMW]);
- Great Hungarian Basin (Pannonian Basin): Budaörs, Pest, Hungary (Vadász, 1915; [MAFI]); Csomád (Magashegy), Pest, Hungary (Horusitzky, 1934; Halmai, 1981; Kroh, 2003b); Herend-Márkó, Veszprém, Hungary (Kókay, 1966); Kemence, Pest, Hungary (Májer, 1915; Vadász, 1915; [MAFI]); Királd, Hungray (Kutassy, 1928); Kisalag, Hungary (Halmai, 1981); Sámsonháza, Nógrád, Hungary ([NHMW]); Szatina, near Kishajmás, Baranya, Hungary (Vadász, 1915)
- Fore-Carpathian Basin: Busko, Central Poland (Mączyńska, 1993); Korytnica Clays, Korytnica, Poland (Mączyńska, 1977, 1987); Niechobrz, near Rzeszów, Southern Poland (Mączyńska, 1996); Pińczów, Central Poland (Mączyńska, 1993); Rybnica, Southern Poland (Mączyńska, 1988); Skowronno, Central Poland (Mączyńska, 1993); Szczaworyż, Central Poland (Mączyńska, 1993); Żerniki, Central Poland (Mączyńska, 1993)
- Transylvanian Basin: Berchezoaia, Romania (Gábos & Ghiurca, 1969); Buituri (= Bujtur), Hunedoara, Romania (Vadász, 1915; [NHMW]); Coştei (= Kostéj), Timiş, Romania ([NHMW]); Lăpugiu des Sus (= Lapugy), Hunedoara, Romania (Vadász, 1915; Gábos & Ghiurca, 1969; [NHMW]); Livezile-Aiud, Romania (Gábos & Ghiurca, 1969); Ribicioara (= Ribice), near Brad, Hunedoara, Romania (Vadász, 1907, 1915); Sîg, Romania (Gábos & Ghiurca, 1969); Valea Satului, Romania (Gábos & Ghiurca, 1969)

Mediterranean: Aquitanian/Burdigalian-transition to Serravallian
- Western Mediterranean: Sardinia, Italy: Santa Reparata (Cap de la Testa) (Lambert, 1907a)
- Central Mediterranean: Maltese Islands: Aquitanian/Burdigalian-transition (dating of Rehfeld & Janssen, 1995): C_1-Phosphorite Layer between the Lower and Middle *Globigerina* Limestone at Dwejra Point, Gozo ([NHMW]); Piemont Basin, Italy: Colli di Torino (Sismonda, 1842; Agassiz & Desor, 1846; Michelotti, 1847; Sismonda, 1847; d'Orbigny, 1852; Desor, 1858; Airaghi, 1901; Cottreau, 1913a)
- Rhône Basin: Burdigalian: Secteur des étangs (Fos-sur-Mer, Istres) (Philippe, 1998), Bassin d'Avignon (Les Angles, Sernhac, Théziers, Vedène) (Philippe, 1998); Late Burdigalian (faciès "Marnes Bleues"): Bassin d'Avignon (Caumont-sur-Durance) (Philippe, 1998), Bassin de Faucon-Mollans-Malaucène (Entrechaux, Mollans-sur-Ouvèze) (Philippe, 1974, 1984, 1998), Bassin d'Uzès et de la Tave (Vers) (Philippe, 1998)

Atlantic Ocean: Burdigalian to Langhian
- Aquitaine Basin: "falun supérieur" of Mérignac, France (Lambert, 1927b; Chavanon, 1974); Peloua, near Saucats, Bordelais, France (Lambert, 1927b; Chavanon, 1974); Pessac, France (Lambert, 1927b; Chavanon, 1974)

Genus *Plegiocidaris* ? Pomel, 1883

Type-species: *Echinus coronatus* von Schlotheim, 1820; by subsequent designation (Lambert & Thiéry, 1910: 135).
Diagnosis: Ambulacra simple throughout the corona, but pluriserially on the peristomal membrane; primary tubercles crenulate; areoles round, well separated; scrobicular tubercles larger than the other secondary tubercles; primary spines thick, with long cylindrical collar and relatively short shaft (only one to three times the length of the collar); shaft diameter twice the collar diameter; transition between shaft and collar oblique, with abrupt change in diameter (modified from Fell, 1966a).
Distribution: Late Triassic to the Late Jurassic; ? Miocene – Europe (Fell, 1966a)
Remarks: Attribution of the present species (*peroni* Cotteau, 1877), although widely accepted in Neogene echinoderm-literature, is problematic. See discussion for details.

Plegiocidaris ? *peroni* (Cotteau, 1877)

(Pl. 2, Fig. 9; Pl. 4, Fig. 12-18)

*	1877	*Cidaris Peroni*, Cotteau, 1877 – Cotteau in Locard: 231-232 ; pl. 8, figs. 8-12 [based on disarticulated primary spines]
	1895	*Cidaris Munsteri*. Sismonda, 1844. – Cotteau: 8-9 [fide Airaghi, 1901 and Philippe, 1998]
pp	1895	*Rhabdocidaris compressa*, Cotteau, 1893. – Cotteau: 10; pl. 1, fig. 7 [fide Philippe, 1998]
.	1897	*Cidaris Munsteri* E. Sismonda. – de Loriol: 115, 119-121; pl. 4, figs. 3-6
?	1901	*Cidaris Peroni* Cott. – Airaghi: 170-171; pl. 19 (1), figs. 23-25 [very poorly preserved]
	1907a	*Plegiocidaris peroni* Cotteau (*Cidaris*). 1877. – Lambert: 9-10; pl. 1, figs. 9-10
	1910a	*Plegiocidaris Peroni* Cotteau (*Cidaris*), 1877. – Lambert: 7-9; pl. 1, figs. 5-17
#	1910a	*Plegiocidaris Cureti* Lambert. – Lambert: 9; pl. 1, figs. 18-19 [fide Philippe, 1998]
#	1910a	*Dorocidaris Deydieri* Lambert. – Lambert: 16; pl. 3, figs. 4-6 [fide Philippe, 1998]
? v	1915	*Plegiocidaris Peroni* Cott. sp. – Vadász: 104; pl. 8 (2), fig. 13 [most probably the figured specimen (MAFI Ech 1398) is a *S.*? *schwabenaui* spine]
non	1915	*Plegiocidaris Peroni* Cott. sp. – Vadász: 104; pl. 8 (2), figs. 18-19 [misidentified *E. zeamays* coronal plates]
	1926	*Plegiocidaris peroni* Cott. – Strausz: 213, 368
?	1930	*Cidaris peroni* Cott. – Vendl: 51
non	1969	*Plegiocidaris peroni* (Cott.) – Gábos & Ghiurca: 82; pl. 1, fig. 1 [misidentified adapical test fragment of *E. zeamays*]
	1974	*Plegiocidaris peroni* (Cott.) – Roman: 332, 333, 336
?	1981	*Plegiocidaris cureti* Lamb. – Halmai: 106
	1981	*P. peroni* Cott. – Halmai: 106
	1984	*Plegiocidaris peroni* (Cotteau, 1877) – Philippe: 86; pl. 5, figs. 7-10
non	1987	*Plegiocidaris peroni* (Cotteau, 1877) – Mączyńska: 146, 148; pl. 1, figs. 2 [misidentified diadematoid interambulacral plate]
.	1989	*Plegiocidaris peroni* (Cotteau) – Philippe: 27; tab. 1
non	1993	*Plegiocidaris peroni* (Cotteau, 1877) – Mączyńska: 106-107; pl. 1, fig. 5 [misidentified *E. zeamays* coronal plates]
non	1993	*Plegiocidaris peroni* (Cotteau, 1877) – Mączyńska: 106-107; pl. 6, fig. 1b [misidentified diadematoid interambulacral plate]
.	1998	*Plegiocidaris peroni* (Cotteau, 1877) – Philippe: 48-50; pl. 3, figs. 20-31
v.	1999	Cidariden-Stachel – Harzhauser & Kroh: 221
v.	1999	Cidaridae indet. – Kroh & Harzhauser: 154-155; pl. 7, figs. 1-4
	2003b	*Plegiocidaris* ? *peroni* (Cotteau, 1877) – Kroh: 249

Type-material:
Type-material: disarticulated spines figured by Cotteau in Locard (1877: pl. 8, figs. 8-12); current whereabouts unknown
Locus typicus: near Bonifacio, Sardinia
Stratum typicum: "couches inférieures"
Age: ? Burdigalian, Early Miocene

Material:
Late Eggenburgian (Early Burdigalian) – Eggenburg (brick-factory Stransky), NÖ, Austria
NHMW: 12 spine fragments (NHMW 2003z0078/0001)
Late Eggenburgian (Early Burdigalian) – Eggendorf, NÖ, Austria
NHMW: 1 spine (NHMW 1998z0048/0094)
Late Eggenburgian (Early Burdigalian) – Grübern (Zogelsdorf Fm.), near Maissau, NÖ, Austria
NHMW: 3 spine fragments (NHMW 1914.VII.23), 1 interambulacral plate and 48 spine fragments (NHMW 2003z0075/0009, 2003z0075/0012, ../12a-b)
Late Eggenburgian (Early Burdigalian) – Klein-Meiseldorf, NÖ, Austria
NHMW: 2 spine fragments (NHMW 1981/56/1)
Late Eggenburgian (Early Burdigalian) – Rohrendorf, E Pulkau, NÖ, Austria
NHMW: 4 spines (NHMW 2003z0077/0001-3)
Late Eggenburgian (Early Burdigalian) – Sonndorf, S Eggenburg, NÖ, Austria
NHMW: slab with 4 spines and 6 spine fragments (NHMW 2003z0076/0001)
Late Eggenburgian (Early Burdigalian) – Unternalb (Retz Fm.), SE Retz, NÖ
NHMW: 4 spine fragments (NHMW 1999z0051/0015)

Although this cannot be demonstrated beyond doubt, these ossicles are considered to be conspecific here.

Description:
Ambulacral plates: not preserved
Interambulacral plates: Only a single isolated, strongly abraded interambulacral plate is preserved. It bears a single large perforate tubercle. The areole is subcircular and a full scrobicular ring is developed. Adradial and interradial zones are subequal and not very wide. Scrobicular and secondary tuberculation obscured.
Primary spines [based mainly on the Sonndorf specimens (NHMW 2003z0076/0001) since these spines are the only ones with well preserved base and ornamentation. The remaining material is abraded, but is considered to be conspecific with the Sonndorf material based on the closely similar morphology (as far as preserved)]: Largest spine fragment 54 mm in length, with a proximal width of 3.7 mm. The spines are straight and slightly tapering distally. They are ornamented by 15 to 20 well separated, longitudinal rows formed by small thorns. The thorns in each row are connected towards each other via shallow ridges. In the distal part of the spines and in some fragments from other outcrops (e.g. Eggendorf) the thorns are less well developed and the interconnecting ridges more prominent, forming an ornamentation very similar to those of the Ottnangian species described above. The space between the longitudinal rows of thorns and the thorns themselves are covered by small granulae and longitudinal striae. The shape of the distal end is unknown. The spine bases are only slightly widened and may have a slightly larger diameter than the thickest part of the shaft. The collar is rather long, being longer than the distance acetabulum margin – milled ring. The neck is moderately well developed and lacks ornamentation. The acetabulum has a crenulate margin (Pl. 4, Fig. 12).

Cross-section (Pl. 2, Fig. 9): The medulla has a diameter of about 30 % of the corresponding spine diameter and consists of an irregular mesh. In the centre of the medulla, the holes of the mesh are larger than at the margin. The lamellae, which are connected to each other by trabeculae, radiate from this central part. The outermost layer of the spine is formed by moderately thick cortex. All three zones are clearly separated.

Differential diagnosis:
This species is easily recognised by its crenulate acetabulum and well developed neck lacking ornamentation. All other species recorded from Austria have noncrenulate tubercles/acetabula. Only in *S.* ? *polyacantha* a crenulation may occur in

aboral tubercles, but they are only subcrenulate, i.e. the crenulation is developed only weakly and only on one side of the tubercle (compare Pl. 3, Fig. 2)

Discussion:
The well preserved material from Sonndorf can be confidently referred to *Plegiocidaris* ? *peroni* (Cotteau, 1877), based on the characteristic crenulation, rather long collar, well developed neck and ornamentation on the shaft. *P. peroni* has recently been re-described by Philippe (1998: 48-50) and the reader is referred to that work for a comprehensive synonymy and description of better preserved coronal material. Albeit rather similar to the primary spines occurring in the Ottnangian of OÖ, the Eggenburgian material is clearly not conspecific.

The generic placement of *peroni* necessitates some remarks: Originally it was attributed to the genus *Cidaris*, like many fossil cidaroids. Lambert (1907a: 9-10) transferred it to the genus *Plegiocidaris*, which has been accepted by most subsequent authors. *Plegiocidaris* Pomel, 1883 (type-species: *Echinus coronatus* von Schlotheim, 1820), however, is characterised by its short spine with long collar and abrupt change in diameter from collar to shaft. The spines are thus a little bit club-shaped and a neck is not developed (compare Fell, 1966a: U337; Hess, 1975: 86, pl. 27, figs. 1-7). According to Fell (1966a) *Plegiocidaris* ranges from the Late Triassic to the Late Jurassic. Albeit there are some similarities (crenulate tubercles, ornamentation of the interambulacral plates) the attribution of *peroni* to the genus *Plegiocidaris* seems doubtful. Unfortunately the available material is not sufficient to revise this taxon and it is thus named in open nomenclature.

Although well figured by Cotteau (1877) this species has often been confused with other cidaroid taxa (e.g. Vadász, 1915 wrongly attributed coronal plates of *Eucidaris zeamays* to *P.* ? *peroni*). Even diadematoid interambulacral plates have been associated with it (Mączyńska, 1987: pl. 1, fig. 2; 1993: pl. 6, fig. 1b).

Occurrence:

Austria: Late Eggenburgian (Early Burdigalian)
- Molasse Zone: Eggenburg (brick-factory Stransky), NÖ ([NHMW]); Eggendorf, NÖ ([NHMW]); Grübern (Zogelsdorf Fm.), near Maissau, NÖ ([NHMW]); Klein-Meiseldorf, NÖ ([NHMW]); Rohrendorf, E Pulkau, NÖ ([NHMW]); Sonndorf, S Eggenburg, NÖ ([NHMW]); Retz Fm., Unternalb, NÖ (Harzhauser & Kroh, 1999; Kroh & Harzhauser, 1999; [NHMW])

Paratethys (non-Austrian occurrences): Karpatian (Late Burdigalian), ? Badenian (Langhian-Early Serravallian)
- Great Hungarian Basin (Pannonian Basin): ? Bélapátfalva, Heves, Hungary (Vadász, 1915); ? Cinkota, Pest, Hungary (Vadász, 1915); Fót (Somlyó Mt.), Pest, Hungary (Strausz, 1926; Kroh, 2003a); ? Györ (brickyard Schwarz), Györ-Monson-Sopron, Hungary (Vendl, 1930); ? Kisalag, Hungary (Halmai, 1981)

Mediterranean: Burdiaglian to Serravallian
- Western Mediterranean: Piemont Basin, Italy: ? Serravalle Scrivia (Airaghi, 1901)
- Central Mediterranean: Corsica, France: Candelabra, près Bonifacio, (Cotteau in Locard, 1877; Cotteau, 1895); Sardinia, Italy: Bingia Fargeri (Fangario) (Cotteau, 1895), Capo Sant'Elia, near Cagliari (Cotteau, 1895; Lambert, 1907a), Mont San Michele (Cotteau, 1895), Saint-Advendrace (Cotteau, 1895), Scala Chilivri (Orosei) (Lambert, 1907a)
- Rhône Basin: Burdigalian: Littoral de Nerthe (Carro près Carry) (Lambert, 1910a; Roman, 1974), Bassin d'Avignon-Carpentras (Beaucaire, Les Angles, Aramon, Avignon, Barbentane, Saint-Hippolyte-le-Graveyron, Saint-Rémy-de-Provence, sernhac, Théziers, Vedène, Villeneuve-lès-Avignon, Notre-Dame-du-Château) (de Loriol, 1897; Lambert, 1910a; Philippe, 1998), Bassin de Valréas-Visan (Montbrison-sur-le-Lez, Saint-Restitut, Taulignan) (Lambert, 1915a; Philippe, 1998); Late Burdigalian (faciès "Marnes Bleues"): Bassin d'Avignon-Carpentras (le Barroux, Caumont-sur-Durance) (Roman, 1974; Philippe, 1998), Bassin de Faucon-Mollans-Malaucène (Entrechaux, St. Marcellin, St. Romain, Faucon, Mollans-sur-Ouvèze) (Philippe, 1984, 1998); Serravallian: Bassin d'Avignon (Beaumes-de-Venise, Courthézon, Entraigues) (Philippe, 1998), Bassin d'Apt, Reillanne, Forcalquier (Reillanne) (Lambert, 1910a; Philippe, 1998), Bassin de Faucon-Mollans-Malaucène (Entrechaux) (Philippe, 1998), Lyonnais [Lyon (Saint-Paul et le jardin des Plantes), Saint-Fons] (Roman, 1974; Philippe, 1998)

Cidarinae sp. 1

(Pl. 1, Figs. 6-10; Pl. 2, Figs. 7-8; Pl. 5, Figs. 1-26)

	1875a	*Cidaris* sp. – Hoernes: 387
	1875b	unbestimmbare *Cidaris*-Stacheln – Hoernes: 211
	1877	*Cidaris* sp. indet. – Fuchs: 663
?	1926	Cidarisstacheln – Stadler: 82
	1956	*Cidaris* sp. – Sieber: 317
v.	1965	*Cidaris* spec. – Schultz: 283-284
	1969	Stachel regulärer Seeigeln – Steininger: 49; pl. 14, fig. 10

Material:
Ottnangian (Late Burdigalian) – Allerding, OÖ, Austria
- Danninger coll.: 1 coronal segment (no inventory no.)

Ottnangian (Late Burdigalian) – between Edermaning and Höbmannsbach, OÖ, Austria
- NHMW: 3 primary spine fragments (NHMW 2004z0002/0004)

Ottnangian (Late Burdigalian) – Höbmannsbach, Taufkirchen Bay, ESE Schärding, OÖ, Austria
- NHMW: 330 primary spine fragments (NHMW 1978/1966/12a, 12j-n, 12s-t), 54 oral primary spines (NHMW 1978/1966/12b, 12o-r), 13 secondary spines (NHMW 1978/1966/12c, 12u, 12w-y), 36 scrobicular spines (NHMW 1978/1966/12d), 8 isolated spine bases (NHMW 1978/1966/12e)

Ottnangian (Late Burdigalian) – Höbmannsbach (playing ground), OÖ, Austria
- NHMW: 2 primary spine fragments (NHMW 2004z0002/0005)

Ottnangian (Late Burdigalian) – Kletzenmarkt, NNW Bad Schallerbach, OÖ, Austria
- NHMW: 4 primary spine fragments (NHMW 1978/1966/15a), 1 oral primary spine (NHMW 1978/1966/15b)

Ottnangian (Late Burdigalian) – Mitterndorf (sandpit Denk), 3.2 km NNE Sigharting, NNE Andorf, OÖ, Austria
- NHMW: 57 primary spine fragments (NHMW 1986/102/37), 10 primary spine fragments (NHMW 1989/58/24)

Ottnangian (Late Burdigalian) – Offenhausen, S Grieskirchen, OÖ, Austria
- NHMW: 17 primary spine fragments (NHMW 1978/1966/14a)

Ottnangian (Late Burdigalian) – Plesching (Alte Königsstrasse), OÖ, Austria
- NHMW: 177 primary spine fragments and 3 oral primary spines (NHMW 2004z0002/0001a-g)

Ottnangian (Late Burdigalian) – Rainbach (large sandpit), near Schärding, OÖ, Austria
- NHMW: 8 primary spine fragments (NHMW 2004z0002/0002a-f)

Ottnangian (Late Burdigalian) – Rainbach (small sandpit), near Schärding, OÖ, Austria

NHMW: 3 primary spine fragments (NHMW 2004z0002/0003a-b)

Foreign material for comparison:
Ottnangian (Late Burdigalian) – Höch (gravel-pit), SW Passau, Bavaria, Germany
NHMW: 257 primary spine fragments (NHMW 1990/1487/0225a-b), 1 test fragment consisting of two interambulacral plates (NHMW 1990/1487/0225b), 83 primary spine fragments (NHMW 1990/1487/0227a), 73 primary spine fragments (NHMW 1990/1487/0228), 96 primary spine fragments (NHMW 1990/1487/0229); 287 spine fragments (NHMW 2003z0090/0007)
SCHULTZ coll.: 5 interambulacral plates (no inv. no.)
Ottnangian (Late Burdigalian) – Holzbach, near Fürstenzell, SW Passau, Bavaria, Germany
NHMW: 17 primary spine fragments (NHMW 1990/1489/0120a)
Ottnangian (Late Burdigalian) – Kälberbach, near Höch, SW Passau, Bavaria, Germany
NHMW: 1 oral primary spine (NHMW 1990/1488/0006), 70 primary spine fragments (NHMW 1990/1488/0007a)

Although this cannot be demonstrated beyond doubt, these ossicles are considered to be conspecific here.

Description:
Ambulacral plates: The ambulacra are very slightly sinuous. Each plate bears a single large, partitioned isopore (P1 to P2 type) and two marginal tubercles, the perradial of which is distinctly smaller. Both marginal tubercles and pore pairs take up the full height of the ambulacral plates. There is no naked area along the perradial suture. Each interambulacral plate is bordered by 12 ambulacral plates at the ambitus.
Interambulacral plates: Each interambulacral plate bears one large perforate noncrenulate primary tubercle. The areoles are not confluent, but separated by a narrow ridge with smaller scrobicular tubercles ambitally. The areoles are near circular except at the ambitus where they are slightly oval. The scrobicular tubercles are distinctly larger than the other secondary tubercles. The adradial zone is not very wide bearing up to two rows of secondary tubercles additionally to the scrobicular tubercles. The interradial zone is only slightly wider and bears 2-3 irregular rows of secondary tubercles additionally to the scrobicular tubercles. The interradial suture is slightly sunken.
Primary spines (Pl. 5, Figs. 1-11, 16-22): Largest complete spines up to 45 mm in length, individual fragments suggest even longer spines. The spines are straight and slightly tapering distally. Primary spine diameter ranges from 1 to 4 mm in the proximal part.

They are ornamented by 13 to 21 well separated, longitudinal ridges. At one side of each spine the ridges are usually straight and of more or less constant width. On the opposing side the width of the ridges undulates, giving them a beaded appearance. In the proximal part of larger spines the beaded ridges may grade into longitudinal rows of large, lentil-shaped knobs which are connected by shallow ridges. Rarely also spine with short, blunt thorns instead knobs are observed. The space between the ridges, the ridges themselves and the base of the thorns are covered by small granulae. The spines end bluntly or, more rarely, terminate in a small crown. The spine bases are not widened and have about the same diameter as the proximal part of the shaft. The neck is poorly developed and may be slightly constricted only. Ornamentation starts immediately above the finely striated collar. The acetabulum has a noncrenulate margin. Some spines have a triangular to T-shaped cross-section in their distal part.

In cross-section the spines show a microstructure similar to that of *Stylocidaris*-spines, with non-specialised lamellae, large medulla and a thin to moderately thick cortex. Most spines are, however, distinctly oval in diameter and have an oval medulla.

Oral primary spines (Pl. 5, Figs. 23-26): Associated with the "normal" primary spines strongly serrated, flattened oral primaries have been observed. They are rarely more than 10 mm in length and are distinctly curved. Apart from the serrated sides they lack any ornamentation and have a smooth, glossy surface. Only close to the tip up to two longitudinal keels may be developed at the inwards bent side. The serration consist of large diametrically opposed thorns. The association with the above described "normal" primary spines is based on their cooccurrence in all localities where the serrated type was recovered. Additionally some spines with intermediate morphology (poorly developed lateral thorns in the proximal part, many longitudinal ridges in the distal part) are preserved.
Secondary spines (Pl. 5, Figs. 12-15): The scrobicular secondary spines are up to 8 mm in length and have a similar ornamentation as the "normal" primary spines. They are, however, slightly bent, flattened and slightly serrated lateral edges. Nonscrobicular secondary spines were rarely recovered and are very similar to the primary spines but much smaller.

Differential diagnosis:
Spines of the Badenian species *Stylocidaris* ? *polyacantha* (REUSS, 1860) differ by their ornamentation (longitudinal ridges with well developed thorns), their well developed porcelaineous neck and widened base. Moreover, no serrated oral primary spines have been found in association with the *S.* ? *polyacantha* species.

Spines of the Badenian *Stylocidaris* ? *schwabenaui* LAUBE, 1869 are generally very similar to the Ottnangian spines but differ by their ornamentation (and microstructure). The longitudinal ridges in *S.* ? *schwabenaui* are usually more numerous and more closely spaced. Moreover, the ridges are made up of large, closely spaced short thorns or nodules, which are better described as beaded longitudinal rows than as ridges (compare Pl. 4, Fig. 10). Additionally, they have a widened base and a well developed neck devoid of any ornamentation. No serrated oral primaries have been found in association with *S.* ? *schwabenaui*.

Plegiocidaris ? *peroni* (COTTEAU, 1877) differs by its strongly crenulate acetabula/tubercles and characteristic long collar.

Discussion:
Although complete specimens are wanting and preservation of most ossicles is poor the abundance of the material allows a good characterisation of the species. Based on primary spine and coronal plate morphology this species is clearly distinct from the Badenian *S.* ? *polyacantha* and *S.* ? *schwabenaui* (see above). Differentiation from the Eggenburgian cidaroid material is more difficult, although the well developed neck and crenulate acetabulum margin of the latter suggest that they are not conspecific.

Generic and specific determination of the Ottnangian cidaroids is very difficult. As stated above cidaroid taxonomy strongly relies on pedicellariae morphology, although MOOI et al. (2000) made a strong case for the importance of primary spine morphology in cidaroid systematics. The horizontal, nonconjugate ambulacral pores and lack of sutural pits or grooves suggest an attribution to the subfamily Cidarinae (compare FELL, 1966a: U330). Extant members of the genera *Cidaris* and *Stylocidaris* are rather similar to the present species. Strongly serrated oral primary spines, however, have been reported in neither. Moreover, primary spines of these genera usually have more strongly developed bases and neck.

Similar shaped oral primary spines are present in the Histocidarinae (genera *Histocidaris* and *Poriocidaris*) and the Ctenocidarinae (genera *Ctenocidaris* and *Aporocidaris*). The former, however, have strong crenulate tubercles, not present in the Ottnangian material and occur in depths below 200 m (the Ottnangian material predominantly comes from shallow-water settings). The Ctenocidarinae are restricted to the sub-Antarctic region and most species are deep-water specialists

(> 2.500 m). For the time being the Ottnangian material is left in open nomenclature until more coronal material becomes available and more extant material is examined.

Most of the Ottnangian cidaroid material comes from higher-energy near-shore settings in the OÖ and Bavarian part of the Molasse Zone. The spines are most frequent in poorly sorted coarse sandy environments. Nearly all specimens were subject to heavy abrasion obscuring ornamentation detail. Coronal plates, even disarticulated interambulacral plates, are extremely rare in most outcrops and seriously underrepresented compared with the number of spine fragments. The single coronal segment available comes from Allerding, OÖ, a breaker zone setting and must be considered as exceptional preservation. A possible explanation would be trapping and rapid burial in e.g. a crustacean burrow.

Occurrence:

Austria: Ottnangian (Late Burdigalian)

Molasse Zone: Allerding, OÖ (Danninger coll.); between Edermaning and Höbmannsbach, OÖ ([NHMW]); Haselbach, near Schärding, OÖ (Schultz, 1965); Höbmannsbach, Taufkirchen Bay, ESE Schärding, OÖ (Schultz, 1965; [NHMW]); Kletzenmarkt, NNW Bad Schallerbach, OÖ ([NHMW]); region of Linz (phosphoritic sands), OÖ (Steininger, 1969); Mitterndorf, NNE Andorf, OÖ ([NHMW]); Plesching, OÖ ([NHMW]); Offenhausen, S Grieskirchen, OÖ ([NHMW]); Ottnang, OÖ (Hoernes, 1875a, b; Fuchs, 1877); Rainbach, near Schärding, OÖ (Schultz, 1965; [NHMW])

Paratethys (non-Austrian occurrences): Ottnangian (Late Burdigalian)

Bavarian Molasse Basin: Höch (gravel-pit), SW Passau, Bavaria, Germany ([NHMW]); Holzbach, near Fürstenzell, SW Passau, Bavaria ([NHMW]); Kälberbach, near Höch, SW Passau, Bavaria (? Stadler, 1926; Sieber, 1956; [NHMW])

Cidaroida indet.

mentioned as Cidaroid spines:

1867 Cidaritenstachel – Karrer: 335, 339-342
1868 Cidaritenstachel – Karrer: 576, 581
1869 Cidaritenstacheln – Bunzel: 81
1877 Cidariten-Stacheln – Karrer: 79, 112, 116, 126, 132, 146-147, 151, 153-56, 159-60, 163, 166-67, 169, 171-73, 181, 187, 188, 195, 201, 222, 223, 225-9, 232-5, 258-9, 266, 277, 282, 285, 297-8, 305-6
1877 Cidariten-Stachel. – Hilber: 261
? 1893 Ocellarplättchen des Scheitelschildes (*Salenia* ?). – Toula: 288 [genital plates; probably from co-occurring cidaroids]
1898 Cidariten-Stachel – Kornhuber: 31
1905 *Cidaris*, sp. – Gaál: 357, 362
1906 Cidariten – Schaffer: 65
1927 riesige Cidaritenstachel – Küpper & Bobies: 3
1928 Große Cidaritenstacheln. – Bobies: 45
1930 *Cidaris*-Stachel. – Vendl: 50
1942 *Cidaris*-Stacheln. – Winkler: 106
1955 Cidarisstachel, Großform. – Tollmann: Tab. 5b
1968 Cidarisstacheln, Großform – Schmid: Anhang

mentioned as *Cidaris* sp.

1853 Stacheln von *Cidaris* – Melion: 707
1856 *Cidaris* – Rolle: 592
1877 *Cidaris* Stachel – Karrer: 104, 193
1882 *Cidaris* sp. – Hilber: 236
1892 *Cidaris* – Hilber: 1032
1893 *Cidaris* n. sp. – Toula: 288
1894 *Cidaris* sp. – Lörenthey: 67
1897 *Cidaris* spec. ind. – Schaffer: 535, 547
1906 *Cidaris* sp. – Vadász: 329 [spine fragments]
1907 *Cidaris* tüskék – Vogl: 245, 306 [= *Cidaris*-Stachel]
1915 *Cidaris* sp. – Májer: 29, 82
1915 *Cidaris* spec. – Toula: 672
1926 *Cidars* sp. – Strausz: 213, 368
1927 *Cidaris* tük. – Horusitzky: 25, 165
1928 *Cidaris* sp. – Bobies: 48
1930 *Cidaris* sp. – Bobies: 26
1953b *Cidaris* sp. – Sieber: 194
1955 *Cidaris* sp. – Tollmann: Tab. 5b
1955 *Cidaris* sp. – Tollmann: tab. 1
1964 *Cidaris* – Kollmann: 540
1965 *Cidaris* spec. – Schultz: 283-284
1968 *Cidaris* sp.– Stancu & Andreescu: 466, tab.
1974 *Cidaris* sp. – Vávra: 345
2000 *Cidaris* – Piller: 87
2002 *Cidaris* sp. – Kazár: 153; fig. 1

mentioned as Cidaridae or Cidaroida indet.:

v. 2002b Cidaridae indet. – Kroh: 12
v. 2003a Cidaroida indet. – Kroh: 159; pl. 2, figs. 6-7
2003b Cidaridae indet. – Kroh: 249

Material:

Ottnangian (Late Burdigalian) – Höbmannsbach, Taufkirchen Bay, ESE Schärding, OÖ, Austria
NHMW: 7 smooth primary spines (NHMW 1978/1966/12f)
Early Badenian (Langhian) – Gainfarn, NÖ, Austria
NHMW: 1 primary spine fragment (NHMW 2004z0076/0020)
Early Badenian (Langhian) – Niederleis, NÖ, Austria
NHMW: 4 fragmented primary spines (NHMW 2002z0087/0006-8)
Early Badenian (Langhian) – Stotzing (sandpit Mayer), Bgld, Austria
NHMW: 1 spine fragment (NHMW 2004z0050/0026), 1 tooth and 1 demipyramid (NHMW2004z0050/0006)
Badenian (Langhian-Early Serravallian) – Forchtenau, NÖ, Austria
NHMW: 1 spine fragment (NHMW 2004z0001/0015e)
Badenian (Langhian-Early Serravallian) – Grinzing, Vienna, Austria
NHMW: 1 spine fragment and 1 demipyramid (NHMW 1846.37.953a)
Badenian (Langhian-Early Serravallian) – old sandpit between Großhöflein and Kleinhöflein, Bgld, Austria
NHMW: 1 scrobicular spine (NHMW 2003z0081/0039)
Late Badenian (Early Serravallian) – Winden [old quarry, N of the Ludlloch (cave), N of the village], Bgld, Austria
NHMW: 1 rotula (NHMW 2003z0082/0042)

Foreign material:

Badenian (Langhian-Early Serravallian) – Nový Rybik (= Portzteich), near Sedlec, W Lednice, Czech Republic
NHMW: 1 genital plate (NHMW 1858.XLVII.78a)

The material discussed under this heading is identifiable to order rank only due to the nature of the studied specimens. The unified discussion under the heading "Cidaroida indet." does not imply that they are conspecific or even congeneric.

Discussion:

Many literature records of cidaroid spines could not be revised since the material on which the records are based is lost or its whereabouts unknown. Additionally, some of the disarticulated cidaroid remains present in the Austrian collections could

not be attached to the groups outlined above and are listed here under the heading "Cidaroida indet.".

Occurrence:

Austria: Late Eggenburgian (Early Burdigalian) to Late Badenian (Early Serravallian)

- Molasse Zone: Enzersdorf, near Staatz, NÖ (Karrer, 1867); Grübern, NÖ (Karrer, 1867); Höbmannsbach, Taufkirchen Bay, ESE Schärding, OÖ ([NHMW]); Laa an der Thaya, NÖ (Karrer, 1867)
- Vienna Basin: Bad Vöslau, NÖ (Karrer, 1877); Baden, NÖ (Karrer, 1877); Brunn am Gebirge, NÖ (Karrer, 1877); Gainfarn, NÖ (Karrer, 1877; Kroh, 2002b; [NHMW]); Grinzing, W ([NHMW]); Gumpoldskirchen, NÖ (Karrer, 1877); Heferlberg, near Gumpoldskirchen, NÖ (Küpper & Bobies, 1927); Leobersdorf, NÖ (Karrer, 1877); Maria-Enzersdorf, NÖ (Karrer, 1877); Mödling, NÖ (Karrer, 1877); Müllendorf (Fenk quarry), Bgld (Tollmann, 1955); Müllendorf (Mühlendorfer Kreide AG quarry), Bgld (Tollmann, 1955); Niederleis, NÖ (Kroh, 2003a; [NHMW]); Perchtoldsdorf, NÖ (Karrer, 1868, 1877; Winkler, 1942); Pötzleinsdorf, W (Sieber, 1953b); Rauchstallbrunngraben, near Baden, NÖ (Karrer, 1877; Bobies, 1928, 1930; Vávra, 1974); Sooss, near Baden, NÖ (Karrer, 1877); Stotzing (sandpit Mayer), Bgld (Kazár, 2002); Wien XVI (Schaffer, 1906); Wöllersdorf, NÖ (Karrer, 1877); Vienna Basin (Melion, 1853)
- Gaaden Bay: Siegenfeld, NÖ (Bobies, 1928)
- Eisenstadt-Sopron Basin: Eisenstadt (Hartl Fm., Johannesgrotte), Bgld (Piller, 2000); Eisenstadt (Schloßpark), Bgld (Tollmann, 1955); Forchtenau, Bgld ([NHMW]); Großhöflein, Bgld (Tollmann, 1955); sandpit between Groß- and Kleinhöflein, near Eisenstadt, Bgld (Tollmann, 1955; [NHMW]); Hader Berg, Bgld (Schmid, 1968); St. Georgen, Bgld (Schmid, 1968)
- Danube Basin: Breitenbrunn, Bgld (Schmid, 1968); Donnerskirchen, Bgld (Schmid, 1968)
- Styrian Basin: Grubthal, near Gamlitz, Styria (Hilber, 1877); Muggenau, Styria (Rolle, 1856); Neurath, Styria (Rolle, 1856); Tafern quarry, Styria (Kollmann, 1964)

Paratethys (non-Austrian occurrences): Eggenburgian (Early Burdigalian), Karpatian (Late Burdigalian) to Late Badenian (Early Serravallian)

- Molasse Zone: Jaklovec (= Jakloretz), near Ostrava, Czech Republic (Karrer, 1867); Knínice (= Kinitz), Czech Republic ([NHMW]); Kralice (= Kralitz) nad Oslavou, Czech Republic (Toula, 1893); Nový Rybik (= Portzteich), near Sedlec, W Lednice, Czech Republic (Bunzel, 1869; [NHMW]); Orlová (= Orlau), near Karvina, Czech Republic (Karrer, 1867)
- Vienna Basin: Devínska Kobyla (= Thebener Kogel), near Bratislava (Kornhuber, 1898); Devínska Nová Ves (= Neudorf an der March), Slovak Republic (Toula, 1915); Devínska Nová Ves (brickyard), Slovak Republic (Schaffer, 1897)
- Great Hungarian Basin (Pannonian Basin): Budapest-Rákos, Pest, Hungary (Vadász, 1906); Fót, Pest, Hungary (Vogl, 1907); Fót (Somlyó Mt.), Pest, Hungary (Strausz, 1926; Kroh, 2003b); Györ (brickyard Schwarz), Györ-Monson-Sopron, Hungary (Vendl, 1930); Hont, Börzsöny, Hungary (Májer, 1915); Mogyoród, near Fót, Pest, Hungary (Horusitzky, 1927); Nógrádszakál (= Szakall), Nógrád, Hungary (Gaál, 1905)
- Fore-Carpathian Basin: Mykolaiv (= Mikołajów), S of Lwów, western Ukraine (Hilber, 1882)
- Transylvanian Basin: Buituri (= Bujtur), Hunedoara, Romania (Lörenthey, 1894); Rugi-Delineşti, Romania (Stancu & Andreescu, 1968)
- Zala, Sáva and Dráva Basins: Bartolomae (Pereiraïa beds), Slovenia (Hilber, 1892)

Additional cidaroid taxa reported from the Central Paratethys

***Prionocidaris avenionensis* (des Moulins, 1837)**

v	1915	*Cidaris* (*Cyathocidaris*) *avenionensis* Desm. sp. – Vadász: 105; pl. 8 (2), figs. 15, 17
	1915	*C.* (*Cyathocidaris*) *avenionensis* Derm. – Májer: 35, 88
	1926	*Cidaris avenionensis* Desm. – Strausz: 213, 368
	1934	*Cidaris avenionensis* Desm. – Horusitzky: 324
	1960	*Cyathocidaris avenionensis* (Desmoulins 1837) – Kojumdgieva & Strachimirov: 228-229; pl. 8, figs. 6-8
	1968	*Cyathocidaris avenionensis* Desm. – Stancu & Andreescu: 466, tab.
	1981	*Cidaris avenionensis* Desm. (= *Cyathocidaris avenionensis*) – Halmai: 105
non	1987	*Cyathocidaris avenionensis* (Desmoulins, 1837) – Mączyńska: 145-146, 148; pl. 1, figs. 4-7; pl. 2, figs. 1a-d [misidentified *Eucidaris zeamays* plates]
non	1993	*Cyathocidaris avenionensis* (Desmoulins, 1837) – Mączyńska: 106; pl. 1, figs. 3-4; pl. 6, fig. 1c [misidentified *Eucidaris zeamays* plates]
non	1996	*Cyathocidaris avenionensis* (Desmoulins, 1837) – Mączyńska: 40-41; pl. 1, figs. 2-3 [misidentified *Eucidaris zeamays* plates]
	2003b	*Prionocidaris avenionensis* (Des Moulins, 1837) – Kroh: 248 [literature review]

Reported occurrence: Ottnangian: Cinkota and Püspökhatvan, Hungary (Vadász, 1915); Karpatian: Cinkota (Vadász, 1915), Csomád (Magas-hegy) (Horusitzky, 1934; Halmai, 1981), Fót (Vadász 1915), Fót (Somlyó Mt.) (Strausz, 1926; Halmai, 1981) all in Hungary; Badenian: Kemence, Hungary (Vadász, 1915); Kisalag, Hungary (Halmai, 1981); Ribicioara (= Ribice), Romania (Vadász, 1915); Rugi-Delineşti, Romania (Stancu & Andreescu, 1968), Tarnene and Opansko bardo, Bulgaria (Kojumdgieva & Strachimirov, 1960)

Remarks: Concerning the generic attribution see above under *P. sismondai*. Some records of *P. avenionensis* species are based on misidentification of other species (e.g. Mączyńska, 1987, 1993 and 1996).

The available material (exclusively spines) is not sufficient to judge whether a single species or two (*P. avenionensis* and *P. sismondai*) were present in the Badenian of the Central Paratethys. Ottnangian and Karpatian material preserved at the Hungarian Geological Survey is closely similar to *P. avenionensis* reported from the Rhône Basin by Philippe (1998). Yet, Badenian material from Austria (here referred to *P. sismondai*) clearly falls outside the variation documented by Philippe (1998) for *P. avenionensis*. More specimens, especially coronal plates, are needed to solve this puzzle and to get a clear idea on the spatial and temporal distribution of these forms.

Misidentifications or dubious records of cidaroids

Apart from the taxa discussed above a number of cidaroids have been mentioned from Austrian and nearby outcrops. Reference material of some of these records could be traced and referred to the taxa above. Part of these records, however, remain dubious since reference material is lost or of unknown repository and descriptions/illustrations if present at all are insufficient.

***Dorocidaris papillata* (Leske, 1778)**

	1893	*Dorocidaris papillata* Leske. – Toula: 288
	1939	*Dorocidaris papillata* Leske – Kapounek: 74

1958a *Cidaris* (*Dorocidaris*) *papillata* Leske – Sieber: 152
1969 *Cidaris* (*Dorocidaris*) *papillata* Leske – Gábos & Ghiurca: 86; pl. 1, fig. 5 [? misidentified *S. schwabenaui* or *S. polyacantha* spines]
1981 *Dorocidaris papillata* Leske – Halmai: 106

Reported occurrence: Leitha Limestone between Groß- and Kleinhöflein, Bgld (Kapounek, 1939); Steinebrunn, NÖ (Sieber, 1958a); Kisalag, Hungary (Halmai, 1981); Kralice nad Oslavou (= Kralitz), Moravia, Czech Republic (Toula, 1893); Valea Satului and Berchezoaia, Baia Mare Basin, Romania (Gábos & Ghiurca, 1969)

Remarks: *Dorocidaris papillata* Leske is a junior synonym of *Cidaris cidaris* Linné, 1758 according to Mortensen (1928), but has been often confused with *Stylocidaris affinis* (Philippi). Both are extant species living in the Mediterranean Sea today. Fossil records of this species from Austria are most probable misidentified *Stylocidaris* ? *schwabenaui* or *S.* ? *polyacantha* spines (see above under these species).

***Cidaris pseudoserrata* Cotteau, 1863**

1893 *Cidaris pseudoserrata* Cott. – Toula: 288

Reported occurrence: Kralice nad Oslavou (= Kralitz), Moravia, Czech Republic (Toula, 1893)

Remarks: This species was established for disarticulated material (mainly spines) from the Middle to Late Eocene of southwestern France. The spines are distinctly flattened with serrate edges and have strongly crenulate acetabula (compare Cotteau, 1863: 75, pl. 2, figs. 17-22; Cotteau, 1892: 474-478, pl. 311, figs. 1-23). There is no similar material in the Badenian of the Central Paratethys and it remains unclear what species Toula's record refers to actually.

***Cidaris subularis* d'Archiac in Agassiz & Desor, 1846**

1893 *Cidaris subularis* d'Arch. var. – Toula: 288

Reported occurrence: Kralice nad Oslavou (= Kralitz), Moravia, Czech Republic (Toula, 1893)

Remarks: This species was based on disarticulated spines from the Eocene of Biarritz, France (Cotteau, 1892: 422-426; pl. 304, figs. 1-16). It is slightly similar to *Stylocidaris* ? *schwabenaui* spines and Badenian Central Paratethyan records may be misidentifications of such spines.

***Cidaris hirta* Sismonda, 1842**

1857 *Cidaris hirta* Sismonda – Peters: 322

Reported occurrence: Baden, NÖ (Peters, 1857)

Remarks: This species was established for isolated spines from the Pliocene of Asti, Italy and is a junior synonym of *Histocidaris rosaria* (Bronn, 1831) according to Borghi (1999: 112). Austrian material referred to his species could probably be misidentified *Stylocidaris* ? *polyacantha* spines, but differences are strong.

***Histocidaris rosaria* (Bronn, 1831)**

1981 *C. rosaria* Bronn – Halmai: 106

Reported occurrence: Csomád, Oldalhegy, Hungary (Halmai, 1981)

Remarks: *Histocidaris rosaria* (Bronn, 1831) is a species occurring in the Pliocene of Northern Italy. Halmai's (1981) record is based on an unpublished Ph.D. thesis and could not be verified.

Subclass Euechinoidea Bronn, 1860
Infraclass Echinothurioidea Claus, 1880
Order Echinothurioida Claus, 1880
Family Echinothuriidae Thomson, 1872
Subfamily Echinothuriinae Thomson, 1872

Fell (1966b) states that the tubercles in the order Echinothurioida are noncrenulate. In extant *Asthenosoma ijimai* Yoshiwara (USNM E10669), however, both noncrenulate and crenulate primary tubercles were observed in the interambulacra, albeit the former were more common. Smith & Wright (1990: 102) report crenulate primary tubercles in the genus *Kamptosoma*.

Genus *Retzneiosoma* Kroh, nov. gen.

Type-species: *Retzneiosoma jaseneki* Kroh, nov. sp.

Derivatio nominis: Named after the locality where the material was found, and adding the echinothuriid suffix *–soma*.

Type horizon and locality: Lower Badenian (Langhian, Middle Miocene) marls overlying the corallinacean limestone of the Weissenegg Formation, outcropping in the quarries of the Lafarge cement company in Retznei, Styria (Austria).
Diagnosis: Echinothuriid with trigeminate ambulacra with single large primary plate reaching from adradial to perradial suture and smaller, ovate demiplates positioned along the horizontal sutures; demiplates occluded from both adradial and perradial sutures; pores arranged in three vertical rows; primary tubercles crenulate and perforate; tubercles arranged in distinct adradial columns in the aboral interambulacra; membranous gap in aboral interambulacra; hollow, smooth primary spines terminating in a tapering, rounded tip.
Remarks: This new genus differs distinctly from all known Echinothurioida. To investigate the placement of this new taxon a cladistic analysis carried out with the program PARS from the PHYLIP Phylogeny Inference Package [Version 3.6 (alpha3), July, 2002, by Joseph Felsenstein] was done. Using the characters and data matrix provided by Smith & Wright (1990: 101-104; Fig. 19) the analysis resulted in a single most parsimonious tree placing *Retzneiosoma* within the clade Echinothuriinae as defined by Smith & Wright (1990) but failed to fully resolve its position within the clade (see Fig. 11.1). Running the same analysis with the different character set and data matrix from Smith ("*The Echinoid Directory*", 12. 11. 2003), *Retzneiosoma* is again placed into clade Echinothuriinae but its position is not resolved either. The analysis yielded 5 most parsimonious trees which differ only in the position of *Retzneiosoma* in relation to the other echinothuriinids (Fig. 11.2a-e). A slightly extended set of characters (Tabs. 7-8) yielded a single most parsimonious tree and places *Retzneiosoma* as sister-group to all living echinothuriinids (Fig. 11.3). *Echinothuria* is the sister-group of all living echinothuriinids plus *Retzneiosoma*. This result is supported by the stratigraphic distribution of the taxa in question (*Echinothuria* – Late Cretaceous, *Retzneiosoma* – Miocene).

Extant and fossil echinothuriinids differ markedly from *Retzneiosoma*: *Araeosoma* has much more prominent membranous gaps and a much sparser tuberculation; *Asthenosoma* lacks primary tubercles on its aboral surface; *Calveriosoma* lacks membranous gaps on the aboral surface and bears primary tubercles only on each second or third primary ambulacral plate; *Echinothuria* has only very few primary tubercles on the aboral side and lacks membranous gaps in the interambulacra; *Hapalosoma* similarly has much less prominent and common primary tubercles and demiplates which reach the adradial suture adapically. Moreover, all of these taxa have noncrenulate primary tubercles and primary spines terminating in a hyaline hoof.