

## Lower and Middle Jurassic Gastropods from the Bakony Mts. (Hungary) Part I. Euomphalidae (Archaeogastropoda)

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**Abstract** — Three Liassic of the here described seven *Discohelix* species are new: *D. inornata* sp. n., *D. miocarinata* sp. n., *D. acarinata* sp. n. Three *Pentagonodiscus* species are described, of which one Liassic is new: *P. initiopentagonatus* sp. n. An exceptional *Pentagonodiscus angustus* WENDT, 1968, specimen proved that in the formation of the parabolic sculptural elements no resorption had role. With 5 figures and 2 plates.

**Introduction** — In the last decade the Hungarian Geological Survey excavated several artificial exposures in the Jurassic of the Bakony Mts. (Transdanubian Central Mountains), and these exposures yielded a rich (approximately 800 specimen) gastropod fauna. The gastropod finds were associated with ammonites in all cases that made a precise

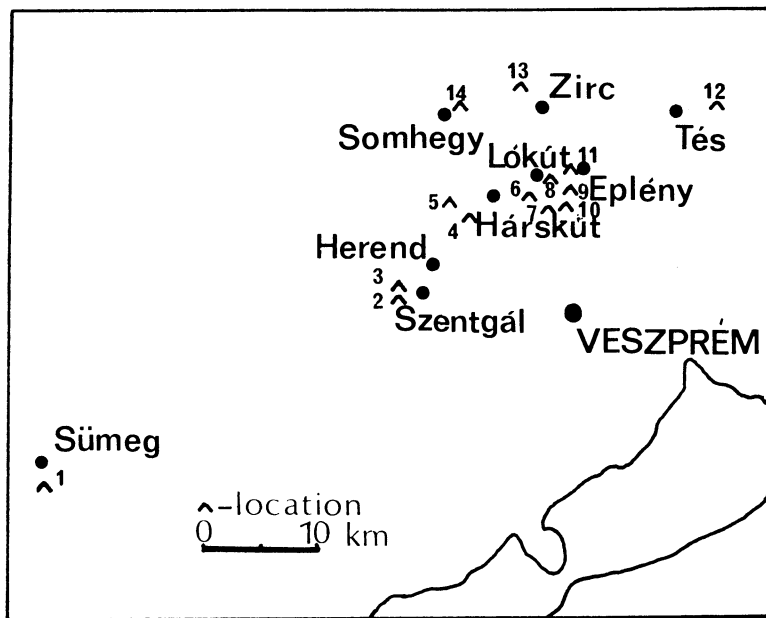


Fig. 1. Sketch-map of the Bakony Mts. localities: 1 = Mogyorósdomb, 2 = Tűzköveshegy, 3 = Gombápuszta, 4 = Közöskúti-árok, 5 = Kisnyerges-árok, 6 = Kericsér, 7 = Középhát, 8 = Lókútiromb, 9 = Kávástető, 10 = Büdöskútpuszta, 11 = Manganese Mine, 12 = Hamuháza, 13 = Bocskorhegy, 14 = Somhegy

stratigraphical dating possible. The majority of the material came from the Upper Sinemurian and the Pliensbachian, but some Toarcian and numerous (approx. 250) Bajocian specimens are also available. This large and partly well-preserved material obviously needs treating. Taking into consideration that the research on Jurassic (especially Mediterranean) gastropods is relatively neglected, the results are expected to emerge from the scope of pure taxonomy.

The present paper, the first part of a series, deals with the results of the systematic treating. To begin with the species of the family *Euomphalidae* is justified by the fact that this is the most commonly represented family in the Bakony Mountains Lower Jurassic: with approx. 150 specimens of 8 species. The Bajocian yielded only two species from a single locality.

The specimens are deposited in the Paleontological Collection of the Hungarian Geological Survey, Budapest.

**Localities** — The sedimentological study of the majority of the localities has been done by KONDA (1970). He distinguished four main facies types. The origin of these different facies types was studied by GALÁ CZ & VÖRÖS (1972). On the basis of these latter studies, VÖRÖS (1974) evaluated the facies-dependence of the branchiopods (Fig. 2: A). The biostratigraphy of the profiles is given for the Lower Jurassic in GÉ CZY'S (1971a–b, 1972a–b, 1974, 1975), for the Bajocian in GALÁ CZ'S (1976) works, respectively. These studies make easier to characterize the localities shown in Fig. 1 and Table I.

### Morphological remarks

**Keels and last whorl** — There is a few morphological element to detail after the exhaustive evaluation of WENDT (1968). As it is shown by the here described new species too, a feature of specific value would be the presence or lack of carinae on the keels. In all the investigated species, fine carinae of at least one or two whorl length appear on the embryonal shell. However, in *Discohelix inornata* sp. n. and *D. acarinata* sp. n. these carinae are lacking on the outer parts of the shell. From this point of view not only the whole, but also a part of the teleoconch would be characteristic. Thus, in *D. miocarinata* sp. n. only the last whorl lacks the carinae.

In several species the sculpture of the last whorl differs from that of the previous ones (*D. excavata*, *D. miocarinata*, ? *D. cotswoldiae*, etc.). In this way the shells show three distinct divisions: embryonal whorls (protoconch), juvenile whorls and last (adult) whorl appear. These three parts are connected by transitional portions. The observations suggests that the different sculpture of the last whorl endures temporally, thus enables specific characterization in itself. In spite of the limited specimen number and narrow stratigraphic extension, the designation of two of the here described new species (i.e. *D. miocarinata* and *P. initiopentagonatus*) can be supported by the above-mentioned morphological considerations.

**Parabolic sculptural elements and the growth of *Pentagonodiscus angustus*** — The *P. angustus* WENDT specimen shown in Plate II: fig. 9. makes the interpretation of the parabolic sculptural elements simpler (cf. WENDT 1968, pp. 555, 560). As it is clear from the figure, the "parabolic nodes" on the keels are actually the insertions of long, slit spines, similar to siphonal canals. These elements therefore do not indicate resorption, but rather changes in the direction of growth. The spines can brack off quite easily, but when are preserved, their delivery from the matrix needs exceptional fortune. Thus only their scars appear, together the infilled "notches". In connection with the spine-secretion, the direction of growth altered in the remaining part of the shell. The spiral threads incline to-

Table I.

Locality	Facies	Age
Sümeg: Mogyorósdomb	Hierlatz-type lmst.	? Upper Sinemurian
Szentgál:		
Tüzköveshegy	Hierlatz limestone	Raricostatum Zone
Gombáspusztá	Red. manganiferous lmst.	Carixian, mainly Ibex Zone
Herend:		
Kisnyerges-árok	Red, manganiferous lmst.	Upper Sinemurian — Carixian
Hárskút:		
Közöskúti-árok	Red, manganiferous lmst.	Ibex Zone
Lókút:		
Kericser	Hierlatz-type lmst.	with mixed Obtusum to Ibex Zone fauna
	Hierlatz limestone	Ibex — Stokesi Zone
	Red, crinoidal lmst.	Spinatum Zone
Büdöskútpuszta	Pink limestone with siliceous sponge-spicules	Davoei — Margaritatus — Spinatum Zone
Középhát	Pink limestone with siliceous sponge-spicules	Davoei — Spinatum — Margaritatus Zone
Lókúti-domb	Red, cherty crinoid lmst.	Davoei Zone
Káváshegy	Red. cherty crinoid lmst.	Jamesoni and Davoei Zones
Eplény:		
Manganese Mine	Vertical fissure infilling	Domerian
Zirc: Bocskorhegy	Grey and pink lmst. with siliceous sponge-spicules	Jamesoni — Margaritatus Zone
	Red, crinoidal lmst.	Pliensbachian
Tés: Hamuháza		
Somhegypuszta:		
Somhegy	Horizontal fissure infilling and red manganiferous limestone	Humphriesianum — Parkinsoni Zone

ward the “parabolic notch”, with extended interspaces, which indicate a tension in this direction, generated by the extended mantle edge.

The suture-to-suture “parabolic growth-line” is a result of the restoration of the normal direction of growth. The withdrawal of the temporal mantle extensions was followed by an opposed decline of the spiral threads and a re-establishment of their original density. The growth-lines themselves are also run differently. When infilling the scars of the “notches” (i.e. the spines), the first growth-lines are similar to the “parabolic growth-lines”, but angle them. Subsequently a series follows with increasing similarity to the form of the normal growth-lines. Approaching the next spine, the growth-lines become more and more proverse near the keels. This suggests that the here situated, spine secreting parts of the mantle edge was the place of the most intensive shell secretion.

The mechanism of infilling corresponds actually to the way of damaged shell restoration, when the soft parts withdraw into the shell, and the mantle edge reaches the margin of the part to be completed. The growth-lines run firstly parallel to the damaged margin, then the normal direction of growth is restored.

The shell secretion remained continuous, even without retardations during the growth-steps in 72° intervals. In these case the inner and outer varices were formed, with soft parts withdrawal and multilayered shell secretion. This way of growth is not unique. It can be recognised in the majority of the *Discohelix* and *Pentagonodiscus* species, where the newly built shell parts join the previous parts roof-tile-like or telescopically (Plate II: fig. 12). The bars

shown on the figure are repeated regularly, and possibly mark daily growth periods. Slightly irregular transverse ribs or riblets, corresponding to these bars, were recognised on the shell of *Pentagonodiscus angustus*. Two of this riblets are separated frequently by "parabolic growth-lines" independent of spines. This "parabolic growth-lines" marks only that the spiral lines do not fit to the lines of the previous riblet. This latter type occurs mainly near the real "parabolic growth-lines", on its adoral shell portion. This suggests a complete soft part rearrangement for the time its formation.

**Facies-dependence and mode of life of *Discohelix* and *Pentagonodiscus*** — Figs. 1A–B show the distribution of the specimens by facies-types. Prominent specimen number values generally mark preferred facies. In the cases of restricted specimen numbers, the occurrence in the preferred facies is most probable. All the *Pentagonodiscus*

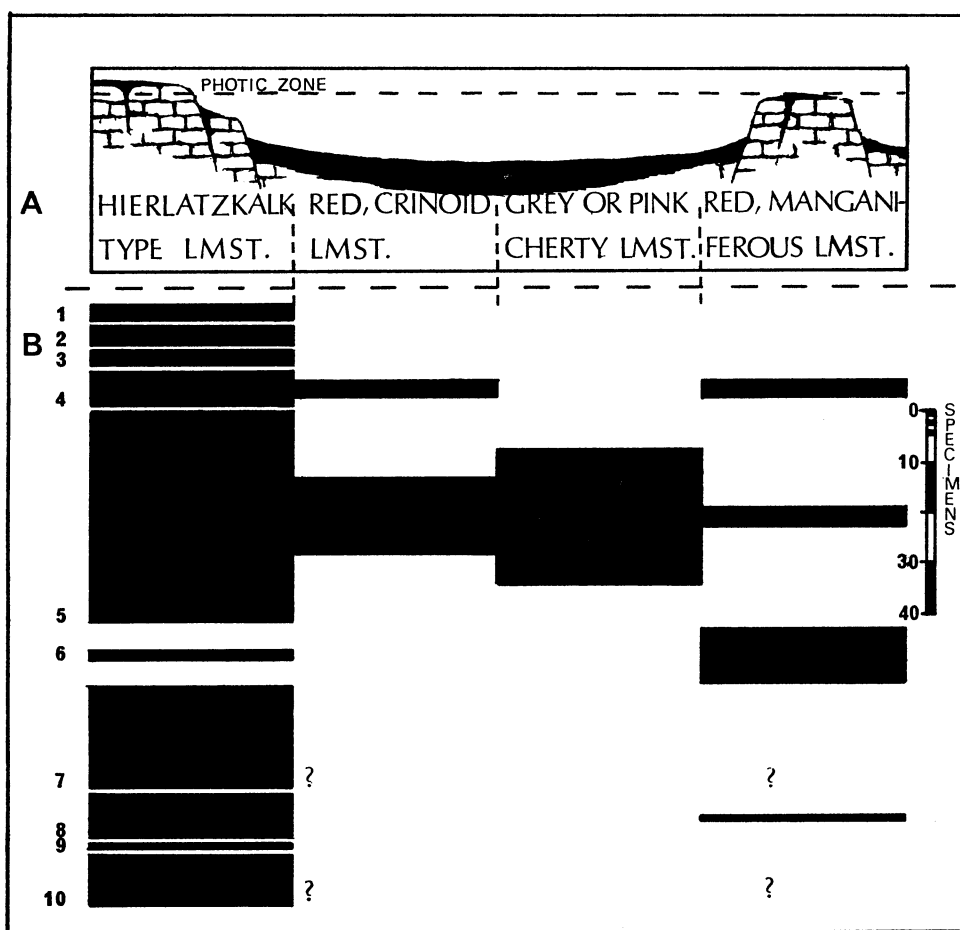


Fig. 2. A: Model for the formation of the Jurassic facies-types of the Bakony Mountains. — B: Distribution of *Discohelix* and *Pentagonodiscus* species in the facies-types, 1 = *D. inornata*, 2 = *D. cf. ornata*, 3 = *D. miocarinata*, 4 = *D. excavata*, 5 = *D. orbis*, 6 = *D. acarinata*, 7 = ? *D. cots-woldiae*, 8 = *P. reussii*, 9 = *P. initiopentagonatus*, 10 = *P. angustus*

and the majority of the *Discohelix* species preferred biotopes on submarin highs. On the other hand, *D. orbis* is rather common in basinal, deeper-water (ammonitico rosso) limestones, too. The high-numbered occurrences of this species presumably cannot be due to transportation, but rather to the fact, that this species lived (also) in deeper-water biotopes. It is suggested also by the observation, that the entire material was yielded by condensed, but autochthonous sediments of 2 to 3 cm thickness. Moreover, it is hard to realize a transportation selecting mainly the *D. orbis* specimens. On the other hand, it is difficult to decide that the occurrence in condensed limestones is produced whether by fossilization or environmental causes. Other fossil groups, e.g. ammonites and brachiopods do occur in crinoideal beds, and the brachiopods appear even in cherty rock-types, too. Accordingly, it is probable that the lack of *D. orbis* in cherty, crinoideal, or siliceous sponge-spicule-bearing limestones is caused by primary, paleoecological factor(s). Presumably the association with crinoids and sponges, or rather the detrital substrate formed from the skeletal parts of these latter, was the unfavourable circumstance. *D. orbis*, like the majority of the Jurassic gastropods (HALLAM 1972), would have preferred hard substrates.

The studies on facies-dependence reinforce the results of WENDT (1968, p. 563) on the mode of life of *Discohelix*. *Pentagonodiscus*, which was suggested as more adapted for living in more agitated waters, occurs only in elevated biotopes. Additionally, their most common occurrences were submarine highs with tops presumably within the photic region of highly agitated wates. On the other hand, *Discohelix* species are common in deeper water

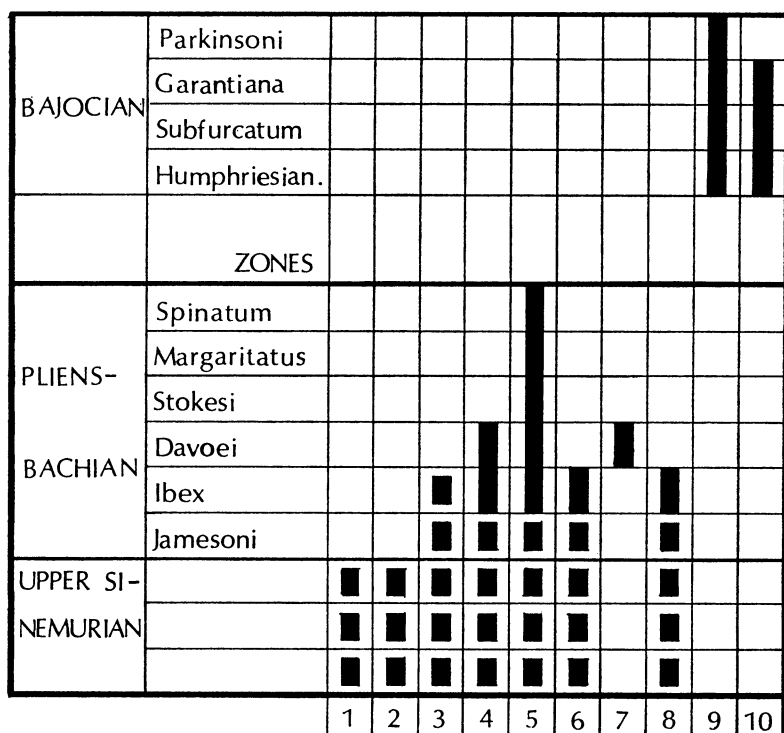


Fig. 3. Stratigraphic distribution of the here described *Discohelix* and *Pentagonodiscus* species: 1 = *D. cf. ornata*, 2 = *D. inornata*, 3 = *D. miocarinata*, 4 = *D. excavata*, 5 = *D. orbis*, 6 = *D. acarinata*, 7 = *P. initiopentagonatus*, 8 = *P. reussii*, 9 = ?*D. cotswoldiae*, 10 = *P. angustus*

facies, too, suggesting preferred biotopes on the deeper and quieter water parts of the submarine topographic highs.

**Stratigraphic value** — Gastropods are extremely rare in the Mediterranean Jurassic. Their approximate ratio of the other fossils with shell is bivalve 0.1, gastropod 1, ammonite 50, brachiopod 100, specimens for the Hierlatz limestone, one of the facies richest in gastropods. This sparsity makes relatively hopeless to find index fossils among them.

As it is clear from Fig. 3., the vertical distribution of the more common *Discohelix* and *Pentagonodiscus* extends to about a stage. The rarer species are represented in single occurrences, thus, their evaluation is difficult. To clear up their evolution needs more data on greater material, possibly from additional localities.

### Systematic descriptions

Subclass PROSOBRANCHIA MILNE EDWARDS, 1848

Order ARCHAEOGASTROPODA THIELE, 1925

Superfamily Euomphalacea DE KONINCK, 1881

Family Euomphalidae DE KONINCK, 1881

Genus *DISCOHELIX* DUNKER, 1848

#### *Discohelix orbis* (REUSS, 1852) (Plate I: figs. 1–3; Fig. 6e)

1852: *Euomphalus orbis* REUSS-REUSS, p. 114., pl. 14., fig. 1.

1861: *Discohelix orbis* REUSS-STOLICZKA, p. 182., pl. 3., figs. 8–10.

1874: *Discohelix orbis* REUSS-GAMMELLARO, G. G., p. 98.

1912: *Discohelix orbis* REUSS-HAAS, p. 283., pl. 20., figs. 23–24.

1924: *Discohelix orbis* REUSS-MAUGERI, p. 48., pl. 1., fig. 26.

1937: *Discohelix orbis* REUSS-PČELINCEV, p. 26., pl. 1., fig. 41.

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: fig. 1	31	9	7.2	0.29	1.25	210°	150°
Plate I: fig. 2	14.5	4.8	3.7	0.33	1.30	208°	142°
Plate I: fig. 3	25.1	6.5	5	0.26	1.20	—	151°

**Material** — Eighty-eight specimens coming from almost all localities. More than half of the material consist of internal moulds with damaged or fragmentary shell. Other specimens are internal casts or impressions. Two-thirds of the internal casts are inner, one-third is outer moulds.

**Shape** — Dextral, discoidal form with concave spire. From the spiral plane of the nearly bilaterally symmetrical shell only the embryonal part raises slightly on the spiral side. The whorl-section is trapezoidal, with slightly convex sides. The carinate keels are accenuate throughout the whole shell. The peristome is simple, entire, sometimes is slightly broadened in every direction.

**Sculpture** — About 2 whorls after the disappearing embryonal sculpture the spiral ornament reappears. It consists of fine lines occurring on the spiral, umbilical and outer sides. Growth-lines are visible slightly earlier. In adult stages weak, transversal ridges appear more or less periodically on the spiral and umbilical sides. With the onset of the visible growth-lines, the carinae of the keels become corrugated. This corrugation endures up to the peristome.

**Embryonal shape and sculpture** — The coiling of the embryonal shell begins differently from that of the adult shell, i.e. the nucleus and about a half whorl are slightly raised on the spiral side. Approximately a half whorl after the nucleus, spiral lines appear on the shell which are visible on about two whorls, then fade away. There is no sharp boundary between the embryonal and the adult shell.

**Remarks** — The relatively large material made possible to study the variability of this species. Because of the rather stable ornamentation, the variability is better reflected by the dimensions (Fig. 5). The diagram is based 50 specimens with measurable height and the related diameter and whorl-width. The points on the figure represent specimens, on the basis of the two ratios. The figure shows both the relation to the other *Discohelix* species and the difference between the variability

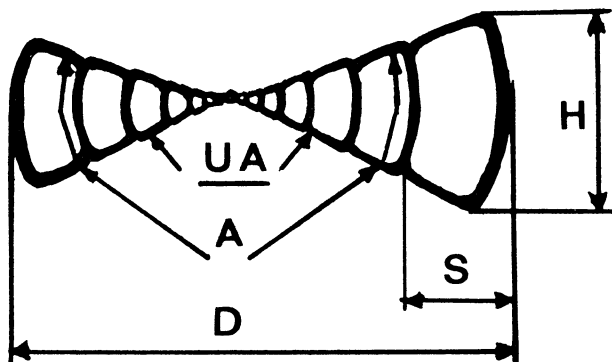


Fig. 4. Measurements and abbreviations used in the descriptions: D = diameter, H = whorl-height, S = peristomal width, A = spiral angle, U = umbilical angle

of the two ratios. In the case of *D. orbis*, the smaller scatter indicates too, that the more realistic values came from the H/D ratio. This can be due to special case of the presence or absence of carinae on the keels. The absence of carinae may reflect in a 0.5 to 2 mm decrease in the H values. In the case of a division with larger numbers (e.g. H/D) this results in lower scatter than in the case of a division with smaller numbers (e.g. H/S). The higher scatter can be related to preservation conditions:

damaged shelly and inner

mould specimens

(carinae absent)

$1.0 < H/S < 1.3$

entire shelly and outer

mould specimens

(carinae present)

$1.3 < H/S < 1.5$

The ornamentation and the dimensions do not show definite tendency with age.

On the basis of the good earlier descriptions and illustrations this species can be easily distinguished. Only its distinction from *Discohelix calculiformis* DUNKER, 1848, is problematic, because of the poor description and figure of the latter form. Some earlier authors (e.g. HÖRNES 1853, STOLICZKA 1861) united this form with *D. orbis*.

**Distribution** — Eastern Alps, Hierlatz limestone; Eastern and Western Sicily, "Pygope aspasia zone" (Middle Liassic); Caucasus, Pliensbachian; Bakony Mountains: Kericser, beds with mixed Obtusum to Ibex Zone fauna — Spinatum Zone; Közöskúti-árok, Ibex Zone; Gombáspuszta, Ibex Zone; Lókúti-domb, Davoei-Zone; Kávástető, Davoei Zone; Búdöskútpuszta, Davoei — Spinatum Zone; Középhát, Davoei — Margaritatus Zone; Bocskorhegy, Stokesi Zone; Hamuháza, Ibex Zone.

#### *Discohelix cf. ornata* (HÖRNES, 1853) (Plate I: fig. 4)

cf. 1853: *Euomphalus ornatus* HÖRNES — in HAUER, p. 760.

cf. 1861: *Discohelix orbis* REUSS-STOLICZKA, p. 182., pl. 3., fig. 9.

cf. 1912: *Discohelix orbis* REUSS-M. GEMMELLARO, p. 218., pl. 9., figs. 9–12.

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: fig. 4	—	5.1	6	—	0.85	—	—

**Material** — Two fragmentary specimens with the visible parts of the characteristically sculptured last whorl and 2 juvenile specimens of probable identity with this form.

**Shape** — The general shape of the shell is very near to that of *D. orbis*, but the two juvenile specimens refer to a somewhat smaller spiral angle, i.e. in contradiction to the equally deep two sides of *D. orbis*, here the spiral side is less concave than the umbilical one.

**Sculpture** — As compared to *D. orbis*, in this form the transversal ridges of the last whorls and the carinae on the keels are much stronger.

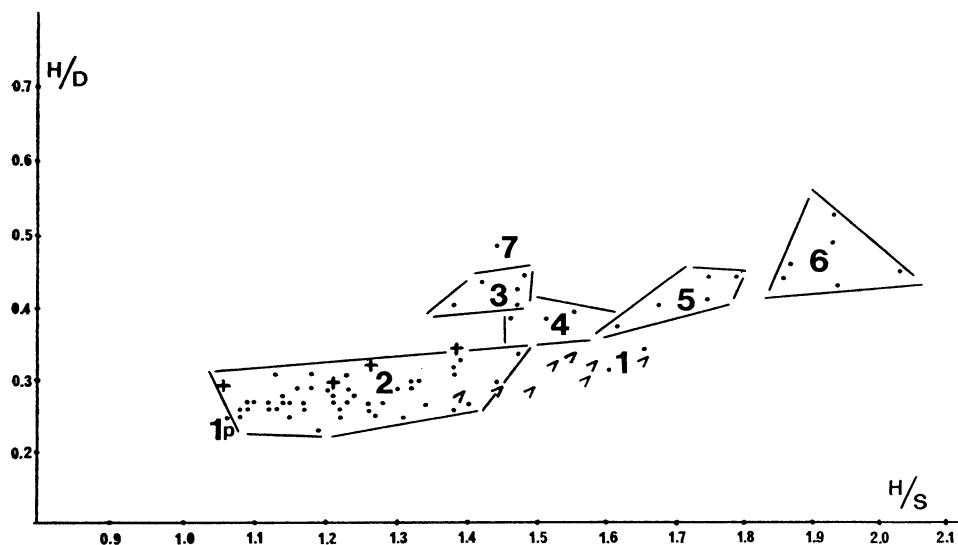


Fig. 5. Measurement ratios of the here described *Discohelix* and *Pentagonodiscus* species. Each specimens with measurable dimensions correspond to one point. These are derived from the corresponding  $H$ ,  $D$  and  $S$  values and the  $H/D$  and  $H/S$  ratios. Dimensions measured at strongly tapering peristome give markedly deviate value (see letter P). 1 = *D. inornata*, 2 = *D. orbis*, 3 = *D. excavata*, 4 = *D. miocarinata*, 5 = *D. acarinata*, 6 = *P. reussii*, 7 = *P. initiopentagonatus*, crosses indicate *P. angustus* and arrows indicate ?*D. cotswoldiae*

**Remarks** — Because of the imperfect preservation, the specific identification of these fragments is merely presumable. The *D. orbis* figures of M. GEMMELLARO (1912) show only more widely spaced tubercles and ridges than those on the specimens from the Bakony Mountains.

**Distribution** — Alps, Hierlatz limestone; Eastern Sicily, "Terebratula aspasia zone"; Bakony Mountains: Sümeg, ? Upper Sinemurian.

#### ***Discohelix excavata* (REUSS, 1852) (Plate I: fig. 5; Fig. 6 d)**

1852: *Euomphalus excavatus* REUSS-REUSS, p. 115., pl. 14., fig. 2.

1861: *Discohelix excavata* REUSS-STOLICZKA, p. 184., pl. 3., fig. 12.

1912: *Discohelix excavata* REUSS-TONI, p. 39., pl. 2., fig. 5.

1912: *Discohelix excavata* REUSS-M. GEMMELLARO, p. 216., pl. 9., fig. 13.

1920: *Discohelix excavata* REUSS-CHAVANNE, p. 54., pl. 4., fig. 5.

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: fig. 5	19.7	9.3	6.6	0.47	1.41	206°	122°

**Material** — Thirteen specimens, mainly moulds with test fragments. Unfortunately, the most characteristically sculptured last whorls are damaged in the majority of the specimens, however, these fragments can be identified with certainty.

**Shape** — Dextral, discoidal, biconcave forms with deeper umbilical side. The surface of the whorls are nearly flat on the spiral and umbilical, and strongly convex on the outer side. The keels are distinct and carinated throughout after the first whorl. The peristome is simple.

**Sculpture** — The ornamentation appears on the third or fourth whorl, and it consists of tiny, roof-tile-like, posteriorly dipping transverse bars. These start from the sutures and strengthen into small nodes on the carinae, then die out rapidly outward. These bars are divided by extremely fine growth-lines. The bars appear repeatedly up to the last whorl, where these are substituted by strong growth-lines. These strong growth-lines appear firstly in bundles, than the bundles strengthen

into ridges. Toward the peristome the ridges are accompanied by increasingly stronger nodes on the keels. The other side shows only fine growth-lines, with a few faint, broad spiral thread.

**Embryonal shape and sculpture** — The nucleus and the first whorl slightly raised on the spiral side, then the characteristic adult coiling appears. The embryonal shell is completely smooth. Because of the lack of the sculpture, its size can only be estimated as about 2.5 whorl.

**Remarks** — The available stratigraphically oldest (Upper Sinemurian) and youngest (Davoei Zone) specimens show marked differences, which are represented as refinement and weakening of the sculpture. Arriving in Davoei times, the transversal bars become narrower and attain 2 or 3 times greater number per whorls. The ridges and the nodes of the last whorl are less marked and appear rather as weak undulations.

The identification of the adult specimens do not present difficulties. This species, having a characteristic, strong sculpture on the last whorl, is easily distinguished from the similarly sized other species. On the last two whorls of *Discohelix miocarinata* sp. n. the keels become rounded and the carinae become smooth. On the other hand, juvenile specimens are rather hard to distinguish. The adult specimens differ from *D. levis* WENDT, 1968, because this latter has smooth keels on its last whorls and a peristome, which is reinforced outward by an inner varix. In this case the identification of the juvenile specimens is problematic, too. The young specimens of *D. acarinata* sp. n. with their rounded keels without carinae can be easily distinguished from *D. excavata*.

From *D. excavata* specimens mentioned by earlier authors those North African forms described by DARESTE DE LA CHAVANNE (1920) differ from the specimens of the Bakony Mountains (and from the other described specimens). In the North African forms the strong nodes appear much earlier (1 or 2 whorls).

**Distribution** — Eastern Alps: Austria, Hierlatz limestone; Vedana, Middle Liassic; — Eastern Sicily, "Terebratula aspasia zone"; Eastern Atlas, Middle Liassic; Bakony Mountains: Sümeg, ? Upper Sinemurian; Kericser, beds with mixed Obtusum to Ibex Zone fauna — Davoei Zone; Lókúti-domb, Davoei Zone; Kávástető, Davoei Zone; ? Kisnyerges-árok, Ibex Zone.

***Discohelix inornata* sp. n. (Plate I: figs. 6–7; Fig. 6c)**

**Holotypus**: Plate I: fig. 6. — **Stratum typicum**: Hierlatz-type, fissure-filling limestone — **Locus typicus**: Sümeg, Mogyorósdomb — **Derivatio nominis**: *inornatus* = without sculpture.

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: fig. 6	29.1	7.2	6.8	0.25	1.06	216°	144°
Plate I: fig. 7	17.7	5.6	3.5	0.32	1.60	—	—

**Material** — Three specimens from the same locality, all are fragmentary, with strongly recrystallized shell, but the fragments can be completed with each other.

**Diagnosis** — Dextral form with concave spire, keels without carinae, peristome trumpet-like, shell smooth, except growth-lines.

**Shape** — The shell is biconcave, with nearly bilateral symmetry. The keels, which are somewhat more distinct on the juvenile whorls, do not have carinae. The surface of the whorls is convex, more slightly on the spiral and umbilical than the outer side. The trumpet-like peristome do not show thickening.

**Sculpture** — On the shell only the fine growth-lines are visible. These are uniform, without any periodicity with growth.

**Embryonal shape and sculpture** — The embryonal whorls can be studied in sections, and show slight raising on the spiral side.

**Remarks** — The characteristic shape, dimensions and "sculpture" make this species easily distinguishable.

**Distribution** — Bakony Mountains: Sümeg, ? Upper Sinemurian

***Discohelix miocarinata* sp. n. (Plate I: figs. 8–9; Fig. 6b)**

**Holotypus**: Plate I: fig. 8. — **Locus typicus**: Lókút, Kericser — **Stratum typicum**: Hierlatz-type limestone — **Derivatio nominis**: less carinated (last whorl without carinae).

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: figs. 8–9	19.8	7.9	5.1	0.40	1.55	229°	131°

**Material** — Three relatively well-preserved, shelly specimens.

**Diagnosis** — Spire concave, keels are carinate only on the juvenile shell, protoconch smooth, shell is ornamented only with bars.

**Shape** — Dextral, discoidal form with a spire less concave than the umbilicus. The cross-section of the juvenile whorls is straight, on both the spiral and umbilical side, but is slightly convex on the last two whorls. The outer side is slightly arched throughout the shell. On the last two whorls, after a gradual transition, the keels become rounded, without carinae. Peristome is unknown.

**Sculpture** — The spiral sculpture of the juvenile whorls consists of carinae on the keels and some faint spiral threads on the outer side. Transverse sculpture appears only on the spiral and umbilical sides, as tiny roof-tile-like bars. On the juvenile whorls each of these bars are accompanied with small nodes on the carinae of the keels. After the keels the bars fade out rapidly on the outer side.

**Embryonal shape and sculpture** — The embryonal shell is smooth, but has distinct keels after the first whorl. The characteristic sculpture of the adult shell onsets after the third whorl.

**Remarks** — The adult specimens can be easily distinguished from the similarly-sized *D. excavata*, because in this latter a marked sculpture appears on the last whorl. In *D. excavata* the keels remain carinate, with appearance of stronger nodes, and the bars in the sculpture are replaced by strong, widely-space ridges. It is possible, that juvenile whorls can be distinguished on their dimensions, but this procedure needs larger material. *D. acarinata* sp. n. is also distinguished in having rounded, uncarinate keels after the embryonal whorls.

**Distribution** — Bakony Mountains: Lókút, Kericser, beds with mixed Obtusum to Ibex Zone fauna; traces of redeposition, perhaps older than Ibex Zone.

***Discohelix acarinata* sp. n. (Plate I: fig. 10, Plate II: fig. 12; Fig. 6a)**

**Holotypus**: Plate I: fig. 10. — **Locus typicus**: Hárskút, Közöskúti-árok — **Stratum typicum**: red, manganiferous limestone — **Derivatio nominis**: without carinae; the teleoconch lacks carinae.

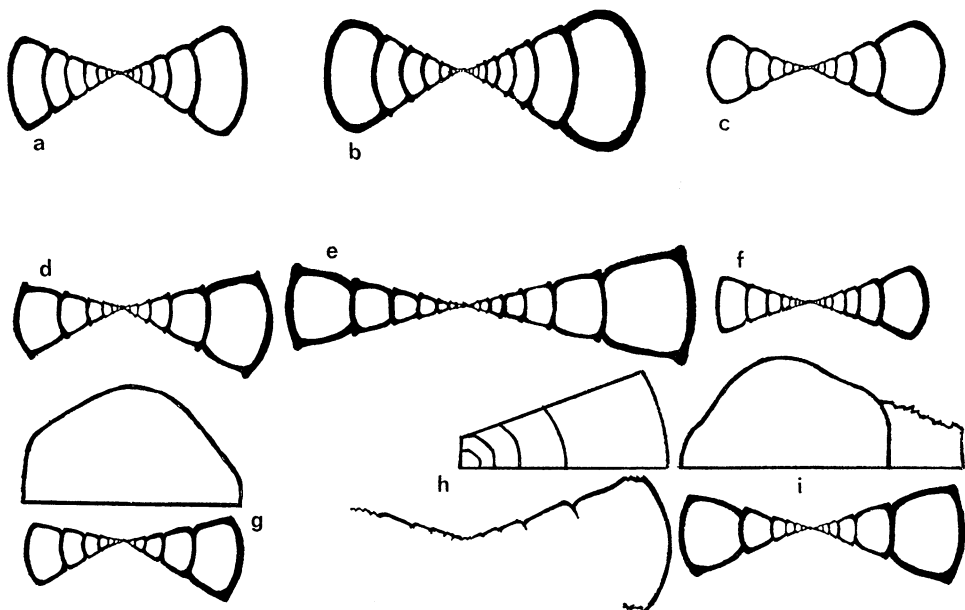


Fig. 6. Cross-sections of the species: a = *Discohelix acarinata*, b = *D. miocarinata*, c = *D. inornata*, d = *D. excavata*, e = *D. orbis*, f = ?*D. cotswoldiae*, g = *Pentagonodiscus reussii*, h = *P. initiopentagonatus*, i = *P. angustus*

Measurements:	D	H	S	H/D	H/S	A	U
Plate I: fig. 10	14.6	6.6	3.8	0.45	1.74	248°	131°

**Material** — Thirteen specimens, all with preserved test, but more or less damaged.

**Diagnosis** — Spire concave, only the keels of embryonal shell are carinate, the shell-sculpture comprises transversal bars.

**Shape** — Dextral discoidal form, with a spire less concave than the umbilicus. The whorl-surface is convex on the outer, but flat on the spiral and umbilical sides. The keels are rounded and uncarinate both on the juvenile and adult whorls. On the available fragmentary peristomes no modification is visible.

**Sculpture** — Spiral sculpture is visible only on the outer side, with magnification. It comprises random fragments of spiral threads. The spiral and umbilical sides are covered by periodically appearing roof-tile-like, tiny transverse bars, which fade on the outer side immediately after the keels. The bars are divided into extremely fine growth-lines, which give rise to the transverse sculpture on the outer side, where these are stronger.

**Embryonal shape and sculpture** — The embryonal whorls are raised in the beginning (i.e. on the nucleus and a whorl). On each keel of the second and third whorls a fine carina appears, which becomes smooth before the onset of the adult sculpture on the fourth whorl. Except the carinae, the embryonal shell is free of sculpture.

**Remarks** — The best preserved specimen shown under magnification a peculiar sculptural pattern. From periodically repeated, spot-like depressions along the suture, arise tangentially directed, prorsiradial, fine, virgatotom and slightly opisthocyt bundles of lines, which reach the keels. The origin of these lines is problematic. Perhaps these are traces of a former organic outer layer.

On the basis of uncarinate keels after the embryonal whorls in *D. acarinata*, this species is easily distinguished from the similarly sized *D. miocarinata* with carination up to the penultimate whorl, and *D. excavata* with carination throughout the shell. The similarly uncarinate *D. inornata* differs in its sculpture and dimensions. Probably the forms regarded by G. G. GEMMELLARO (1874) as *D. excavata* are conspecific. His Plate 9: figs. 14–15. show well the characteristic bars of the sculpture, and the size is also similar. The cross-section on his fig. 16. clearly shows that the keels are rounded throughout the shell. It is clear from the description, that GEMMELLARO also observed the differences from the *D. excavata*.

**Distribution** — Western Sicily, „Pygope aspasia zone” ?; Bakony Mountains: Kericsér, beds with mixed Obtusum to Ibex fauna — Davoei Zone; Kőzöskúti-árok, Ibex Zone and a bed with mixed Ibex Zone to Lower Toarcian fauna.

### ? *Discohelix cotswoldiae* (LYCETT, 1850) (Plate II: figs. 1–3; Fig. 6f)

1968: *Discohelix (Discohelix) cotswoldiae* (LYCETT, 1850) — Wendt, p. 572., pl. 110., figs. 5–12., text-figs. 2F, 3M.

Measurements:	D	H	S	H/D	H/S	A	U
Plate II: figs. 1–2	22.1	7.3	4.6	0.33	1.59	—	143°
Plate II: fig. 3	22.7	6.7	4.6	0.29	1.45	220°	140°

**Material** — Twenty, mostly damaged and a few excellently preserved specimens.

**Shape** — Dextral, discoidal, nearly bilaterally symmetrical forms. The keels are distinct throughout the shell, and except the last 1 to 1.5 whorl, bear weak carinae. The peristome tapers out slightly, the outer and somewhat the inner lip is thickened.

**Sculpture** — The adult sculpture appears simultaneously with the disappearing of the embryonal ornamentation. The adult sculpture comprises of regularly repeated small ribs. These ribs begin as corrugations of the keels, but later elongate transversally. With a gradual weakening, the ribs end before reaching the suture, and do not spread to the outer side. On the penultimate whorl the riblets fade out gradually, thus the last whorl is smooth. Some low ridges are visible sometimes mainly near to the peristome. On the penultimate whorl, together with the fading of the transverse riblets, the spiral lines, which cease after the embryonal shell, reappear on the spiral and umbilical sides. On the basis of the sculpture of a juvenile specimen, this happens quite earlier on the outer side.

**Embryonal shape and sculpture** — The smooth, globular nucleus and slightly the first whorl too, are raised on the spiral side. About a half whorl after the nucleus, 3 to 4 fine spiral lines appear, which endure through 1 to 1.5 whorl, and then disappear.

**Remarks** — The available specimens agree well with the descriptions and figures given by WENDT (1968). However, in the Bakony Mts. material the markedly sculptured forms shown in his pl. 110., figs. 9–12. are absent. — According to the present writer's judgement, the figured Sicilian and Bakony Mts. forms cannot be identified with *D. cotswoldiae* (LYCETT, 1850).

**Distribution** — Western Sicily, Aalenian — Lower Bajocian; Bakony Mountains: Somhegy, Humphriesianum to Parkinsoni Zones.

### Genus *PENTAGONODISCUS* WENDT, 1968

Euomphalid species with pentagonal shape are known from the Lower Liassic onwards. Earliest representative is the *Pentagonodiscus mellonii* (GEMMELLARO, 1879), which still shows trochospiral coiling. Other species (*P. reussii*, *P. initiopentagonatus* sp. n., *P. angustus*) have biconcave shell.

The shape is extremely characteristic; the pentagonal symmetry, as traces in the sculpture, remains even when the normal logarithmic spiral coiling is partly restored (e.g. *P. initiopentagonatus* sp. n.). This feature makes these forms easily distinguishable from the *Discohelix* species. This morphological difference, together with the wide distribution, gives reason to separate it as an independent genus.

#### *Pentagonodiscus reussii* (HÖRNES, 1853) (Plate II: figs. 4–5; Fig. 6g)

1853: *Euomphalus reussii* HÖRNES — in HAUER, p. 760.

1861: *Discohelix reussi* HÖRNES-STOLICZKA, p. 184., pl. 3., fig. 14.

1911: *Discohelix reussi* HÖRNES-M. GEMMELLARO, p. 215., pl. 9., fig. 14.

1968: *Discohelix (Pentagonodiscus) reussii* (HÖRNES, 1853) — WENDT, p. 574., pl. 110., figs. 22–24, text-figs. 2G., 3P., 5.

<b>Measurements:</b>	D	H	S	H/D	H/S	A	U
Plate II: figs. 4–5	10.7	4.8	2.6	0.45	1.85	204°	118°

**Material** — Ten internal moulds, with more or less fragmentary, strongly recrystallized test.

**Shape** — Dextral form, the spire is less concave than the umbilicus. In axial view the shell — except the embryonal whorls — is pentagonal. The whorl-section on the spiral and umbilical side is slightly, on the outer side is strongly convex. The peristome is narrowed by the keel-to-keel inner varix. The inner lip is also somewhat thickened by a thin plate. The inner varices are repeated periodically at intervals of somewhat less than 72°, their places are marked on the surface of the whorls by transverse swellings on the spiral and umbilical sides and shallow successive depressions on the outer side. The inner varix marks an adaxial narrowing of the whorl, while the outer broadening shows an axial expansion — thus the area of the whorl section remains unchanged. The outer swellings, with their constant < 72° periodicity resemble some posteriorly arched spiral arms.

**Sculpture** — The adult sculpture onsets at about the end of the third whorl. The recurring spiral and the transversal sculpture, as well as the pentagonal shape appears roughly simultaneously. The spiral sculpture consists of threads on the whole whorl-surface, which are separated by narrow incisions. The transversal sculpture is resulted from costellae reaching from suture to the keels. These costellae become stronger toward the keels, corrugating the latter, and then rapidly fade out outward. The spiral and transversal sculpture results in a retiform ornamentation.

**Embryonal shape and sculpture** — The embryonal whorls show a normal logarithmic spiral in coiling, with slight elevation on the spiral side of the nucleus and approx. one whorl. About a half whorl after the nucleus appears a spiral sculpture of 3 to 4 fine lines, which disappears after about two whorls, and renews again on the adult shell.

**Remarks** — One of the available specimens shows a „parabolic notch” on the outer side, following the inner varix (Plate II: fig. 5). It is problematic to distinguish the juvenile specimens of *P. reussii* and *P. initiopentagonatus* sp. n. (see below).

From the earlier illustrations, that of STOLICZKA 1861. pl. 3., fig. 13. is different, having a tetragonal outline. Disregarding this case, other earlier works made this characteristic species easily distinguishable.

**Distribution** — Eastern Alps, Hierlatz limestone; Eastern Sicily, „Terebratula aspasia zone”; Bakony Mountains: Sümeg, ? Upper Sinemurian; Kericser, beds with mixed Obtusum to Ibex Zone faunas; Közősküti-árok, Ibex Zone.

***Pentagonodiscus initiopentagonatus* sp. n. (Plate II: figs. 6–7; Eig. 6h)**

**Holotypus**: Plate II: fig. 6. — **Locus typicus**: Lókút, Kericser — **Stratum typicum**: Hierlatz limestone — **Derivatio nominis**: pentagonal in the beginning; the initial part of the teleoconch shows pentagonal shape.

Measurements:	D	H	S	H/D	H/S	A	U
Plate II: figs. 6–7	20.0	9.8	6.8	0.49	1.44	218°	—

**Material** — The available specimen shows the preserved juvenile and the majority of the outer whorls.

**Diagnosis** — Dextral form with concave spire, only the juvenile whorls show pentagonal shape, sculpture with fine spiral lines, dense ribbing in the spiral and umbilical sides and nodes of two kind of strength in the keels.

**Shape** — Dextral, discoidal form with less concave spiral than umbilical side. The juvenile whorls are pentagonal in outline, but on the last two whorls the normal logarithmical coiling of the embryonal shell renews. However, the arrangement of the sculpture on the last two whorls retains the pentagonal symmetry. The keels are distinct and carinate throughout the shell. The surface of the whorls is flat on the spiral and umbilical sides, and convex on the outer side. Peristome and inner structure of the shell is unknown.

**Sculpture** — From the third whorl the spiral lines are visible on the whorl-surface. From the penultimate whorl onwards, these lines are arranged into pairs. The pairs are 3 to 4 times widely spaced than space between them. On the spiral and umbilical sides 6 of these paired lines appear. The outer side is covered by dense, evenly-spaced lineation. Contemporaneously with the spiral lines, tiny transverse ribs appear strengthening slightly toward the keels. On the penultimate whorl the endings of these riblets strengthen into nodes. The nodes become increasingly stronger and sparser. On the last whorl the nodes appear independently from the riblets; there are stronger nodes at intervals of 35 to 36°, and three smaller, similar nodes between them. Within a space between two stronger nodes 13 to 17 riblets are visible. The nodes are elongated transversally, and fade out rapidly in the two, especially in the outward direction. The stronger nodes appear in points corresponding to the “tips” and the side bisectors of the former pentagonal whorls, thus the earlier pentagonal symmetry is retained.

**Embryonal shape and sculpture** — The coiling of the embryonal whorls (approx. two and half) follows normal logarithmic spiral, with a nucleus slightly elevated on the spiral side. Because of the strong recrystallization, the sculpture cannot be studied here, only some uncertain portions of spiral lines are visible.

**Remarks** — The juvenile (approx. 6) whorls of *P. initiopentagonatus* resemble those of *P. reussii*. The difference, on the basis of this limited material, is the stronger sculpture, the stronger divergence from the normal spiral coiling and the smaller whorl-width in *P. reussii*. The diameter of the pentagonal whorls in *P. initiopentagonatus* is 8 mm. In a diameter bigger than this, a distinction from *P. reussii* seems to be more certain. After this stage the specific features of *P. initiopentagonatus* are present: i.e. the loss of the pentagonal shape, the appearance of a different sculpture. In *P. reussii* the habit of the shell remains unchanged up to the adult stage (12 to 15 mm in diameter).

**Distribution** — Bakony Mountains: Kericser, Davoei Zone.

***Pentagonodiscus angustus* (WENDT, 1968) (Plate II: figs. 8–11; Fig. 6i)**

1968: *Discohelix* (*Pentagonodiscus*) *angusta* WENDT-WENDT, p. 573., pl. 110, figs. 17–21., text-figs. 1B., 2H., 30., 4A–B., 6A–B.

Measurements:	D	H	S	H/D	H/S	A	U
Plate II: fig. 8	17.5	5.1	4.7	0.29	1.06	—	—

**Material** — Ten specimens, some are excellently preserved.

**Shape** — Dextral, planispiral shell, with pentagonal shape in axial view. The keels are distinct in all growth-stages, with occasional weak carina. Owing to the periodical thickening of the peristome, inner and outer varices appear on the shell at intervals of about 72°. A type of inner varices appears at the place of the former peristomal inner lip, slightly behind the tip of the pentagon, an other type occurs at the place corresponding to the outer side of the outer lip, on the side bisector of the pentagon. The places of the inner varices correspond roughly to those of latter type, and reach from the keels to the suture and the quarter of the outer side. The peristome shows the two inner varices.

**Sculpture** — From the fourth whorl the whole shell is covered by spiral lines, with cross-ing, and frequently interrupting growth-lines. The most distinct features are the exceptionally preserved, long hollow spines on the keels. These spines, when broken off, leave the characteristic parabolic nodes on the test. The surface of the fracture is usually visible. On the last whorl these nodes are arranged into triples around the tips of the pentagon. The first node of each triples forms a part of the outer varia, too. The next two nodes succeed with a similar interspace. The succeeding nodes appear on, and somewhat after the tip, respectively. The infillings of the scars of the broken spines begin with „parabolic growth-lines”, which run suture-to-suture, and apparently cross the former growth-lines. On the juvenile whorls the nodes elongated transversally, without associated spines.

**Embryonal shape and sculpture** — The nucleus is smooth, globular. It is followed by approximately 3 whorls with normal logarithmic spiral coiling, then the first deviation appears. About a half whorl after the nucleus onsets a spiral lineation, which endures on the next 1.5 to 2 whorls, then disappears and renews after a one-whorl interruption.

**Remarks** — The Bakony Mountains specimen with the preserved spines suggests to reinterpret the explanation of WENDT (1968) on the parabolic sculptural elements (see above).

**Distribution** — Western Sicily, Aalenian — Middle Bajocian; Bakony Mountains; Somhegy, Humphriesianum to Garantiana Zone.

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### Plate I.

- Fig. 1. *Discohelix orbis* (REUSS), Kericser, Bed No: 6/25,  $\times 2.5$
- Fig. 2. *Discohelix orbis* (REUSS), Gombáspuszta, Bed No: IV/4,  $\times 3.2$
- Fig. 3. *Discohelix orbis* (REUSS), Kericser, Bed No: 6/36,  $\times 1.2$
- Fig. 4. *Discohelix cf. ornata* (HÖRNES), Sümeg,  $\times 1.8$
- Fig. 5. *Discohelix excavata* (REUSS), Kericser, Bed No: 6/17,  $\times 1.5$
- Fig. 6. *Discohelix inornata* sp. n., holotype, Sümeg,  $\times 1$ , J 9591
- Fig. 7. *Discohelix inornata* sp. n., Sümeg,  $\times 3.5$
- Fig. 8. *Discohelix miocarinata* sp. n., holotype, Kericser, Bed No: 6/33,  $\times 1.3$ , J 9592
- Fig. 9. *Discohelix miocarinata* sp. n., juvenile whorls of the holotype,  $\times 2.7$
- Fig. 10. *Discohelix acarinata* sp. n., holotype, Közösküti-árok, Bed No: HK/18,  $\times 3.9$ , J 9593

### Plate II.

- Fig. 1. ? *Discohelix cotswoldiae* (LYCETT), Somhegy, Bed No: 1,  $\times 1.6$
- Fig. 2. ? *Discohelix cotswoldiae* (LYCETT), protoconch of the specimen on fig. 1,  $\times 15$
- Fig. 3. ? *Discohelix cotswoldiae* (LYCETT), Somhegy, Bed No: 1,  $\times 1.7$
- Fig. 4. *Pentagonodiscus reussii* (HÖRNES), Sümeg,  $\times 2.5$
- Fig. 5. *Pentagonodiscus reussii* (HÖRNES), outer side of the specimen on fig. 4. with a parabolic growth-line,  $\times 3.2$
- Fig. 6. *Pentagonodiscus initiopentagonatus* sp. n., holotype, Kericser, Bed No: 6/15,  $\times 1.7$ , J 9594
- Fig. 7. *Pentagonodiscus initiopentagonatus* sp. n., juvenile whorls of the holotype,  $\times 4.6$
- Fig. 8. *Pentagonodiscus angustus* WENDT, Somhegy, Bed No: 3,  $\times 4.4$
- Fig. 9. *Pentagonodiscus angustus* WENDT, Somhegy, the specimen with unbroken spines, Bed No: 1,  $\times 3$
- Fig. 10. Outer side of *P. angustus* specimen of fig. 8. with a parabolic node,  $\times 4.7$
- Fig. 11. Parabolic nodes and parabolic growth-lines on *P. angustus* specimen of fig. 8.,  $\times 8.8$
- Fig. 12. *Discohelix acarinata* sp. n., sculpture,  $\times 8$

## Plate I.

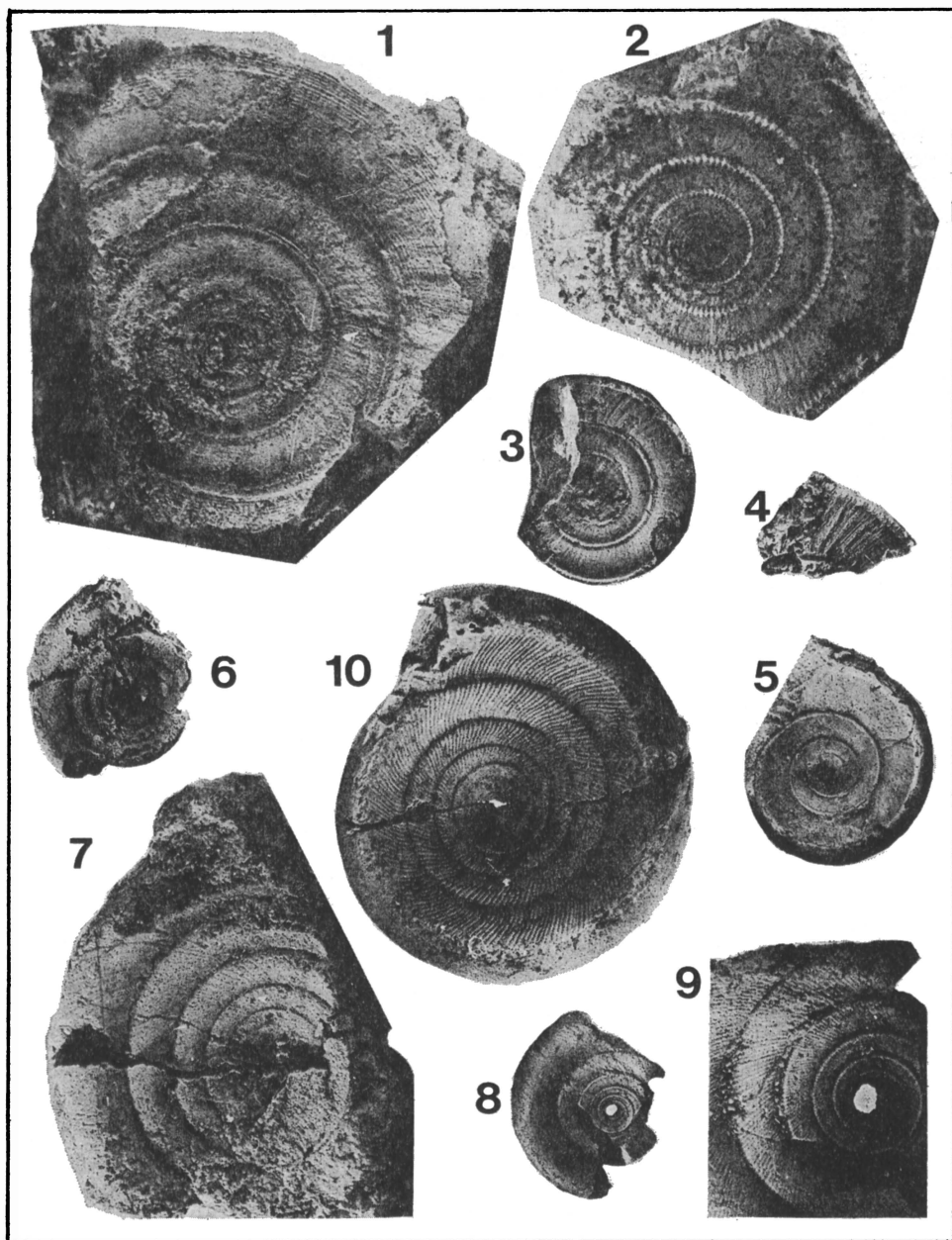


Plate II.

