

BOHUSLAV RŮŽIČKA & FERDINAND PRANTL:

Zámkový aparát u rodu *Goniophora* Phillips (Pelecypoda)
The hinge apparatus of the genus *Goniophora* Phillips
(Pelecypoda)

PL. XII.

(Předloženo — Presented 20. 1. 1958.)

Práce pojednává o druhu *Goniophora secans* Barrande, 1881, při čemž je zvláštní pozornost věnována především zámkovému aparátu tohoto druhu. V práci je zámkový aparát podrobně popsán, protože doplňuje a zpřesňuje naše dosavadní znalosti o rodu *Goniophora* Phillips, 1848. Rovněž je diskutována systematická příslušnost zmíněného rodu.

Při určování mlžů ze středočeského spodního devonu (*svrchní vápence Koněpruské*) získali jsme ve výplavu materiálu z t. zv. „bílé vrstvy“ bývalého *Houbova lomu na „Zlatém koni“* u Koněprus větší počet volných mlžů s oběma miskami v přirozené biologické poloze. Na tomto materiálu jsme se pokusili odhalit vnitřní stavbu misek tak, aby bylo možno stanovit charakter zámkového aparátu.

Po prudkém nahřátí a následujícím rychlém ochlazení, které bylo doplněno prudkým úhozem na zámkovou linii mlží schránky, podařilo se nám některé schránky otevřít tak, že jsme získali nepoškozený zámkový aparát. Mezi takto preparovaným materiálem získali jsme i jeden velmi dobře zachovaný zámkový aparát druhu *Goniophora secans* Barrande. Charakter zámku tohoto druhu vykazuje několik morfologicky důležitých, dosud neznámých podrobností, které do značné míry zpřesňují a doplňují diagnosu rodu *Goniophora* Phillips, 1848.

Zámkový aparát levé misky sestává z jednoho kardinálního zubu, z jednoho okrajového zubu, jedné jamky pro kardinální zub opošíční misky, jedné jamky pro okrajový zub opošíční misky a z jedné deprese pro okrajový zub opošíční misky. Vedle toho nese zúžená část přední zámkové plochy tři mírně vyčnívající hrbolky a tři nepřilíš hluboké deprese.

Zámkový aparát pravé misky sestává z jednoho zubu kardinálního, ze dvou zubů okrajových, z jedné jamky pro kardinální zub opošíční misky a jedné jamky pro okrajový zub opošíční misky. Připomínáme však, že zámkový aparát jak jej popisujeme u pravé misky není úplný vzhledem ke špatnému zachování přední zámkové plochy.

Jak je vidět, je zámkový aparát u druhu *Goniophora secans* Barr. značně složitější, než se udává v původní rodové diagnose, kde Phillips (1848, str. 264) uvádí, že zámek rodu *Goniophora* je složen z jednoho kardinálního zubu v misce levé a z příslušné jamky v misce pravé. I když mezi všeobecnější a jednodušší charakteristikou zámku u rodu *Goniophora*, uvedenou v původní rodové diagnose, a mezi naším popisem zámku druhu *Goniophora secans* Barr. není zásadního rozporu, přece stavba posledně jmenovaného zámkového aparátu vnuká jisté závažné pochybnosti o správnosti dosavadního systematického zařazení rodu *Goniophora* Phillips.

K. Zittel (1895; 1915) řadí tento rod k čeledi *Astartidae* Gray, tedy mezi *Heterodonta* Neumayr. Podle našeho názoru není však možno pokládat rod *Goniophora* Phillips za příslušníka zmíněné čeledi již proto, že, jak se ukázalo, postrádá jak předních tak zadních laterálních zubů a dokonce na zámkových plochách nejsou ani náznaky toho, že by tyto zuby byly zakrnělé nebo redukovány. E. Maillieux (1932; 1937) řadí rod *Goniophora* Phillips k čeledi *Modiolopsidae* Fisher emend. Dall. Domnívám se, že ani toto zařazení není správné, protože zástupci zmíněné čeledi mají zámek složený z několika zubů umístěných pod vrcholem a po stranách, což představuje docela odlišný typ zámkového aparátu, než bylo zjištěno u výše popsaného druhu *Goniophora secans* Barr. Rovněž jiní autoři kladou rod *Goniophora* buď k čeledi *Modiolopsidae*, nebo k nadčeledi *Mytilacea*. Domníváme se, že charakter zámkového aparátu, jak jsme jej poznali u druhu *Goniophora secans* Barr. nedovoluje zatím jeho jednoznačné přiřazení mezi ostatní typy mlžích zámků. Podle našeho názoru je typem novým, pro který navrhuje označení typ *goniophorní*. Tento typ zámků by bylo možno definovat jako zámek složený ze stejného počtu zubů hlavních v obou miskách, z různého počtu zubů okrajových v obou miskách, po případě s různým počtem hrbolků a jamek na přední zámkové ploše obou misek. Je pochopitelné, že popsaný typ zámků velmi ztěžuje ba dokonce i znemožňuje zařazení rodu *Goniophora* Phillips do některé ze známých čeledí. Nevylučujeme ani tu možnost, že tento charakter zámků si vynutí stanovení samostatné čeledi pro rod *Goniophora* Phillips a po případě i pro další rody, u nichž se zjistí *goniophorní* typ zámkového aparátu.

Považujeme za milou povinnost poděkovat mistru R. Prokopovi za provedení kreseb, a Libuši Dorotíkové za zhotovení fotografií.

THE HINGE APPARATUS OF THE GENUS *GONIOPHORA* PHILLIPS (PELECYPODA).

(With 1 plate and 4 text figures.)

The species *Goniophora secans* Barrande, 1881, is described and especially a thorough study of its hinge apparatus is given in the present report. The position of the genus *Goniophora* Phillips, 1848 in the paleontological system is discussed.

While studying the Pelecypoda of the so called "white beds" of the Lower Devonian of Central Bohemia (Upper Koněprusy Limestones) we obtained out of the residues of the material from the former Houb'a's quarry on „Zlatý kůň“ near Koněprusy a number of free fossil Pelecypoda with both valves in the natural biological position. In this material we tried to reveal the internal structure of the valves, so as to be able to determine the character of the hinge apparatus.

After a rapid warming and successive cooling, which was completed by a violent stroke on the hinge line, we succeeded to open several shells and so obtained the hinge apparatus undamaged. Among the prepared material we obtained a very well preserved hinge apparatus of *Goniophora secans* Barr., 1881, as well. As this hinge type shows several morphologically important, hitherto unknown details, we present further below its detailed description.

GONIOPHORA PHILLIPS, 1848.

Genotype: *G. cymbiformis* Sowerby.

We refer to the original Phillips' diagnosis*) which agrees on the whole with our observation. However, we point out that the hinge apparatus does not consist of a cardinal tooth in the left valve and a corresponding socket in the right valve, as states the author of the genus, but according to our observation, made on the species *Goniophora secans* Barr., which by its general habitus undoubtedly belongs to the genus *Goniophora* Phillips, it is much more complex.

Goniophora secans Barrande, 1881.

1881 — *Goniophora secans* Barr. Vol. VI., Pl. 255, Fig. II, 1—17.

1881 — *Goniophora testis* Barr. Vol. VI., Pl. 261, Fig. V, 1—8.

1881 — *Goniophora pugio* Barr. Vol. VI., Pl. 357, Fig. 1—8.

1881 — *Goniophora media* Barr. Vol. VI., Pl. 357, Fig. 9—17.

1881 — *Goniophora rara* Barr. Vol. VI., Pl. 357, Fig. 18—21.

Lectotype: A shell with both valves in the original biological position, figured by J. Barrande (1881) on pl. 255, as fig. II, 12—15. (Inv. Nro. ČF 254).

Stratum typicum: Upper Koněprusy Limestones.

Locus typicus: Koněprusy.

Material: A number of isolated left and right valves including all Barrande's syntypes, and several shells with both valves in the original biological position. Material comes partly from Barrande's collections, partly was supplemented by our own material. It is deposited in the collection of the *National Museum in Prague*.

Description: Lectotype is a goniophorous shell, longitudinally elongated with protrusive, expressive, slightly sinuous keel. Lunule faintly marked, the surface sculpture consisting of more or less fine, partly irregular, concentric striae multiplied by intercalations before the keel. Beaks and hinge apparatus are not preserved in the lectotype. They are excellently preserved in a specimen (figured in this paper on pl. I. fig. 1; 3), in which we succeeded to isolate both valves and reveal the hinge apparatus. To complete our study, we present here the description of the studied hinge apparatus which considerably differs from the descriptions made on casts by different authors.

Left valve: Hinge consisting of two hinge branches which meet under the umbo in a precisely unmeasurable dorsal angle. The posterior hinge branch is short, subtriangular, being widest under the beak and reduced in form of a rostrum posteriorly. Its upper margin is widely arcuate, formed by the swelling of the valve material, which has the appearance of a morphologically marked, faintly prominent border. (Text fig. 1, E). The lower margin of this branch is slightly arcuate. The posterior hinge plate is moderately concave, nearly flat, in its upper part a short, narrow crest formed by the swelling of the valve material being visible. (Text fig. 1, V.). The anterior hinge branch is longer than the posterior one, it is

*) Memoirs of the Geological Survey of Great Britain, Vol. II. part 1. p. 264, London 1848.

elongated and of irregular shape. It is widest under the beak, narrowing slowly anteriorly. Its lower margin is undulate, upper margin nearly straight, only in a short distance from the point lying close under the beak anteriorly, its is somewhat obliquely sloping downwards. The anterior hinge plate is irregularly morphologically differentiated.

The hinge apparatus of the left valve consists of a cardinal tooth (Text fig. 1;1), a marginal tooth (Text fig. 1; 3), a socket for the reception of the cardinal tooth of the opposite valve (Text fig. 1; 2), a socket for the marginal tooth of the opposite valve (Text fig. 1; 4) and a depression for the second marginal tooth of the opposite valve (Text fig. 1; 5). Besides, the reduced anterior hinge plate bears three moderately protruding tubercles and three rather shallow depressions.

The cardinal tooth is situated on the boundary between the anterior and posterior hinge plate. It has the shape of a blunt spine, being strong, well

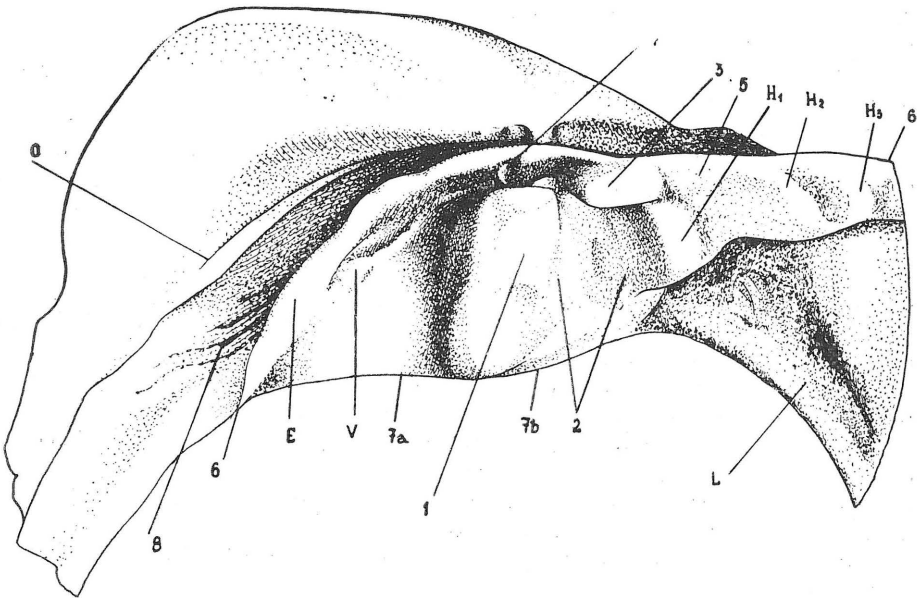


Fig. 1. *Goniophora secans* Barr., 1881. — Hinge apparatus of the left valve. View of the hinge plate, the anterior hinge plate being a little remote from the observer.

- 1 — cardinal tooth
- 2 — socket for the reception of the cardinal tooth of the opposite valve
- 3 — marginal tooth
- 4 — socket for the posterior marginal tooth of the opposite valve
- 5 — depression for the anterior marginal tooth of the opposite valve
- 6 — upper margin of the hinge plate
- 7 — lower margin of the hinge plate, a — posterior, b — anterior
- 8 — fine striae on the wall of the ligamental groove, serving to the insertion of the inner portion of the ligament
- L — inner ridge
- H₁, H₂, H₃ — the first, second and third tubercle of the anterior hinge plate
- V — crest on the posterior hinge plate
- E — border of the posterior hinge plate.
- O — margin of the ligamental furrow.

developed, its base occupying nearly the total length of the hinge plate under the umbo. The cardinal tooth is out of the lower margin of the hinge plate prolonged upwards, and projects strongly into the cavity of the shell. On the posterior side it is spoonlike carved, its anterior side being vaulted and sloping down into the socket for the cardinal tooth of the opposite valve.

The marginal tooth is subtriangular, having the shape of a low spine extending by its rounded apex into the inner cavity of the shell. It belongs by its position to the anterior hinge plate, being situated with its base close to the upper margin of the hinge plate, on the spot where the upper margin is breaking. The marginal tooth is essentially a projection of the anterior hinge plate upper margin into the inner shell cavity.

The socket for the cardinal tooth of the opposite valve is considerably deep, crescent-shaped. Its posterior margin is formed by the vaulting of the anterior portion of the cardinal tooth, its anterior margin being spoonlike carved, limited by the marginal tooth and the first tubercle of the anterior hinge plate.

The socket for the marginal tooth of the opposite valve is situated under the beak, above the cardinal tooth of the left valve. It is minute, ovoidal, rather deep.

The depression for the second marginal tooth of the opposite valve belongs by its position to the anterior hinge plate. It is shallow, sub-elliptical, situated along the upper margin of the anterior hinge plate, close before the marginal tooth (text fig. 1; 5).

As mentioned above, the anterior hinge plate bears three moderately protruding tubercles between which it is modelled into depressions. The first tubercle borders the anterior margin of the socket for the cardinal tooth of the opposite valve, being subelliptical, elongated obliquely up towards the beak and morphologically most prominent of all the three tubercles. (Text fig. 1, H₁.) The second tubercle has the form of a narrower ridge, extending obliquely towards the beak. (Text fig. 1, H₂.) The depression between the first and the second tubercle is rather broad, unexpressive. The third tubercle is situated near the broken anterior margin of the hinge plate, being more expressive, reniform. (Text fig. 1, H₃.) The depression between the second and the third tubercle is narrower and deeper.

We admit that there might have been more of such tubercles and depressions on the wanting portion of the anterior hinge plate than those we have just described.

On the left valve there can be noticed an expressive strong ridge, which extends from the lower margin of the anterior hinge plate, approximately from the border of the dental socket for the cardinal tooth of the opposite valve, and in a vaulted arch bends downwards to the free margin, protruding strongly into the inner cavity of the valve. Owing to the incompleteness of the anterior valve border, the total course of the described ridge could not have been followed in our specimen. (Text. fig. 1, L.).

Right valve: The hinge of this valve is formed by two hinge branches which meet under the umbo in an obtuse, precisely unmea-

surable dorsal angle. The posterior branch is short, subtriangular, its upper margin being broadly arcuate, morphologically unexpressive, formed by a rather narrow, faint thickening of the valve material, having the appearance of a low, slightly distinct ridge.

The lower margin of the posterior hinge branch is nearly straight. The posterior hinge plate is deeply morphologically differentiated. The anterior hinge plate is in the studied specimen partly broken off, so that its general shape and size could not have been observed.

The hinge apparatus of the right valve consists of a cardinal tooth (Text fig. 3; 2), of two marginal teeth (Text fig. 3; 4, 5) of one socket for

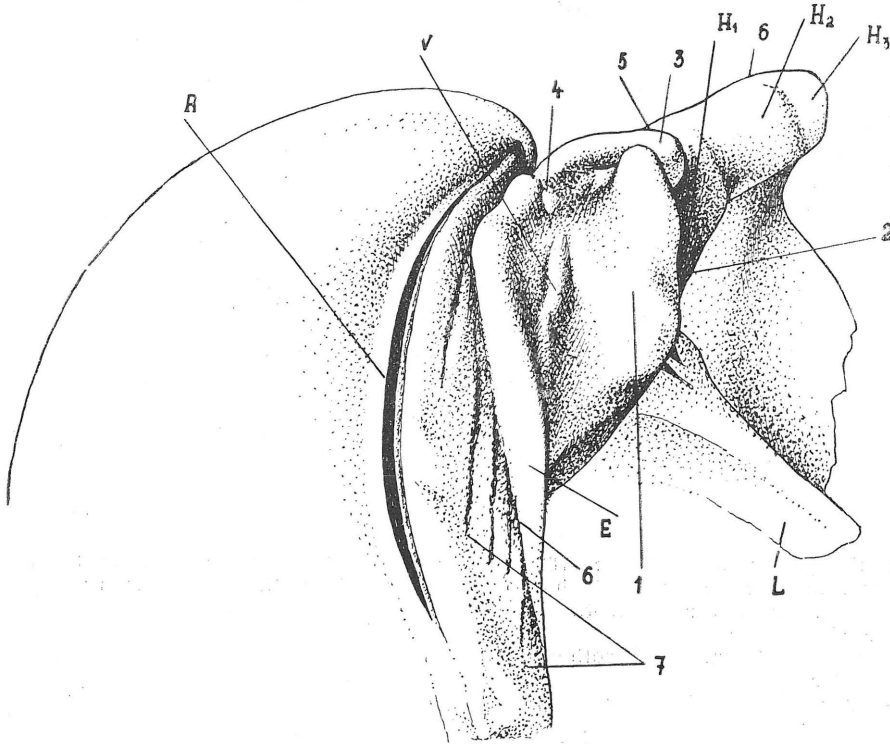


Fig. 2. *Goniophora secans* Barr., 1881. — Hinge apparatus of the left valve, lateral view.

- 1 — cardinal tooth
- 2 — socket for the cardinal tooth of the opposite valve, only partly visible
- 3 — marginal tooth
- 4 — socket for the posterior marginal tooth of the opposite valve
- 5 — depression for the anterior marginal tooth of the opposite valve, hidden for the most part by the marginal tooth
- 6 — upper margin of the hinge plate
- 7 — fine striae on the wall of the ligamental groove serving to the insertion of the inner portion of the ligament
- L — inner ridge
- H₁, H₂, H₃ — the first, second and third tubercle of the anterior hinge plate
- V — crest on the posterior hinge plate
- R — ligamental furrow.
- E — border of the posterior hinge plate.

the reception of the cardinal tooth of the opposite valve (Text fig. 3; 1) and one socket for the marginal tooth of the opposite valve (Text fig. 3; 3). However, we again remind that the hinge apparatus of the right valve is not complete owing to the poor preservation of the anterior hinge plate.

The cardinal tooth of the right valve is strong, well developed, having the form of a body with both bases subovoidal, the anterior wall moderately convex, the posterior one truncated, partly moderately concave. The lower base of the tooth occupies the whole length of the hinge plate and

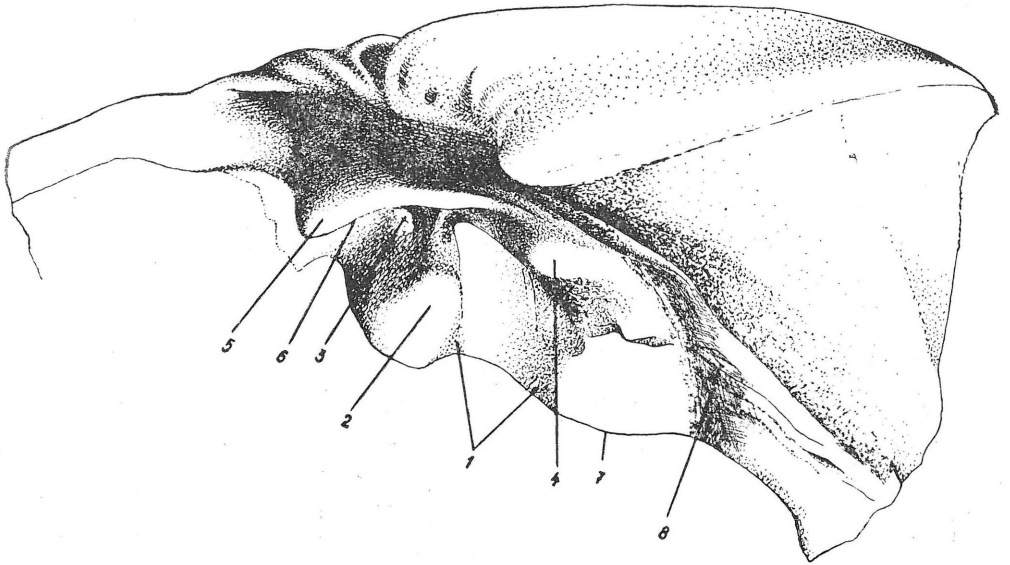


Fig. 3. *Goniophora secans* Barr., 1881. — Hinge apparatus of the right valve, the valve being somewhat inclined by the hinge plate downwards, so that the lunule is visible.

- 1 — socket for the cardinal tooth of the opposite valve
- 2 — cardinal tooth
- 3 — socket for the marginal tooth of the opposite valve
- 4 — posterior marginal tooth
- 5 — anterior marginal tooth
- 6 — upper margin of the hinge plate
- 7 — lower margin of the hinge plate
- 8 — fine striae on the wall of the ligamental groove, serving to the insertion of the inner portion of the ligament.

is situated on the anterior hinge plate, its posterior border being the boundary between the anterior and posterior hinge plate. The upper base of the tooth is narrower, smaller than the lower one, and irregularly vaulted. The cardinal tooth strongly extends into the shell cavity.

The anterior marginal tooth is subtriangular, with an oblique base; it has the shape of a blunt spine, extending by the rounded apex into the inner shell cavity. This tooth belongs by its position to the anterior hinge plate, its base lying close to the upper margin of the hinge plate, so that the tooth is essentially a projection of the upper margin of the anterior hinge plate into the inner shell cavity.

The posterior marginal tooth is also subtriangular, with large base; it has the shape of a low spine with rounded apex, extending into the inner shell cavity. By its position this tooth belongs to the posterior hinge plate, its base lying close to the upper margin of the hinge plate, so that the tooth is essentially a projection of the posterior hinge plate into the inner shell cavity.

The posterior margin of the anterior marginal tooth and the anterior margin of the posterior marginal tooth meet exactly on the boundary between the anterior and the posterior hinge branch in an obtuse angle.

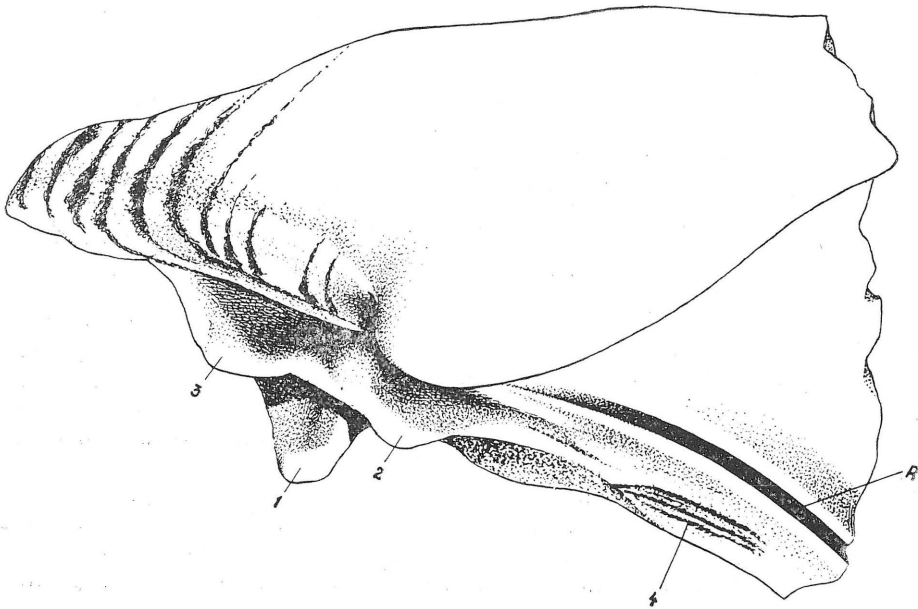


Fig. 4. *Goniophora secans* Barr., 1881. — Hinge apparatus of the right valve, apical view.

- 1 — cardinal tooth
- 2 — posterior marginal tooth
- 3 — anterior marginal tooth
- 4 — fine striae on the wall of the ligamental groove, serving to the insertion of the inner portion of the ligament
- R — ligamental furrow.

The dental socket for the cardinal tooth of the opposite valve belongs by its position to the posterior hinge plate. It is considerably deep, irregularly crescent-shaped. Its anterior margin is formed by the posterior wall of the cardinal tooth, its posterior margin being spoonlike carved, partly limited by the posterior marginal tooth and the hinge plate.

The socket for the marginal tooth of the opposite valve is minute, rather deep, conical. It lies on the anterior hinge plate close to its upper margin, so that the socket partly extends into the anterior wall of the cardinal tooth.

In our specimen there is also possible to study the insertion of the external ligament. Its external borders are inserted into two deep narrow furrows, which extend backwards from beneath the umbo and run in the close proximity of the dorsal margin of the valve. Between those furrows and the dorsal margin a narrow triangular groove is running throughout the length of the upper margin of the posterior hinge plate in both valves, its steep slopes bearing fine, partly undulate striae, which served to the insertion of the internal portion of the ligament.

The beak is in our specimen well preserved, too. It is minute, expressively prosogyrate, not extending over the cardinal margin, its oldest portion being moderately rounded. From the anterior part of the valve it is separated by an expressive, though small, lunule. The posterior boundary of the beak is formed by the keel of the valve.

Remarks and Observations: We place into the synonymy of the species described above also some other Barrande's species designated as *Goniophora testis*, *G. pugio*, *G. media* and *G. rara*. Those species do not differ in any essential feature from *G. secans* Barrande. They merely represent different growth stages of the same species, showing a slight variability in the character of the outline and in the pointing of the oldest portion of the beak. In some forms the oldest portion of the beak is more pointed, in others more rounded and blunt. Those features, however, are according to our opinion insufficient for the establishing of new species. In the present report we do not give a more detailed description of all hitherto known representatives of the above mentioned species, as would correspond to the claims of modern paleontology. The reason is our planning a revision of all hitherto known members of the genus *Goniophora* Phillips of the Czech Devonian.

The remaining Barrande's representatives of the genus *Goniophora* Phillips differ essentially in their general character of the shell from the above described species *Goniophora secans* Barr. The other foreign representatives which we have had the possibility to study, differ from it as well.

CONCLUSIONS

The above described hinge apparatus of the species *Goniophora secans* Barr. complets and makes more precise the present knowledge about the genus *Goniophora* as a whole. As the description shows, there is no essential contradiction between the latter and the more general and simple characteristic of the hinge apparatus in the original diagnosis. On the other side, however, the structure of the hinge apparatus, as was recognised in *Goniophora secans* Barr., suggests certain serious doubts concerning the correctness of the present systematic position of the genus *Goniophora* Phillips. K. Zittel (1895; 1915) refers this genus to the family *Astartidae* Gray, consequently among the *Heterodonta* Neumayr. According to our opinion, however, it is not possible to consider the genus *Goniophora* Phillips a member of the mentioned family for its lacking both posterior and anterior lateral teeth and for not having even obscure indications on the hinge plates of such teeth being either

obsolete or reduced. E. Maillieux (1932; 1937) places the genus *Goniophora* Phillips into the family *Modiolopsidae* Fischer, emend. Dall. According to our opinion neither this placing is correct, as the representatives of the mentioned family have the hinge consisting of a number of teeth, situated under the beak and laterally, which is a quite different hinge type than that one ascertained in *Goniophora secans* Barr. Other authors place likewise the genus *Goniophora* Phillips into the family *Modiolopsidae* or the supper-family *Mytilacea*.

We believe that the character of the hinge apparatus of *Goniophora secans* Barr. does not permit, as far, its definite placing among the existing types of lamellibranch hinges. To our opinion it is a new hinge type, for which we recommend the designation of *goniophorous hinge*.

This hinge type could be defined as consisting of an equal number of cardinal teeth in both valves, of different number of marginal teeth in both valves, eventually with different number of tubercles and depressions on the anterior hinge plate of both valves.

It is evident, that the described hinge type makes very difficult, nearly impossible, the placing of the genus *Goniophora* Phillips in some of the existing families. We do not exclude the possibility of this hinge type enforcing the establishing of an independent family for the genus *Goniophora* Phillips, and eventually for further genera in which the *goniophorous* hinge apparatus would be found.

Translated by M. Šňupárková.

Explanation of plate XII.

Goniophora secans Barr., 1881. (Inv. Nro. 35050)

Fig. 1. — hinge apparatus of the left valve × 6,6

Fig. 2 — view of the beak of the left valve × 12

Fig. 3 — hinge apparatus of the right valve × 6,4

Horizon: Upper Koněprusy Limestones.

Locality: Koněprusy, near Beroun (Central Bohemia).

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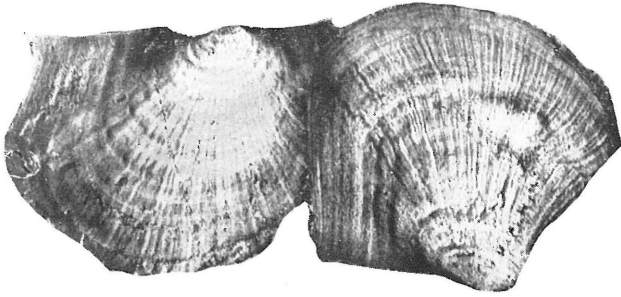
B. Růžička, F. Prantl & A. Příbyl: O některých pectinoidních mlžích českého siluru a devonu — Some pectinoid Pelecypods from the silurian and devonian of Central Bohemia.

Some pectinoid Pelecypods from the silurian and devonian of Central Bohemia.

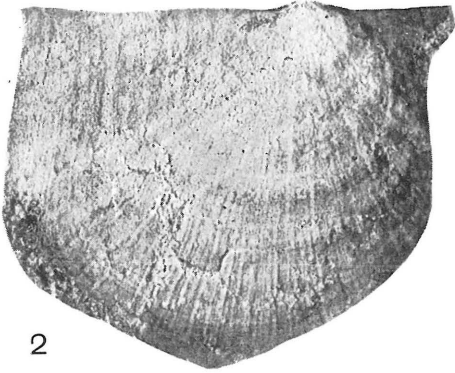
B. Růžička & F. Prantl: Zámkový aparát u rodu Goniophora Phillips (Pelecypoda) — The hinge apparatus of the genus Goniophora Phillips (Pelecypoda).

V lednu 1959 vydalo svým nákladem v počtu 800 výtisků Národní museum v Praze.

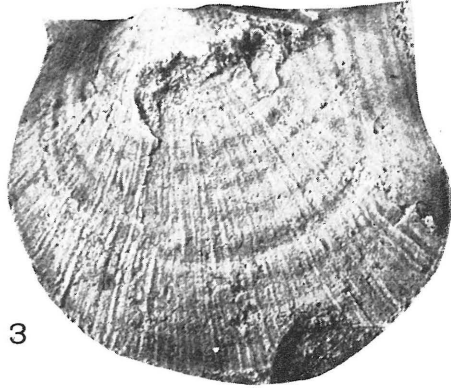
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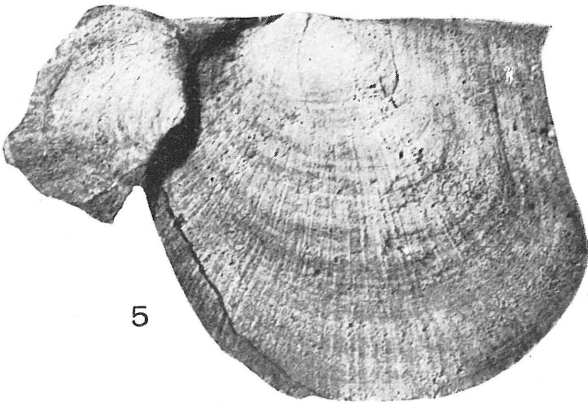
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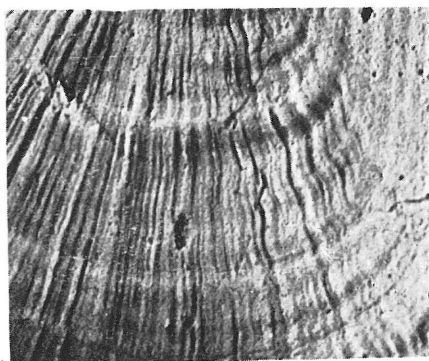
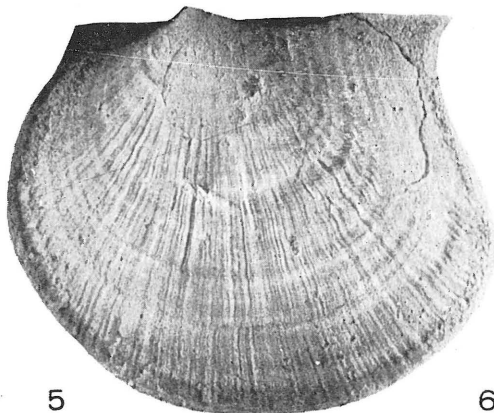
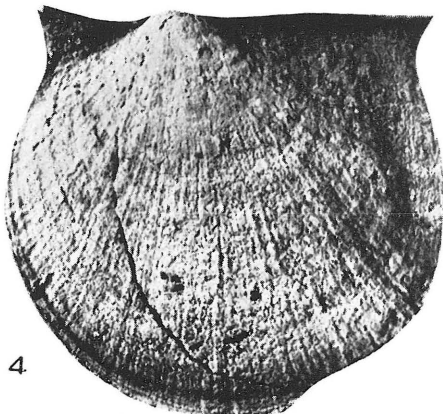
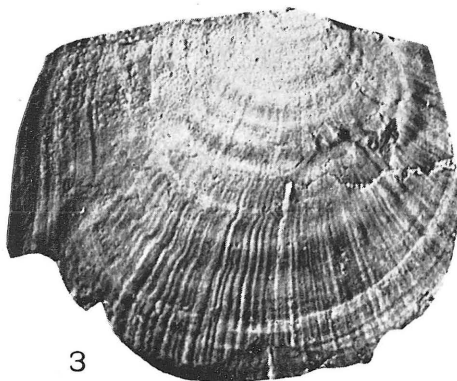
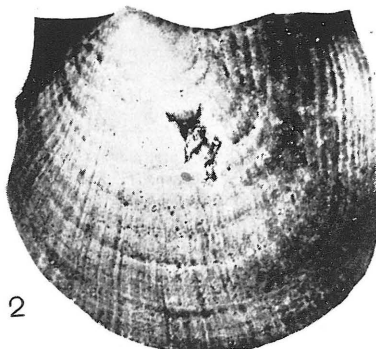
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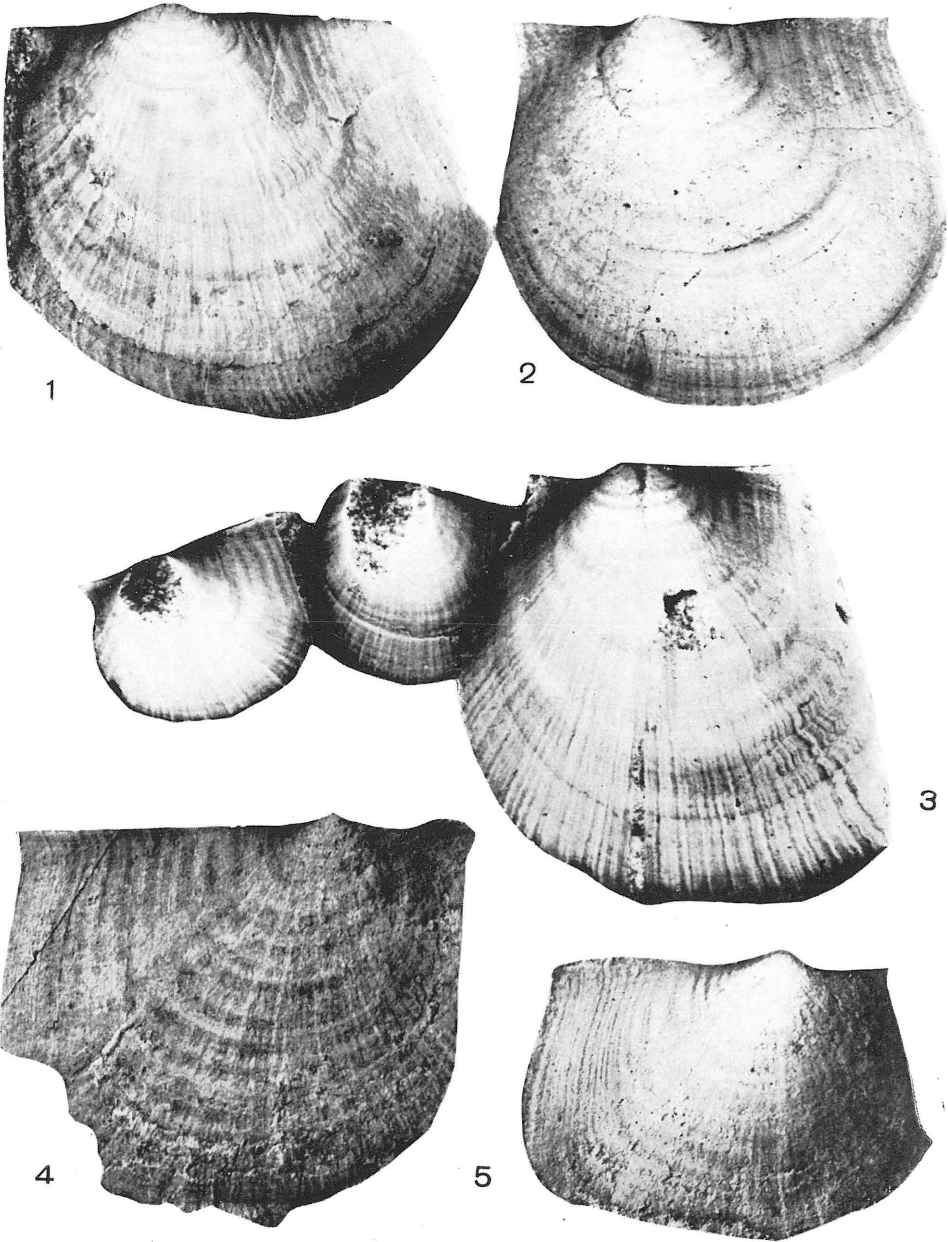


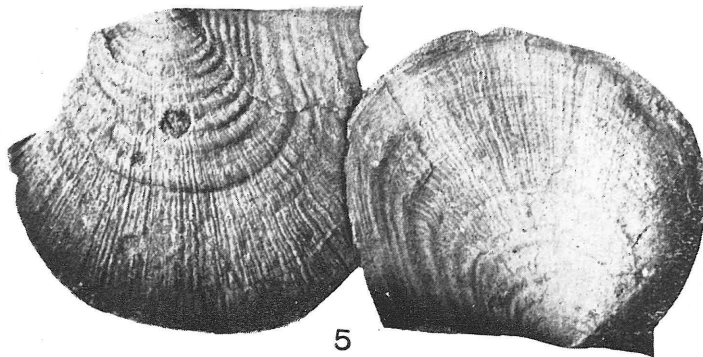
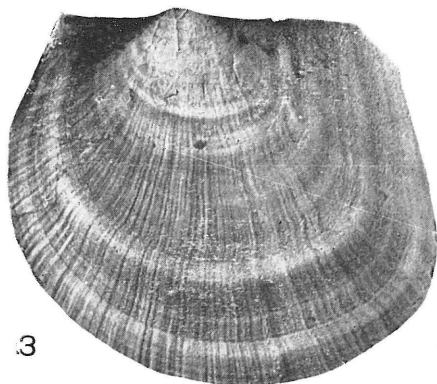
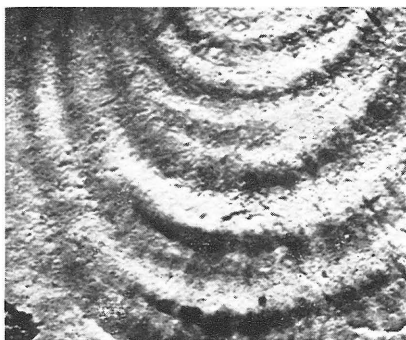
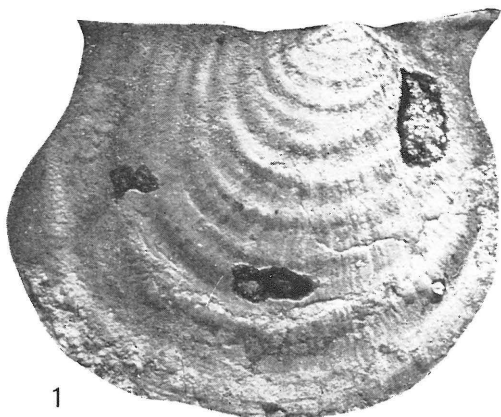
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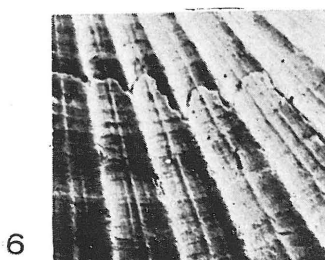
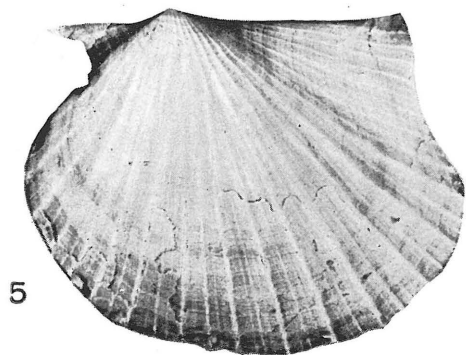
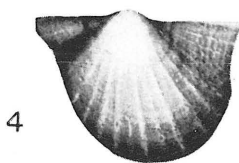
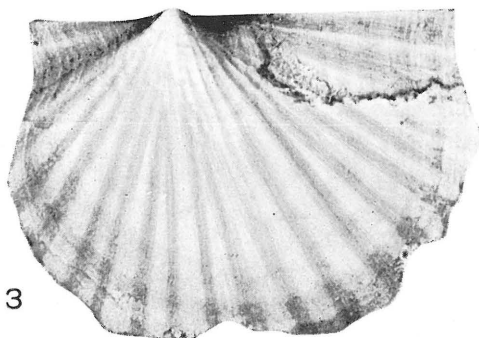


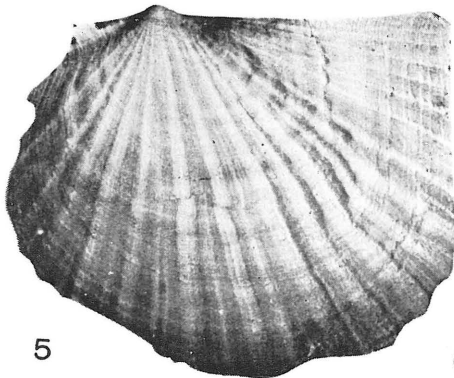
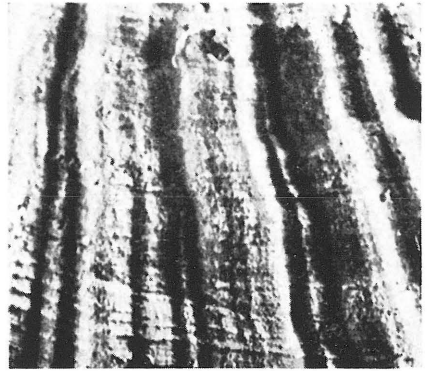
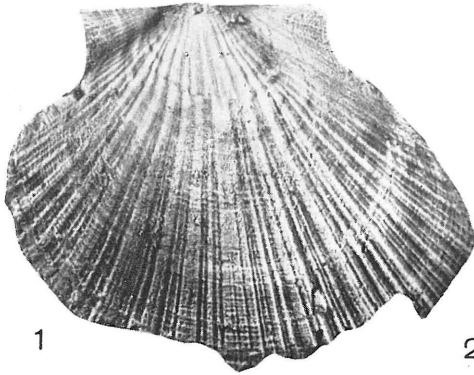
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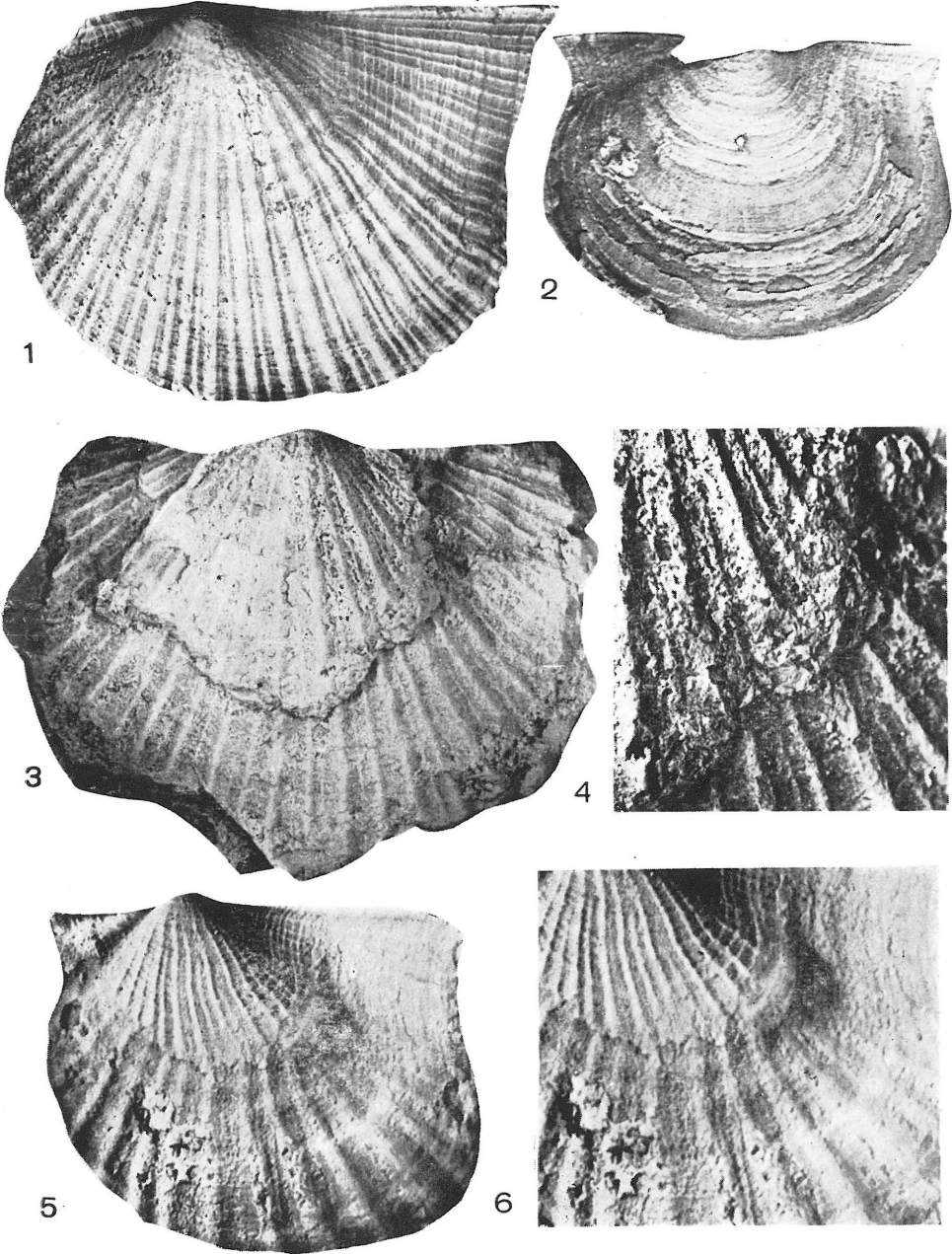


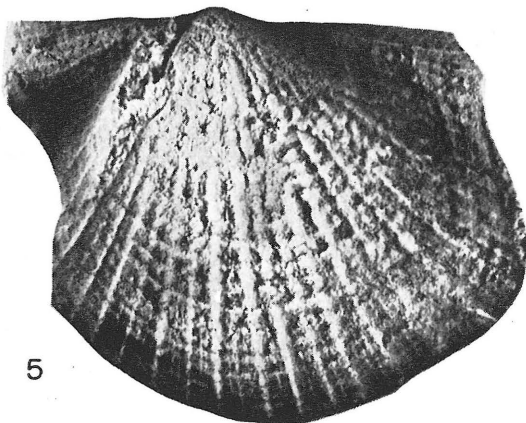
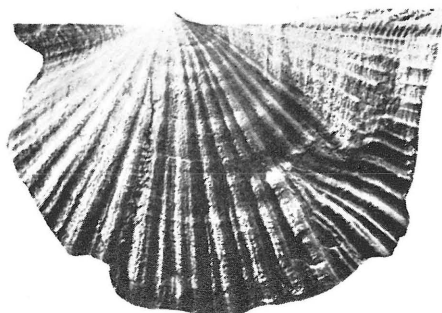
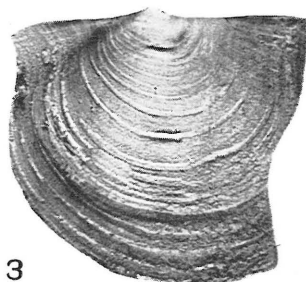




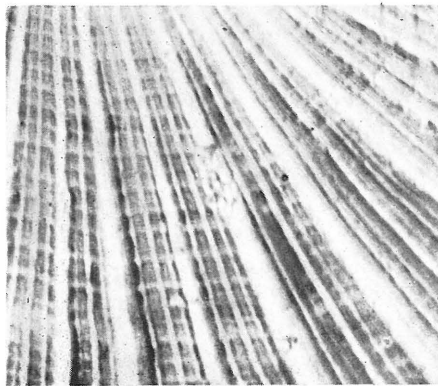
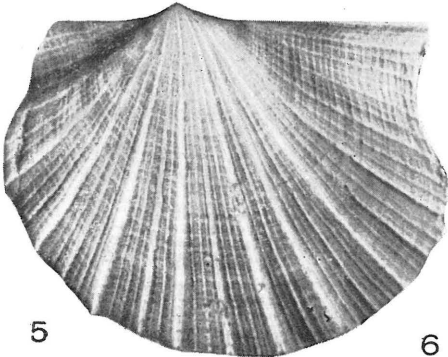
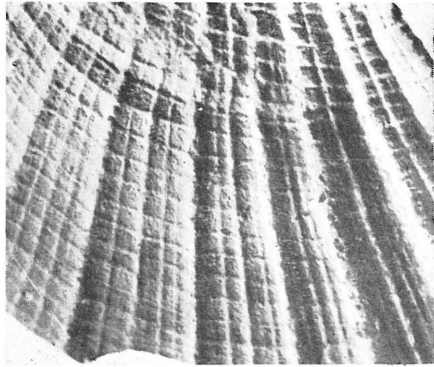
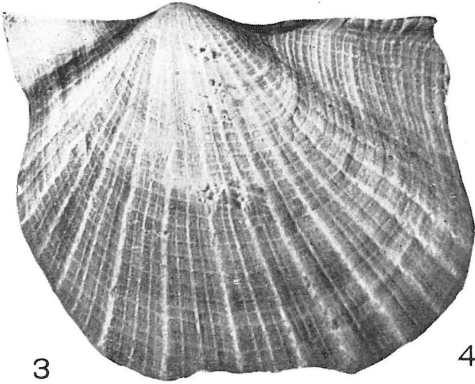
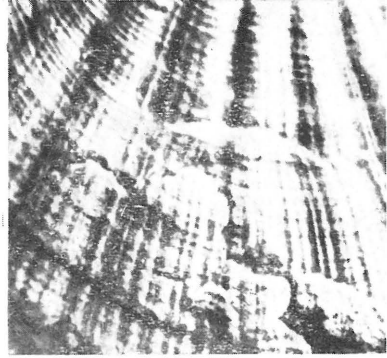
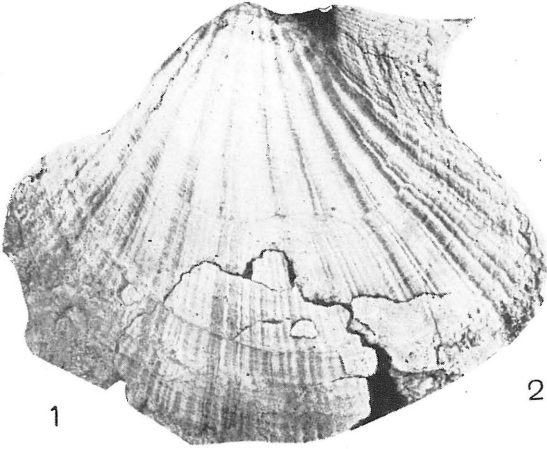


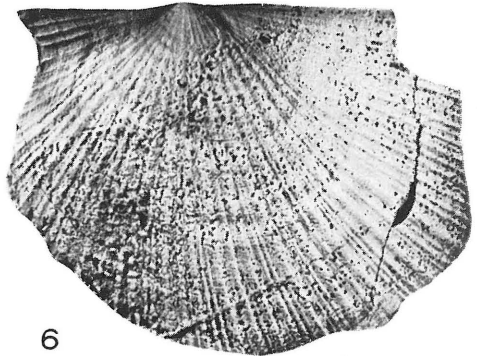
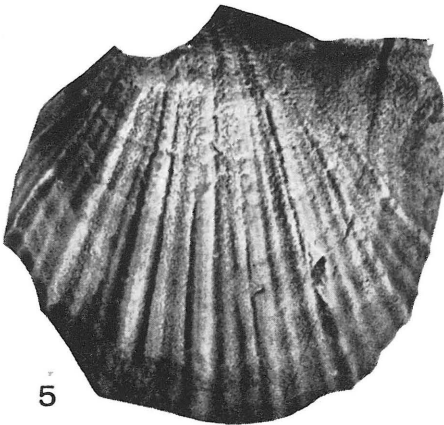
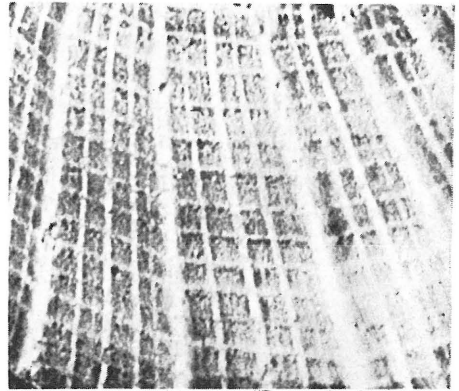
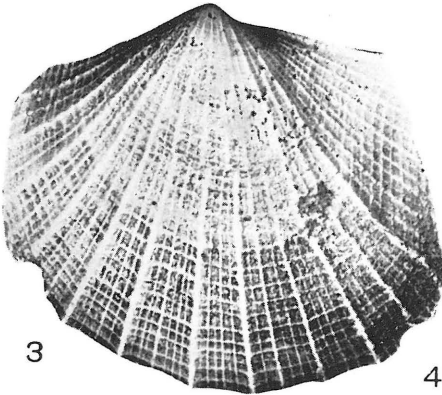
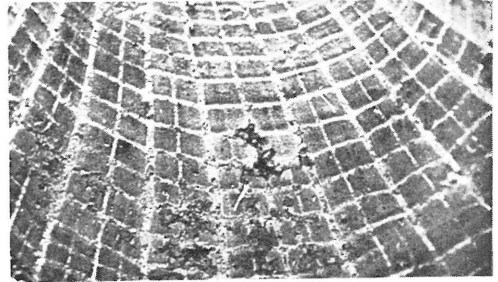
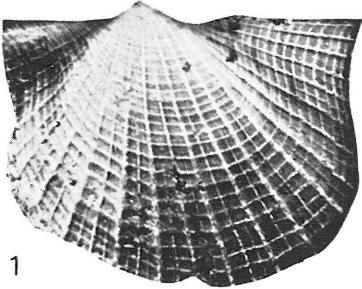


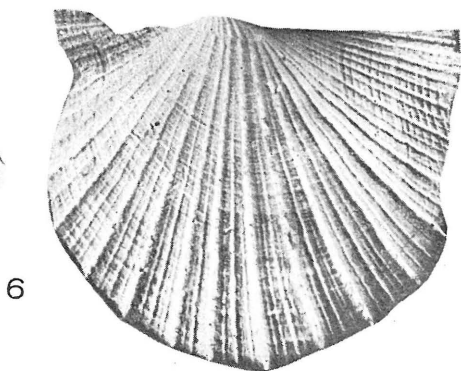
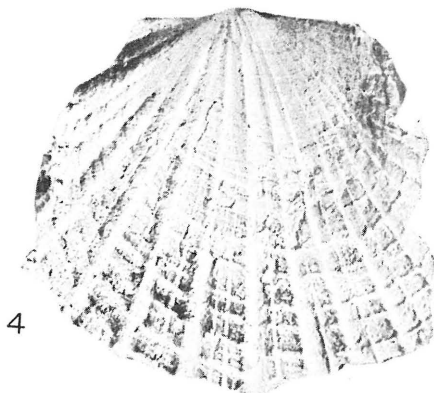
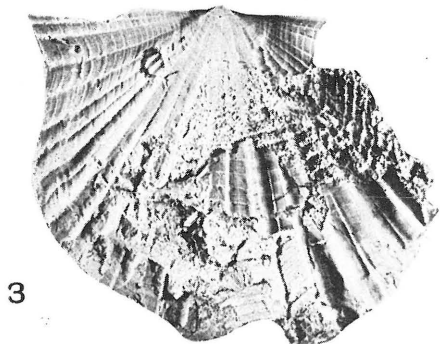
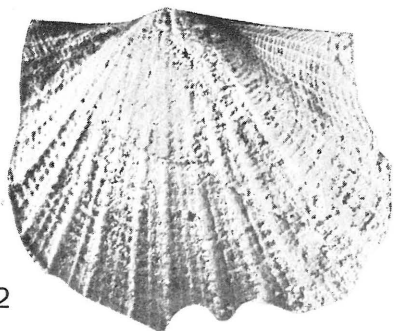
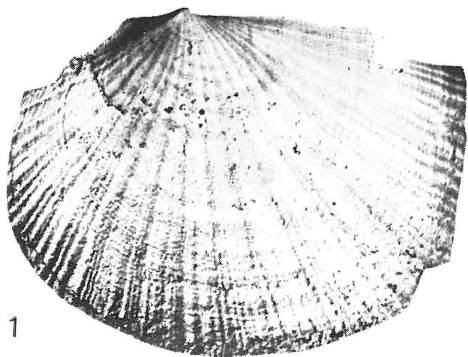




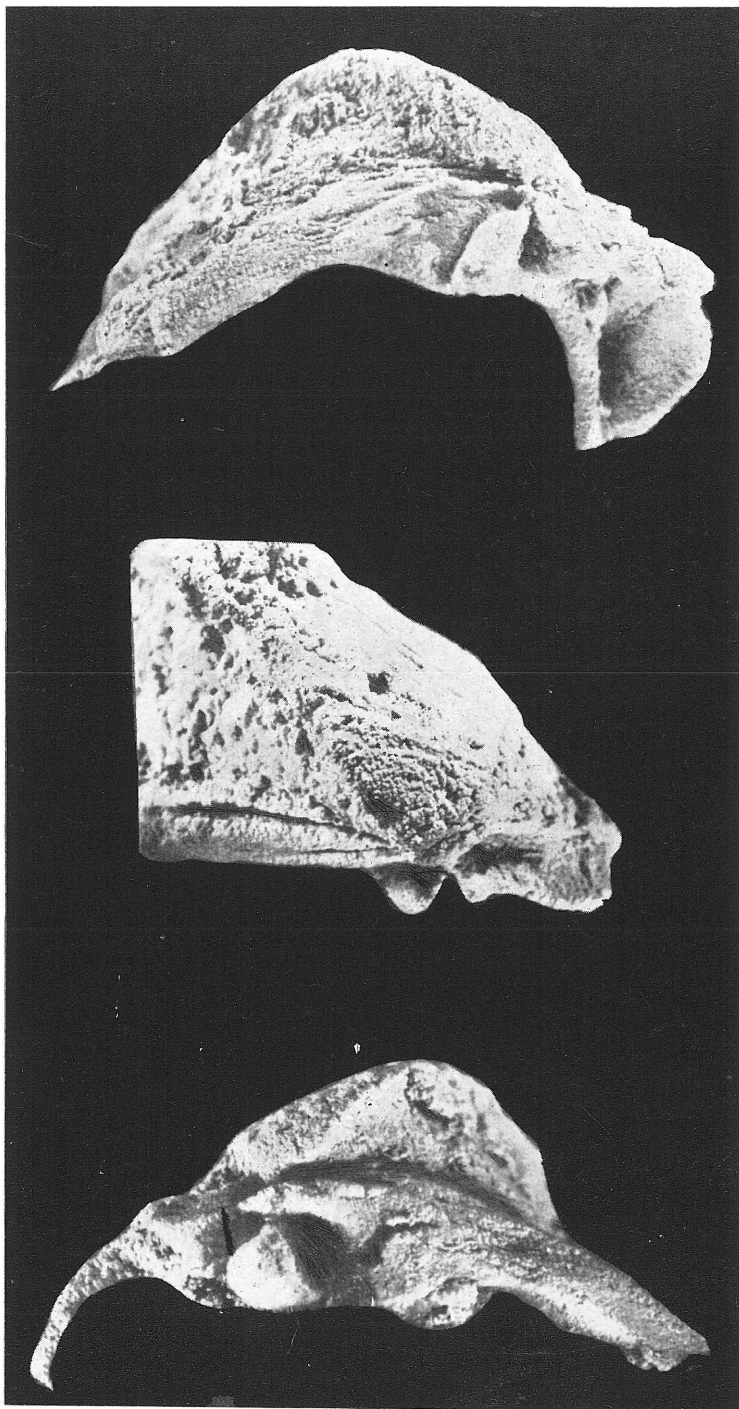
B. Růžička, F. Prantl & A. Přibyl: O některých pectinoidních mlžích...







B. Růžička & F. Prantl: Zámkový aparát u rodu Goniophora.



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