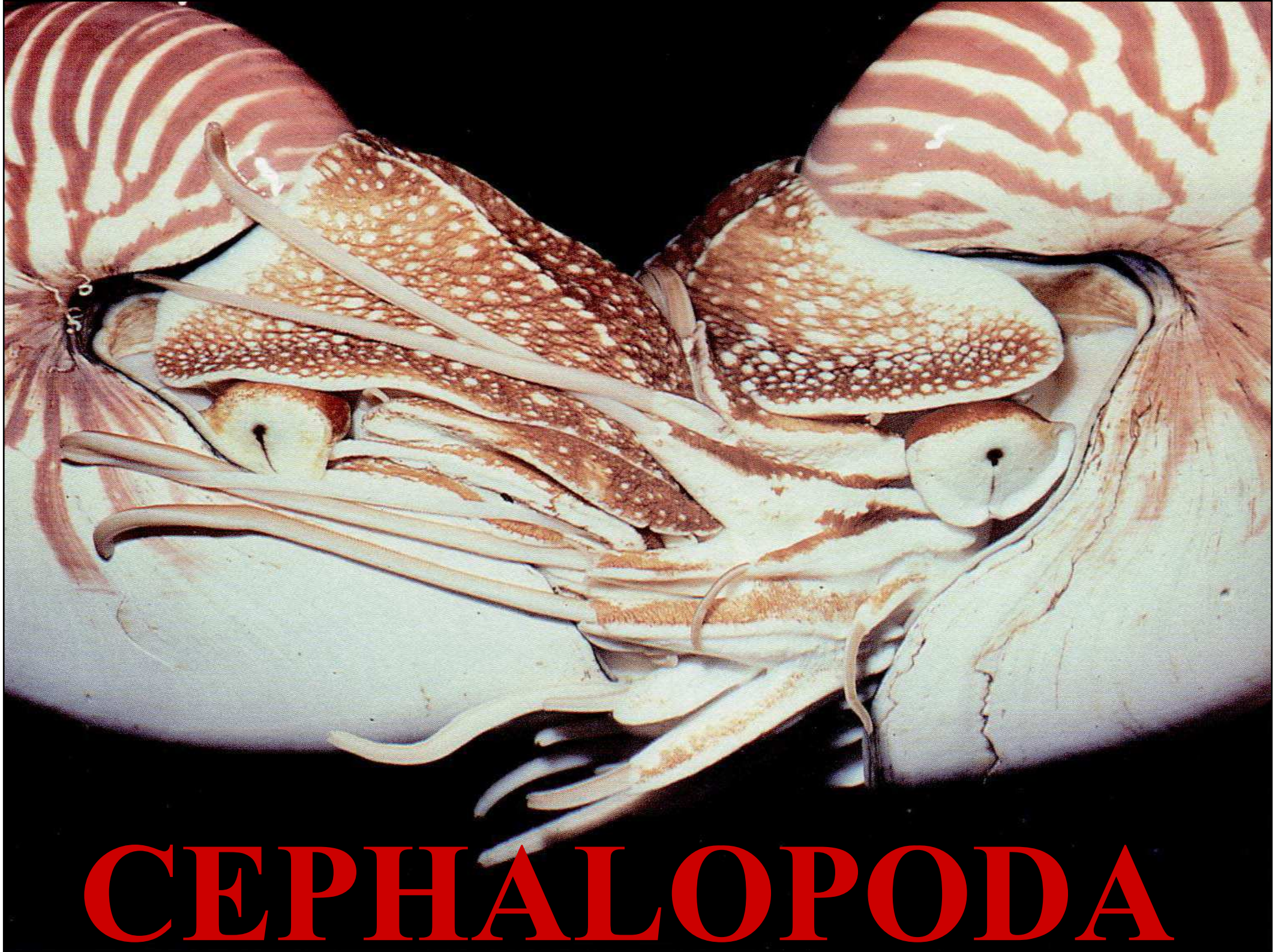


CEPHALOPODA

Stavba organizmu

Nautilus macromphalus

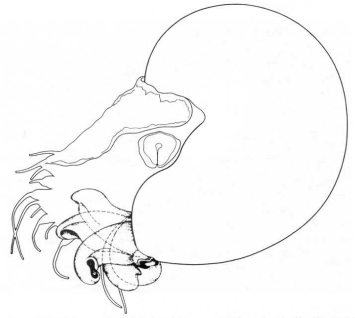
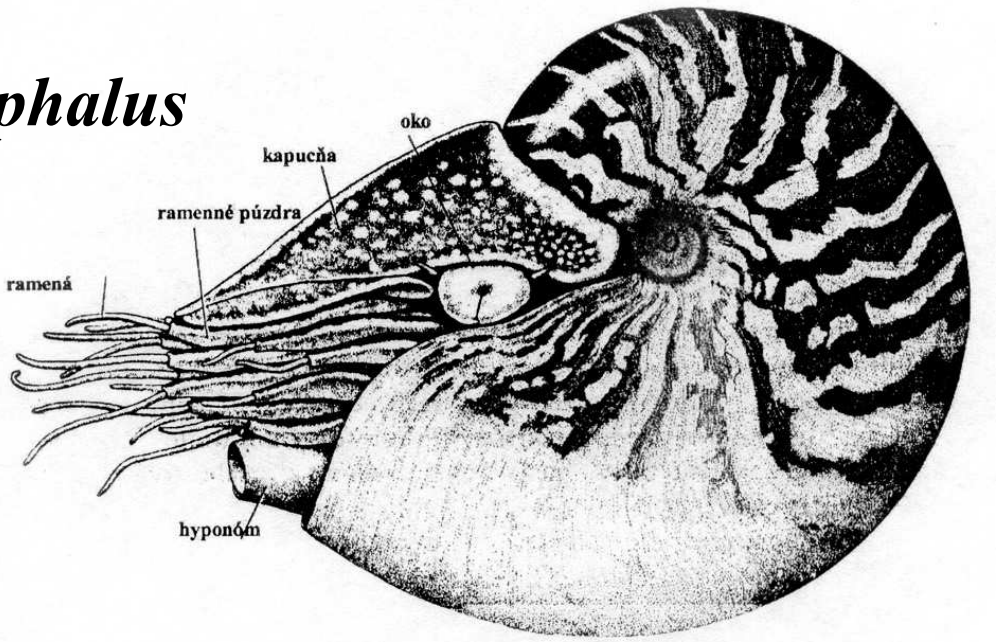
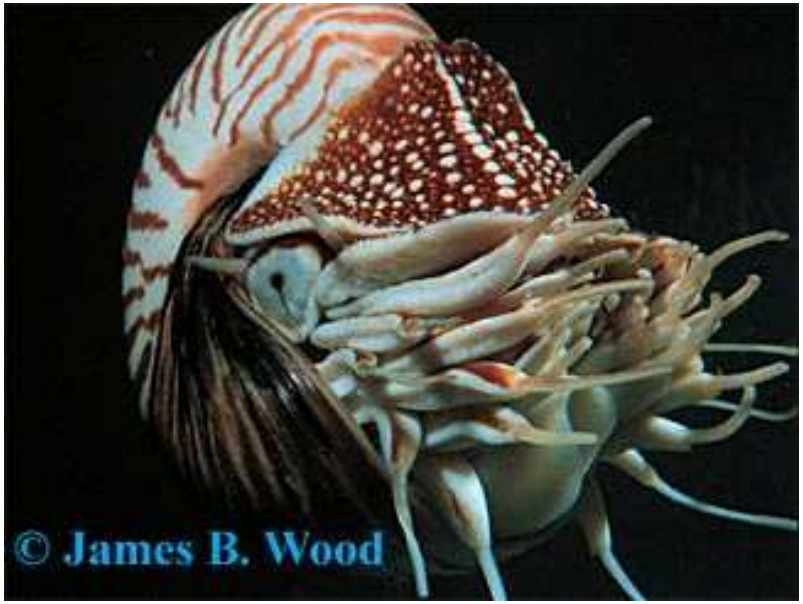
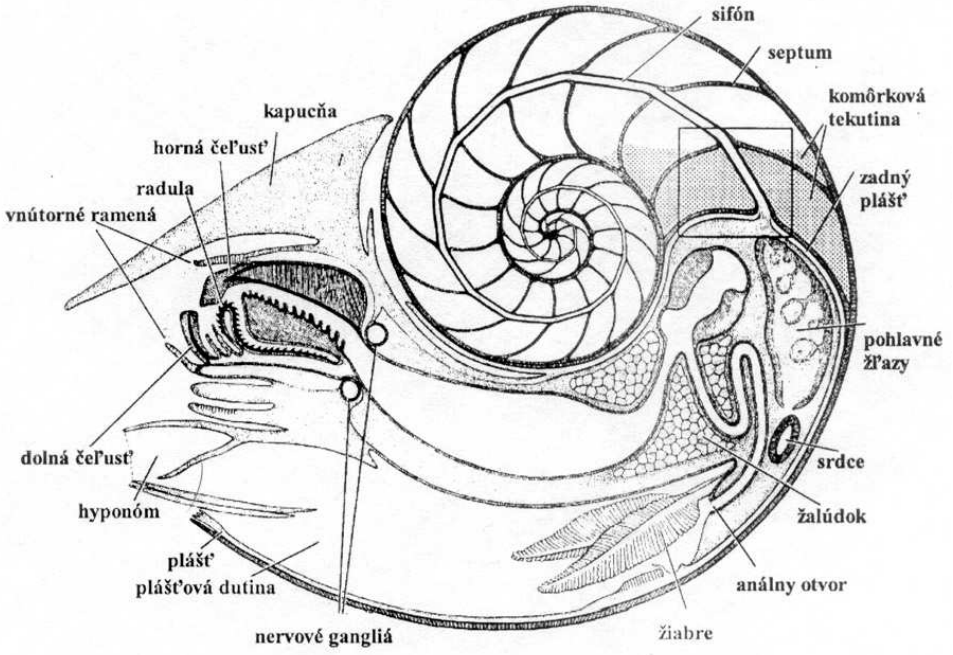
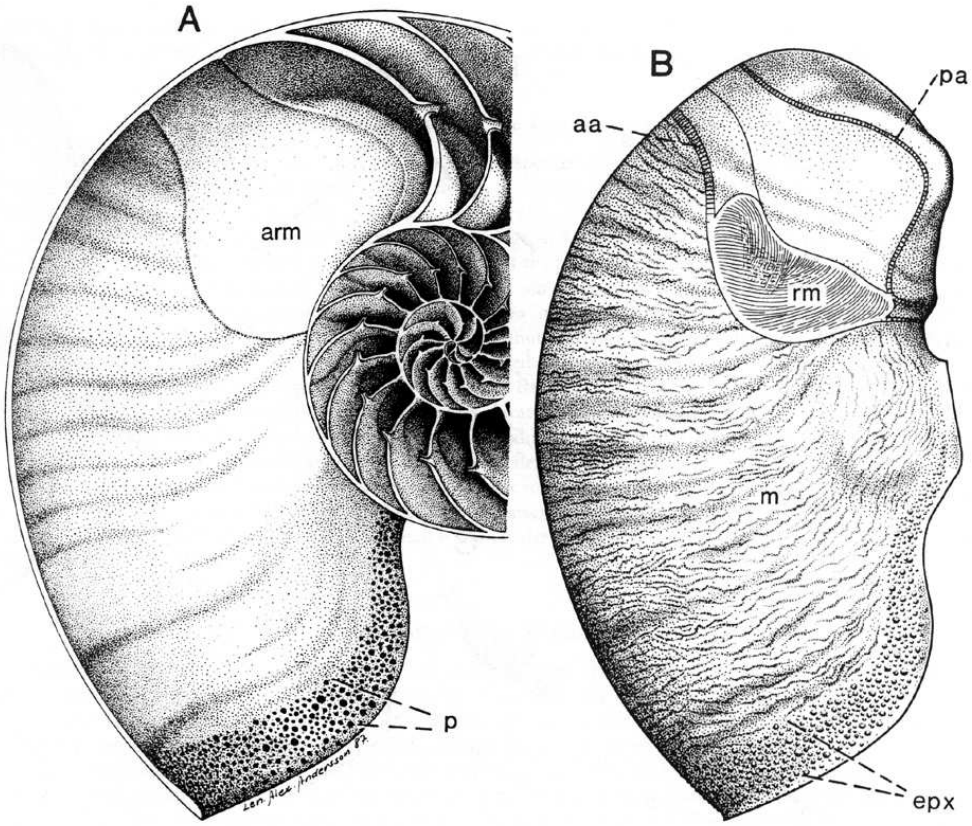


Figure 4.23 Various positions of the funnel (hyponome) during swimming (from Packard *et al.* 1980).

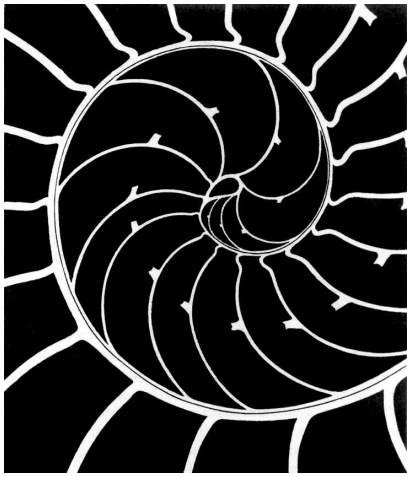


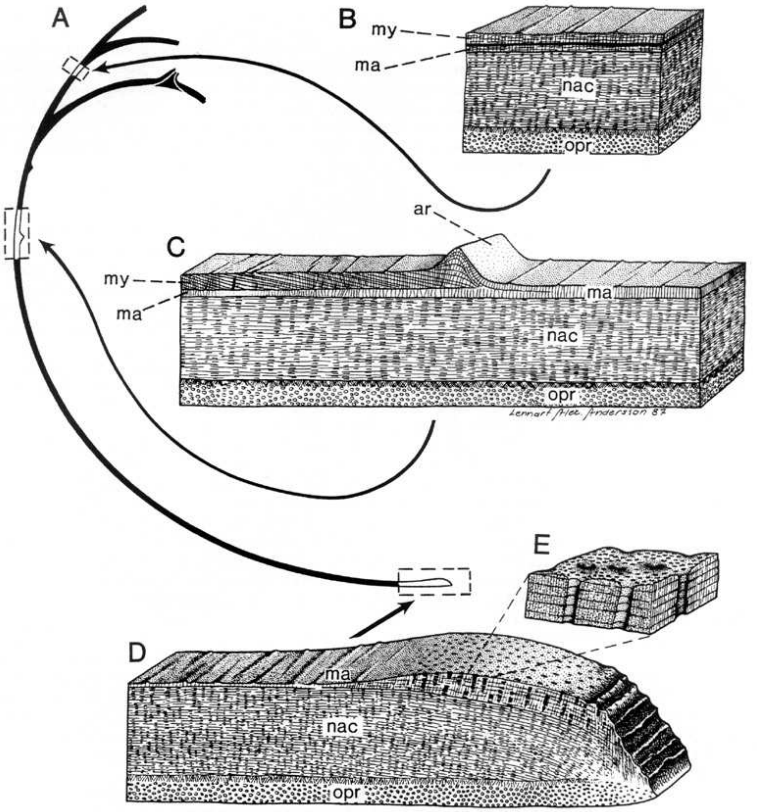






Text-fig. 10. A, median section of the living chamber in a fully grown shell, to show the annular elevation and attachment site for the retractor muscles (arm) and the apertural mantle attachment layer with vertical pores (p); B, reconstruction of the lateral side of the soft body, to show the myo-adhesive epithelial zones I and II (aa, pa), lateral termination of the retractor muscle (rm), mantle surface (m), and apertural mantle attachment zone with finger-like epithelial extensions (epx).





Text-fig. 9. Median sections of the ventral shell wall in a fully grown shell; B, in the last chamber to show two inner prismatic layers (my, ma) separated by an organic lamella; C, at the base of the living chamber to show the thickened myostracal layer (my), which forms a conspicuous ridge (ar) on the adapertural margin of the annular elevation; D, at the apertural margin where the mantle attachment layer (ma) is thickened and traversed by vertical canals; E, detail of vertical pores.
opr, outer prismatic layer; nac, nacreous layer.

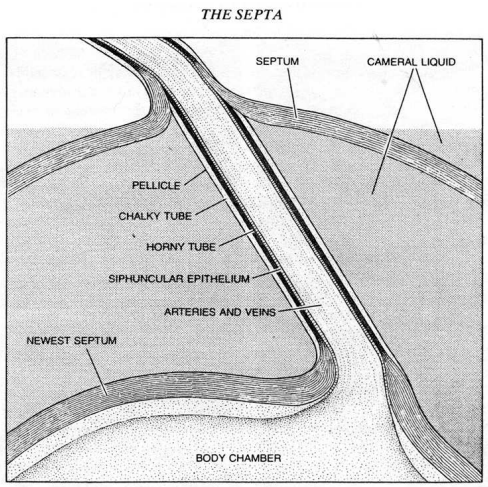


Figure 1.19 Schematic view of phragmocone, composed of septum and siphuncle (from Ward *et al*. 1980).

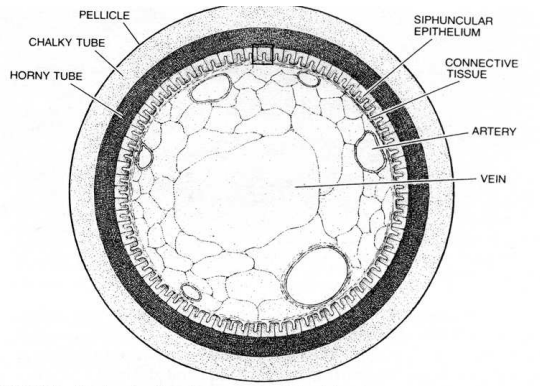


Figure 2.11 Hard- and soft-part components of the siphuncle. The three-part connecting ring (pellicle, chalky tube, and horny tube) enclose the siphuncular strand, composed of outer epithelium, and inner blood circulatory region (from Ward *et al*. 1980).

Typy septálnych hrdiel

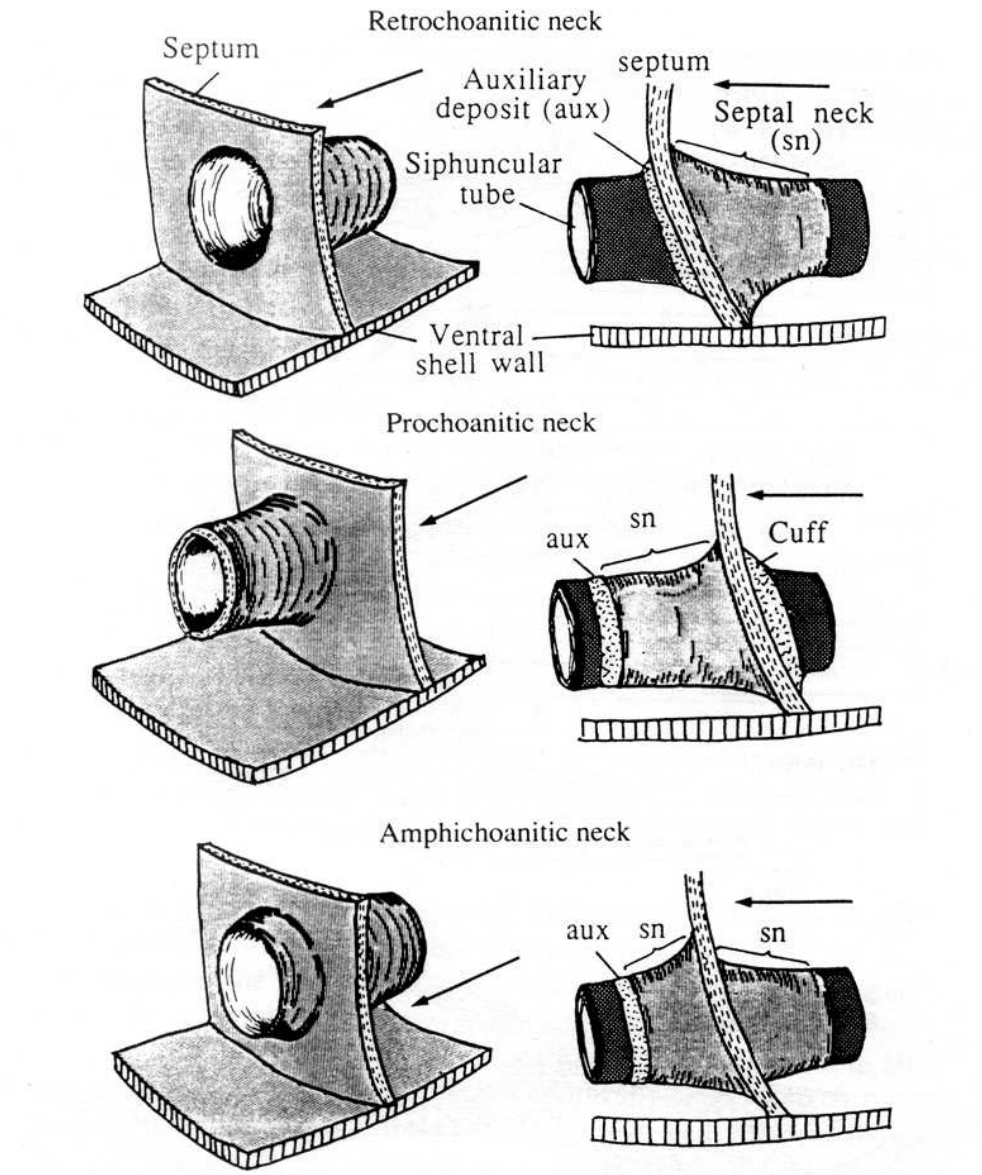


Fig. 4.1. Retro-, pro-, and amphichoanitic septal necks in the Mesozoic Ammonoidea shown in oblique (left) and lateral (right) views. With simplified septa; arrows indicate the adoral direction.

Vylučovanie schránky

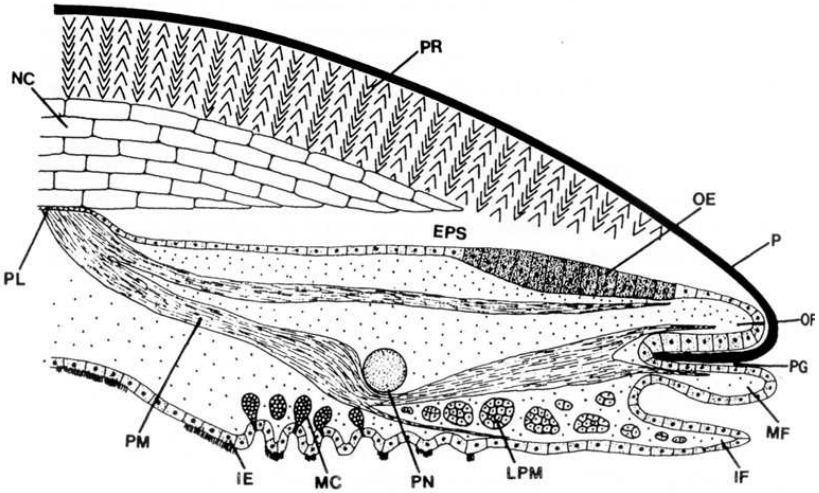


Fig. 1. Radial section of the mantle edge of a bivalve to show the relationship between the shell and mantle. (Not to scale.) EPS, Extrapallial space; IE, inner epithelium; IF, inner fold; LPM, longitudinal pallial muscle; MC, mucous cell; MF, middle fold; NC, nacreous shell layer; OE, outer epithelium; OF, outer fold; P, periostracum; PG, periostracal groove; PL, pallial line; PM, pallial muscle; PN, pallial nerve; PR, prismatic shell layer.

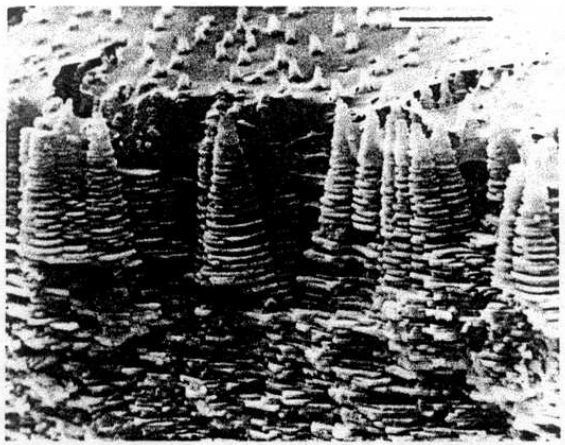
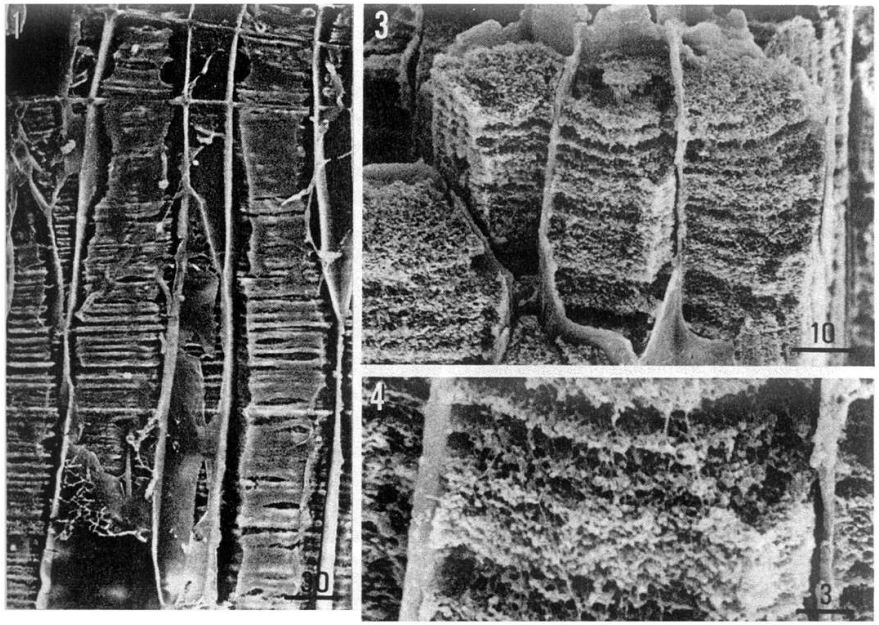


Fig. 7. Columnar nacreous layer (*Amphalius rusticus*). Vertical fracture. Bar = 20 μm. (Courtesy of Dr. S. Uozumi.)



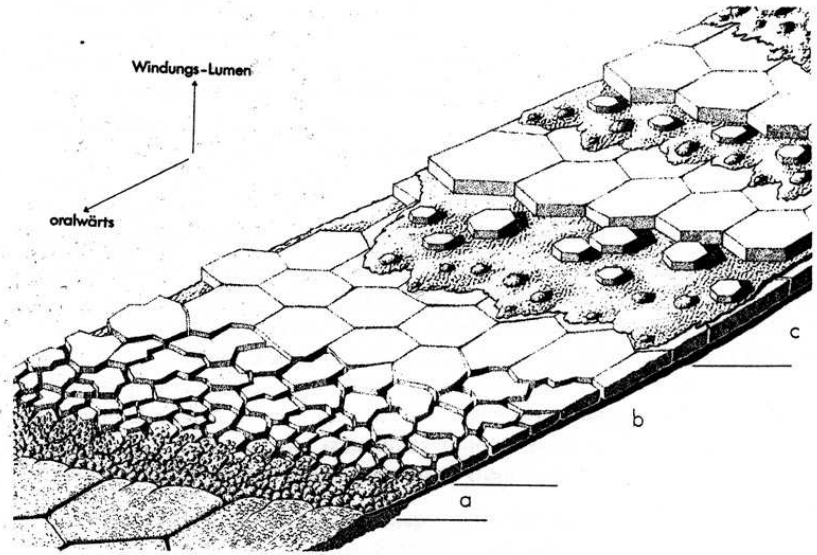


Fig. 12. Diagram of the formation of nacreous layers near the growing edge of a bivalve shell. The shell edge is to the left. Four layers are in the process of crystal deposition and growth. a, Early crystal formation; b, crystals increase in size and form a complete lamella; c, development of a lamella on a sheet of matrix. (Erben, 1972.)

Nautilus belauensis

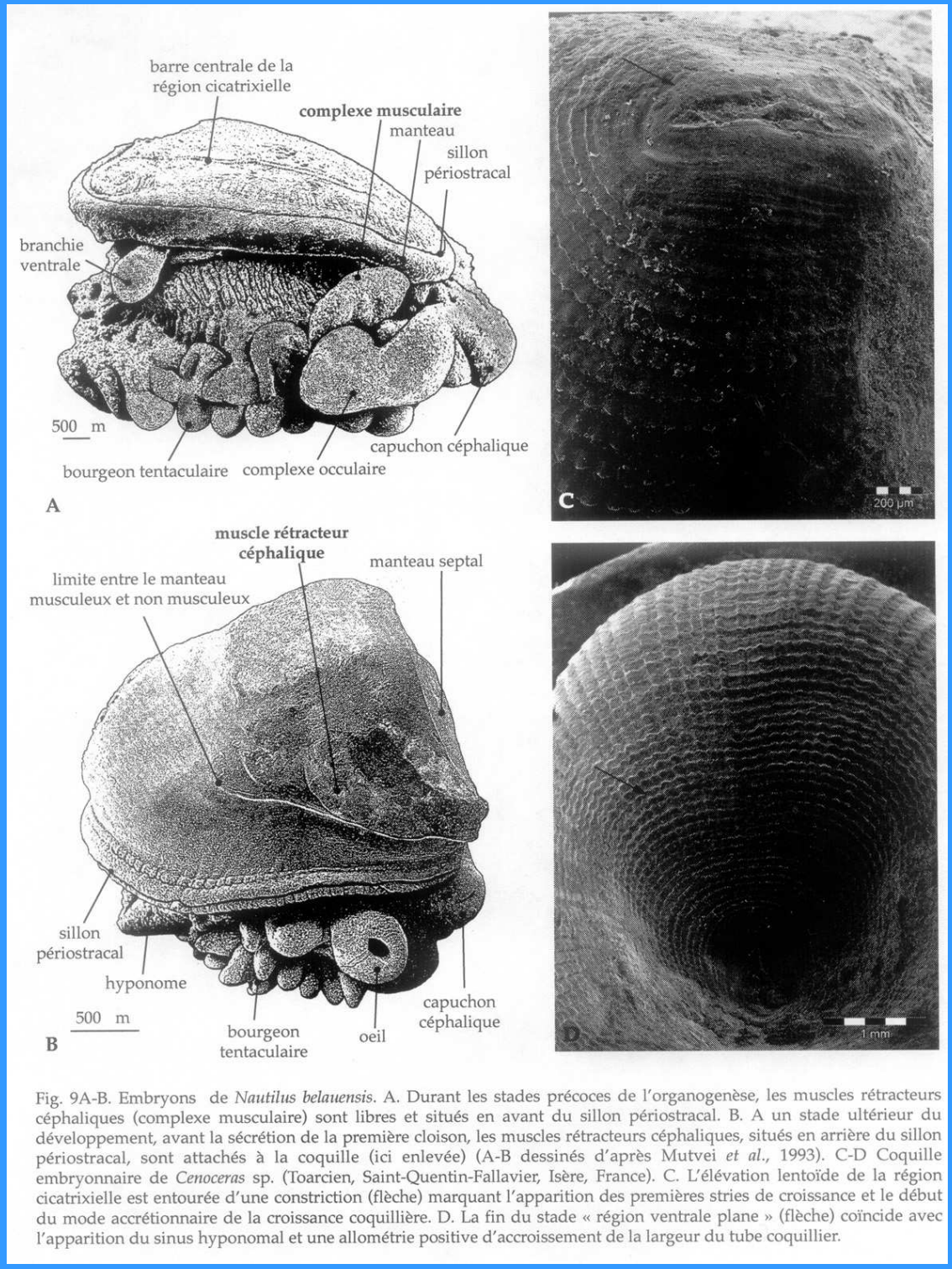


Fig. 9A-B. Embryons de *Nautilus belauensis*. A. Durant les stades précoces de l'organogenèse, les muscles rétracteurs céphaliques (complexe musculaire) sont libres et situés en avant du sillon périostracal. B. A un stade ultérieur du développement, avant la sécrétion de la première cloison, les muscles rétracteurs céphaliques, situés en arrière du sillon périostracal, sont attachés à la coquille (ici enlevée) (A-B dessinés d'après Mutvei *et al.*, 1993). C-D Coquille embryonnaire de *Cenoceras* sp. (Toarcien, Saint-Quentin-Fallavier, Isère, France). C. L'élévation lentoïde de la région cicatrixielle est entourée d'une constriction (flèche) marquant l'apparition des premières stries de croissance et le début du mode accrétionnaire de la croissance coquillière. D. La fin du stade « région ventrale plane » (flèche) coïncide avec l'apparition du sinus hyponomal et une allométrie positive d'accroissement de la largeur du tube coquillier.

Nautilus

male and female

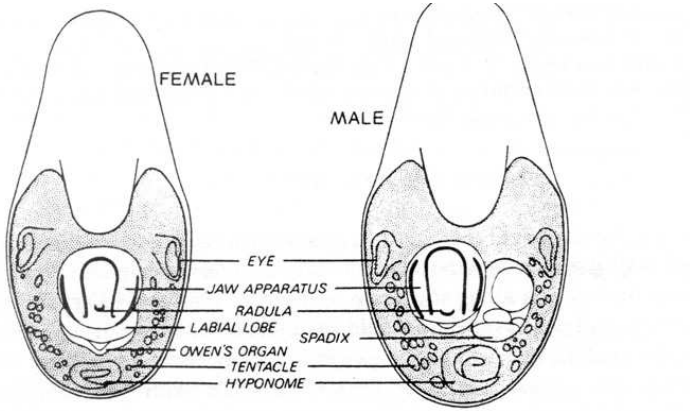


Figure 5.10 Cross sections of male and female *Nautilus*, demonstrating sexual differences. The male shell is wider, to accommodate the large spadix (from Saunders & Spinosa 1978).

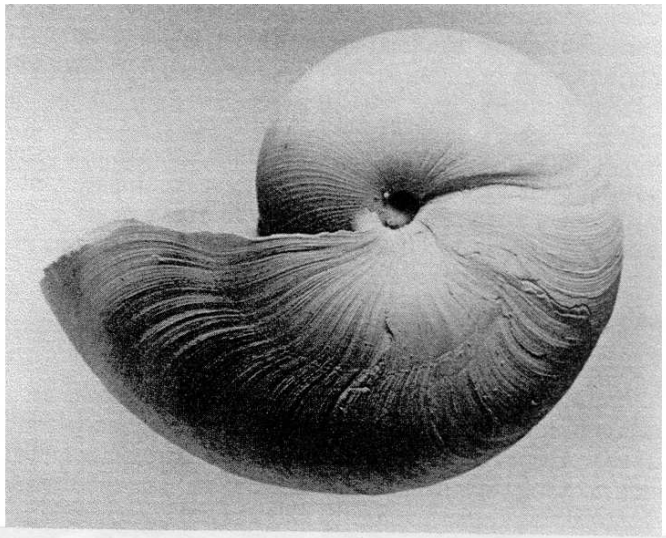
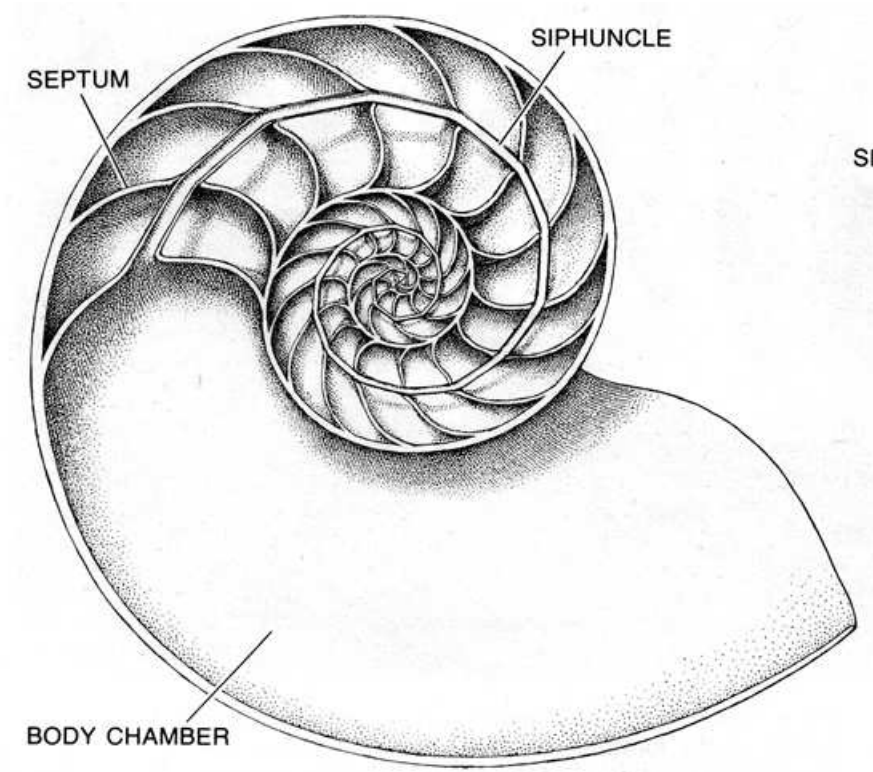


Figure 5.8 Juvenile shell of *N. macromphalus*, showing nepionic constriction, and pre- and post-hatching shell ornamentation. The constriction forms after the secretion of the seventh septum.

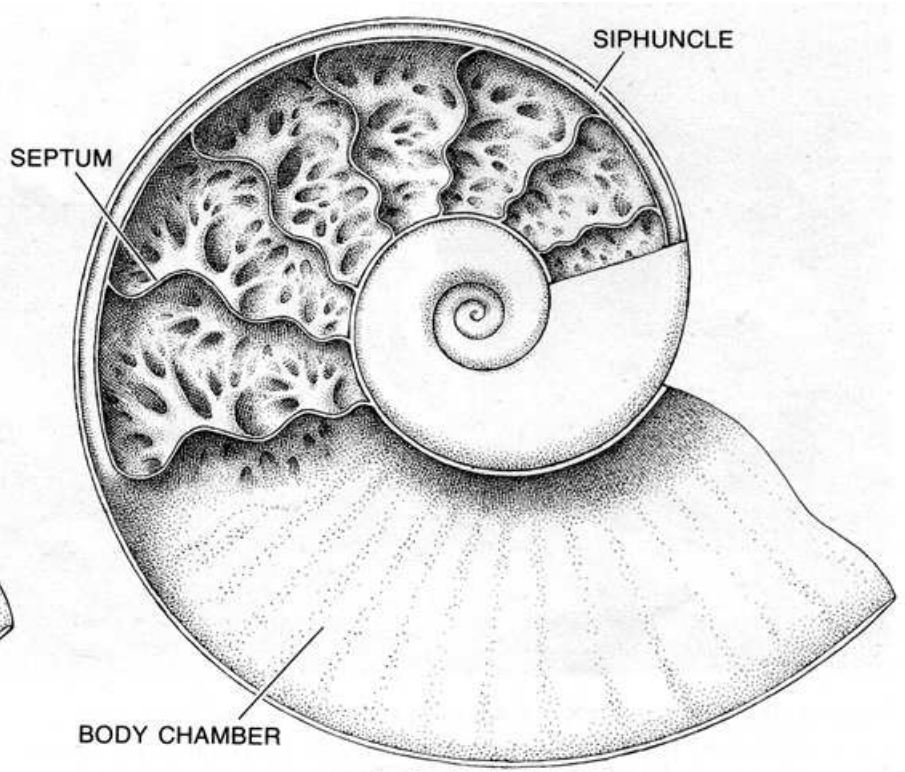
Nautilus macromphalus

juvenilná schránka s nepionickou konstrikciou

Porovnanie stavby nautilusa a amonita

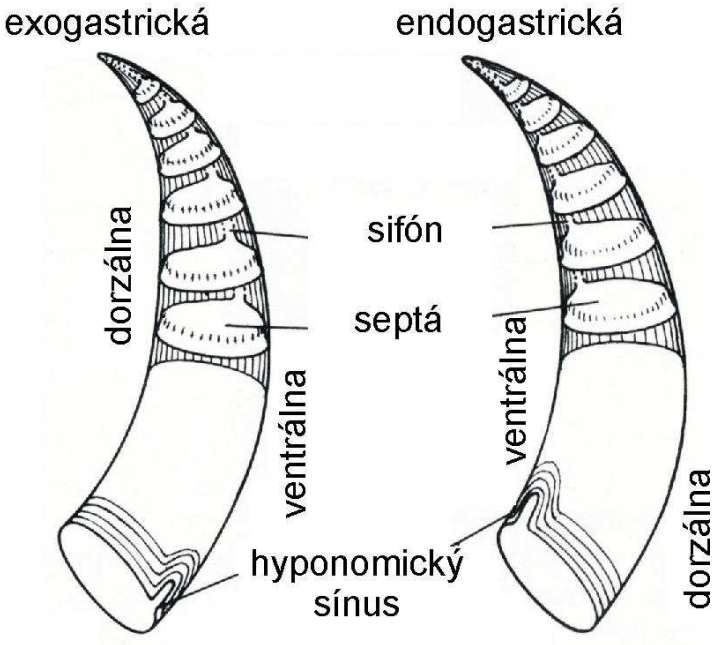


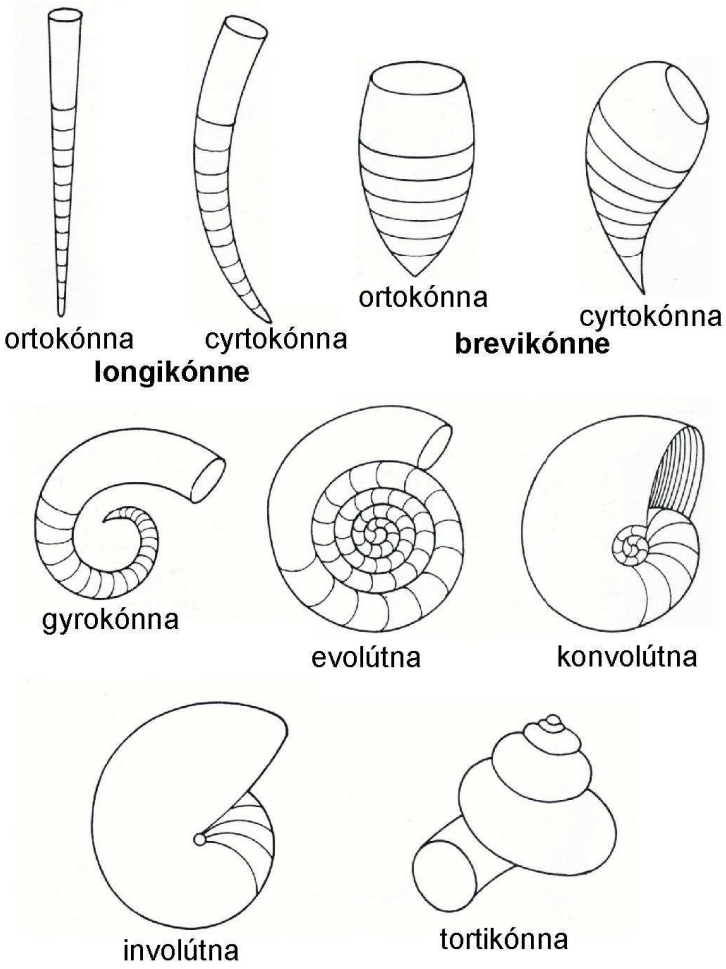
SHELLS OF THE AMMONOIDS differ from those of the nautiloids in two respects. The septa (chamber walls) of the nautiloid shells are smooth, curved surfaces. The septal sutures (lines along which the septa intersect the inner wall of the shell) are gentle curves. The septa of ammonoid shells, on the other hand, are fluted at the periphery, and the septal sutures are folded into complex, frilled curves.



The complexity of the septa and septal sutures of the ammonoid shell made it possible for the shell wall to be relatively thin. The other difference between the nautiloids and the ammonoids is the position of the siphuncle, the organ that empties the walled-off chambers of fluid. In the nautiloids the siphuncle generally passes through the center of the whorl; in the ammonoids it is on the outer wall of the whorl.

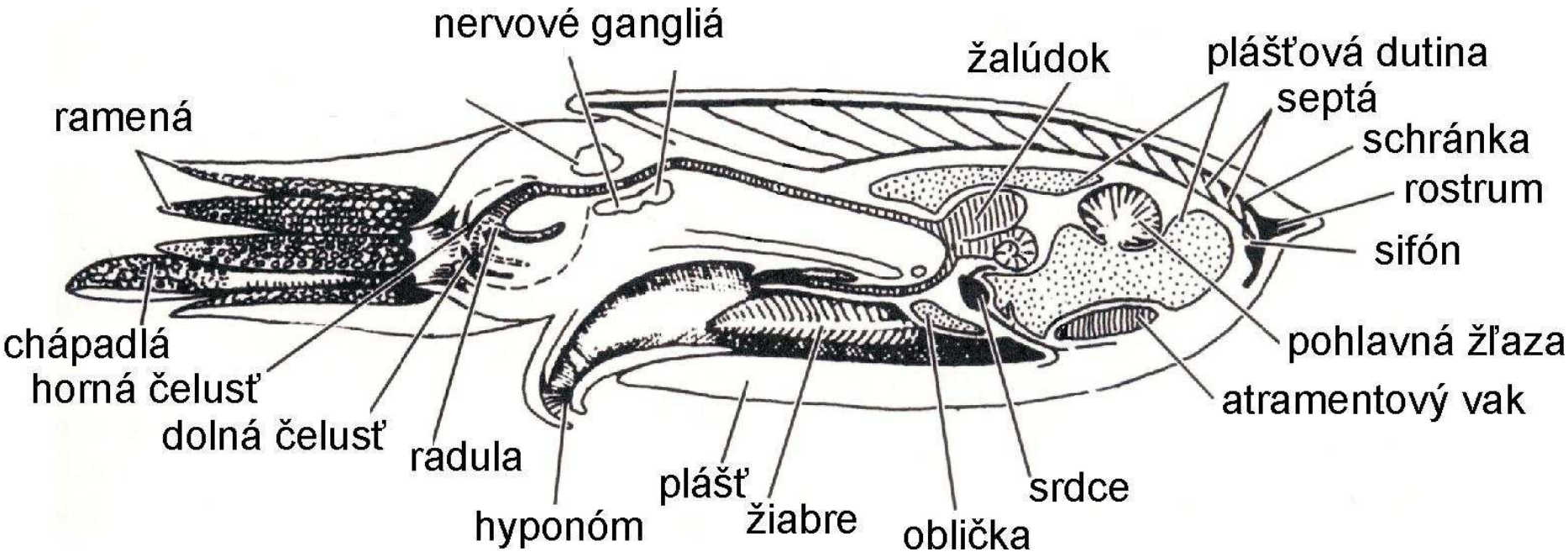
Typy schránok





Stavba tela

Sepia officinalis



Evolúcia
Nautiloidea

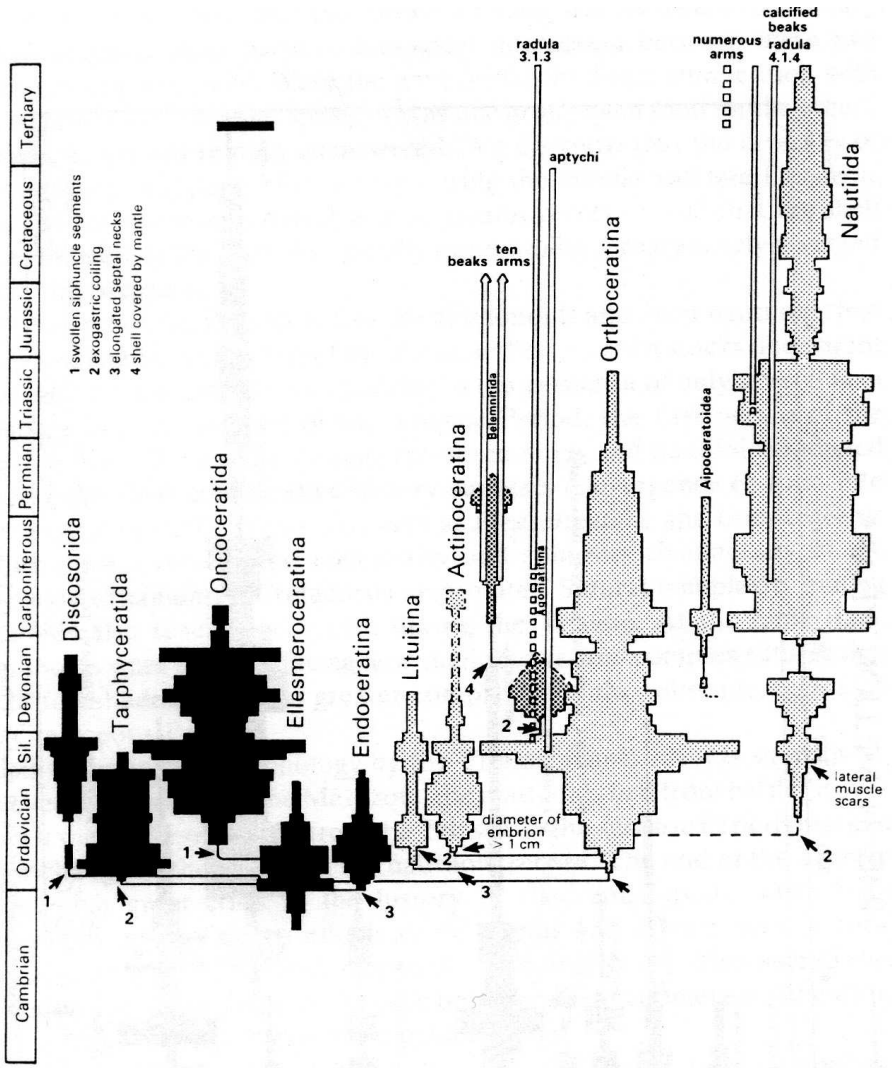


Figure 7.2 Phylogenetic relationships among higher taxa of nautiloid cephalopods. The width of each of these cladograms or spindle diagrams reflects species richness, with 10 species equal to bar in upper left of graph (from Dzik 1981).

Vaginoceras

Endoceratida (vrch. kam. – devón)

-ortokónne alebo endogastricky zahnuté
-až 9 m dlhé
-rovný okraj, niekedy ventrálny sínus
-hladká schr., niekedy pozdĺž. a prieč. orn.
-ventrálny sifón, cylindrický a široký
-vnútrosifonálne uloženiny (endokóny)

vnútrosifonálne uloženiny

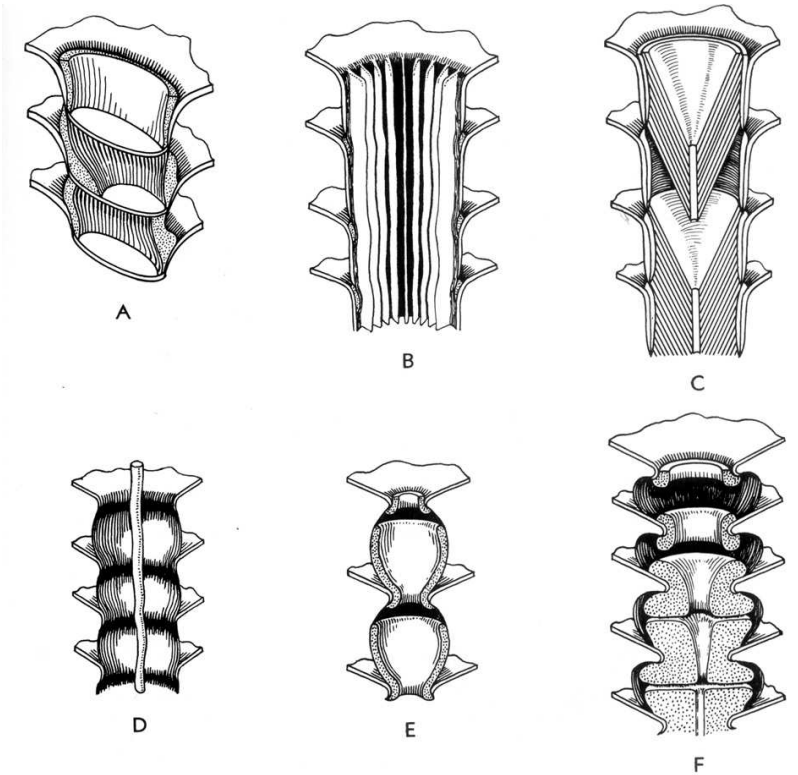
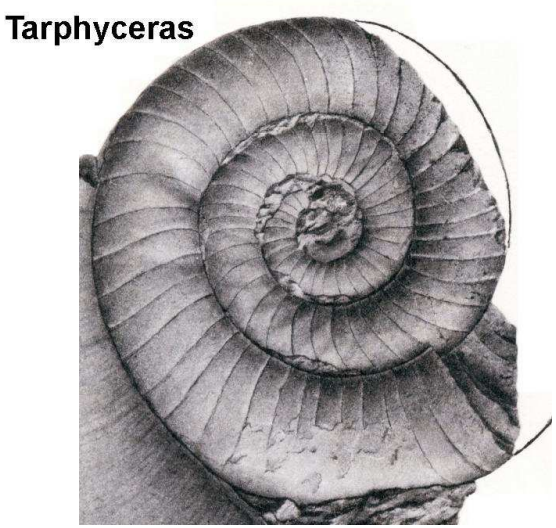
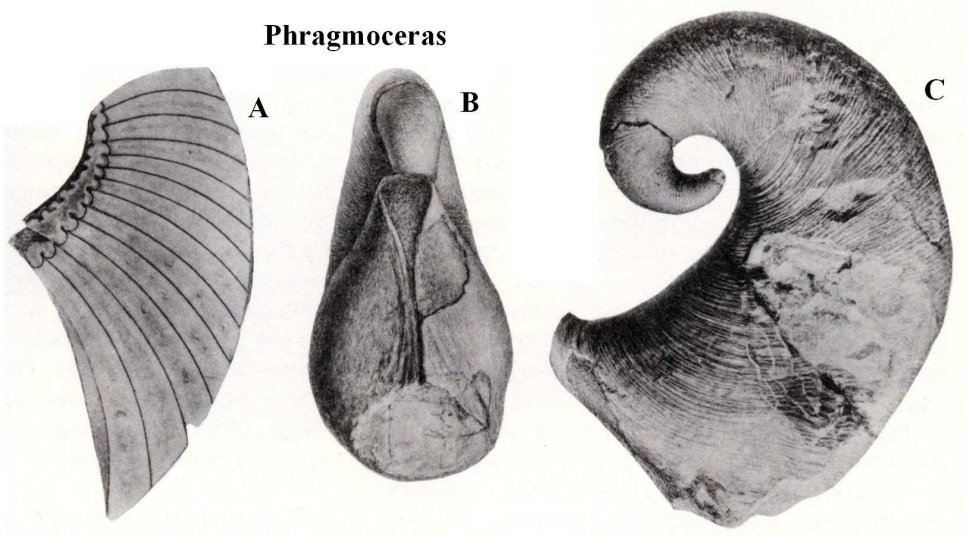


FIG. 34. Types of endosiphuncular structures; *A*, diaphragms; *B*, longitudinal lamellae; *C*, endocones; *D*, central cylindrical tube; *E*, parietal deposits; *F*, "annulosiphonate" deposits (not to scale). In *A* and *B* connecting rings are stippled; in *E* and *D* endosiphuncular deposits are stippled (Teichert, n).



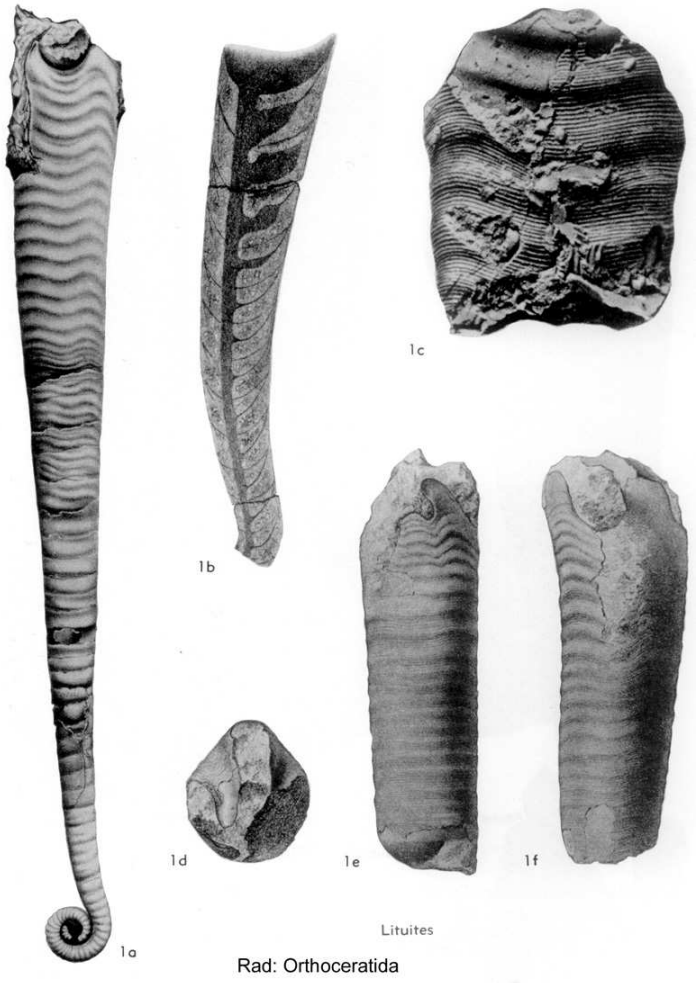
Tarphyceratida sp. ord. – vrch. devón

-exogastrické
-veľká protokoncha
-ortokónne až planišpirálne
-cylindrický sifón, meniaci pozíciu počas ontogenézy



Discosorida ord. – vrch. devón

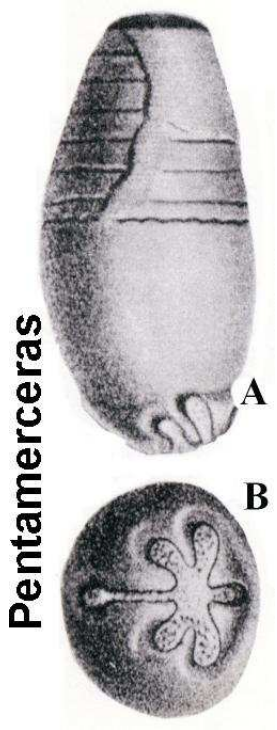
-endogastrické
-krátkokónické, zahnuté a priame schr.
-centrálny alebo ventrálny sifón
-hrubé, vypuklé sif. trubice



Rad: Orthoceratida

Oncoceratida ord. – karb.

-endogastrické, zahnuté
-ventrálny sifón
-tenké, vypuklé sif. trubice
-krátka obývacia komôrka

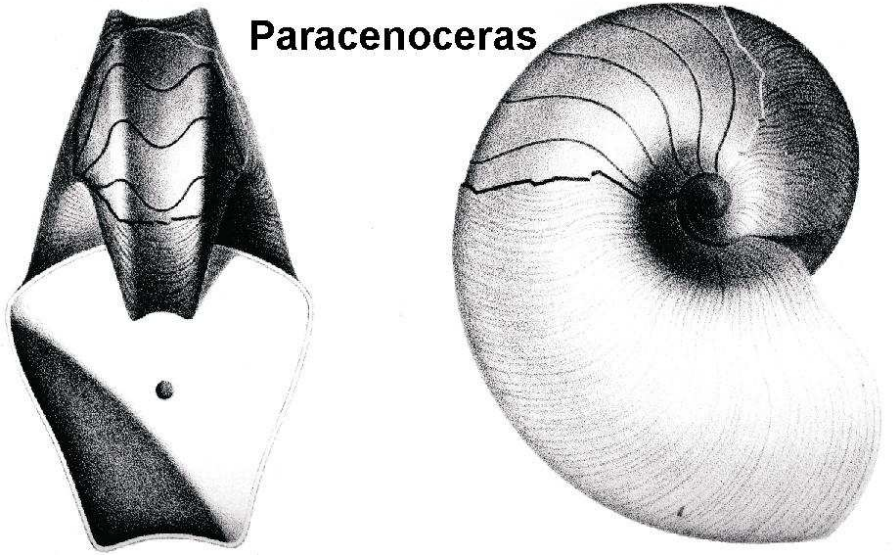


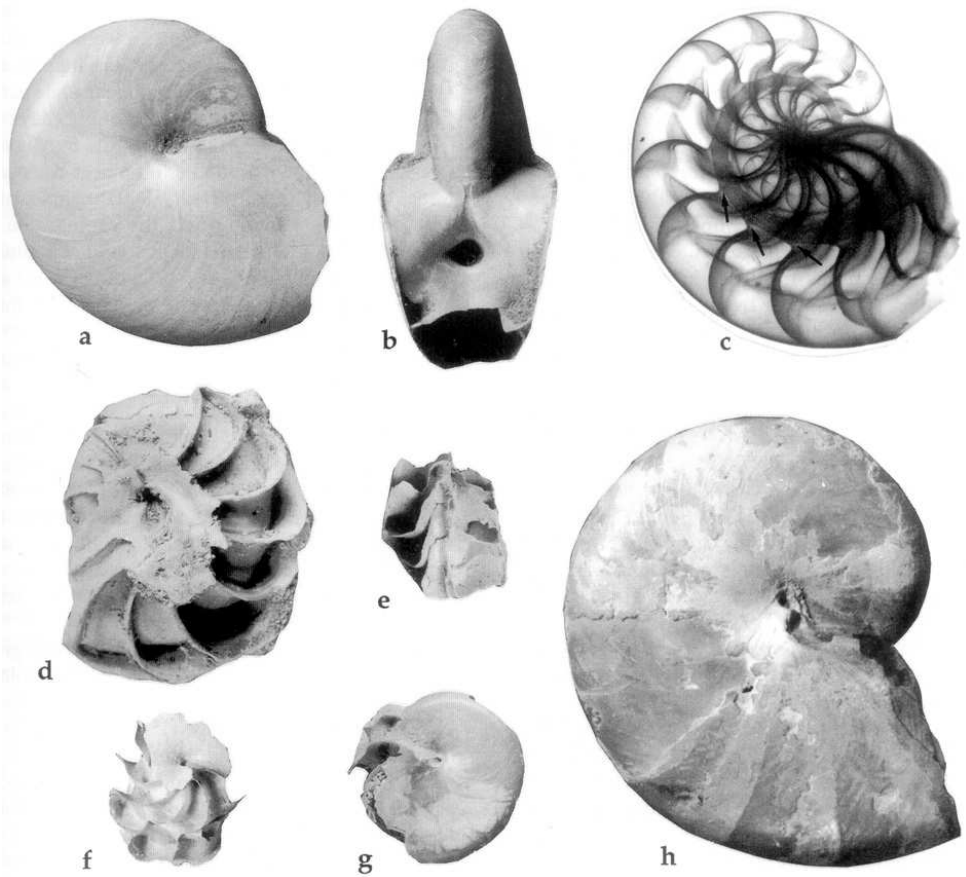
Orthoceratida ordovik – vrch. trias

-ortokónne a cyrtokónne
-subcentrálne uložený sifón
-hladké alebo nevýrazne orn. schránky
-formy so špir. exogastr. schr.

Nautilida devón – recent

-planišpirálne vinutá schránka
-tenký sifón, centrálny až subcentrálny
-krátke a rovné sept. hrdlá
-hladké alebo nevýrazne orn. schránky
-veľmi jednoduchá sutúra –
nautiloidný typ





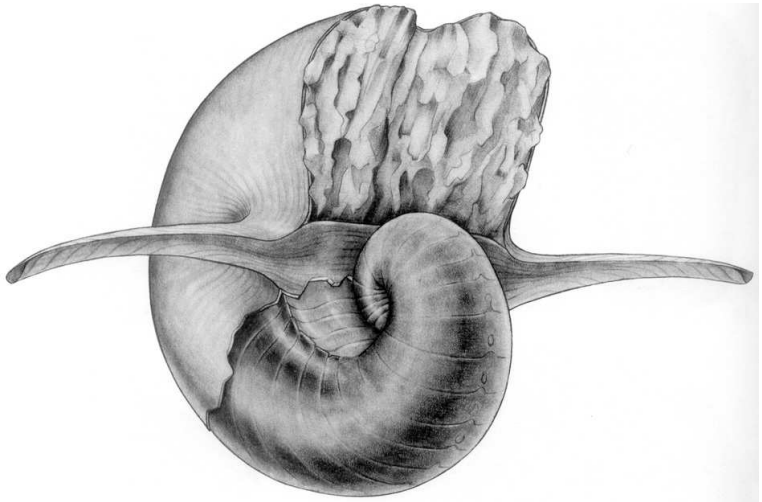
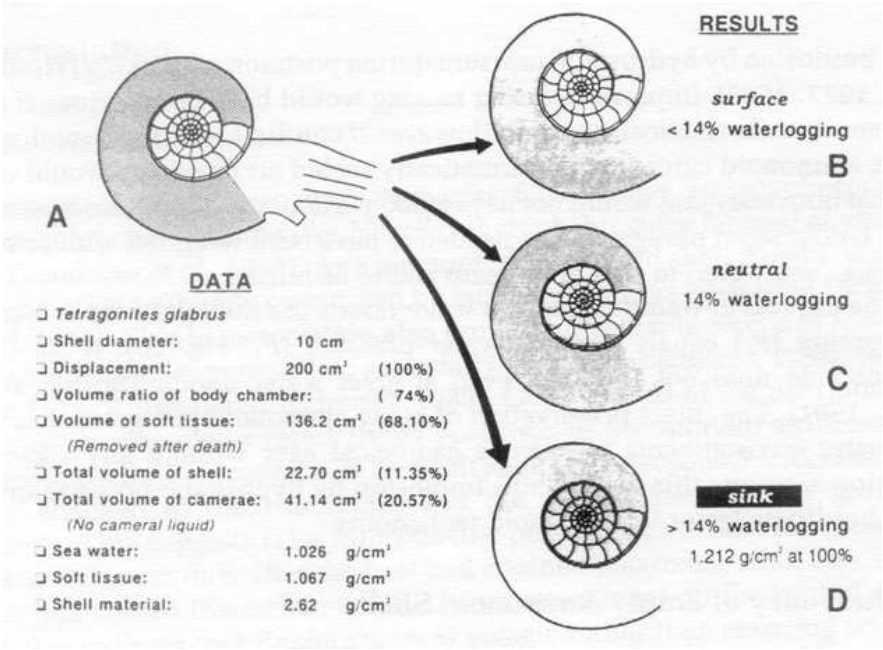
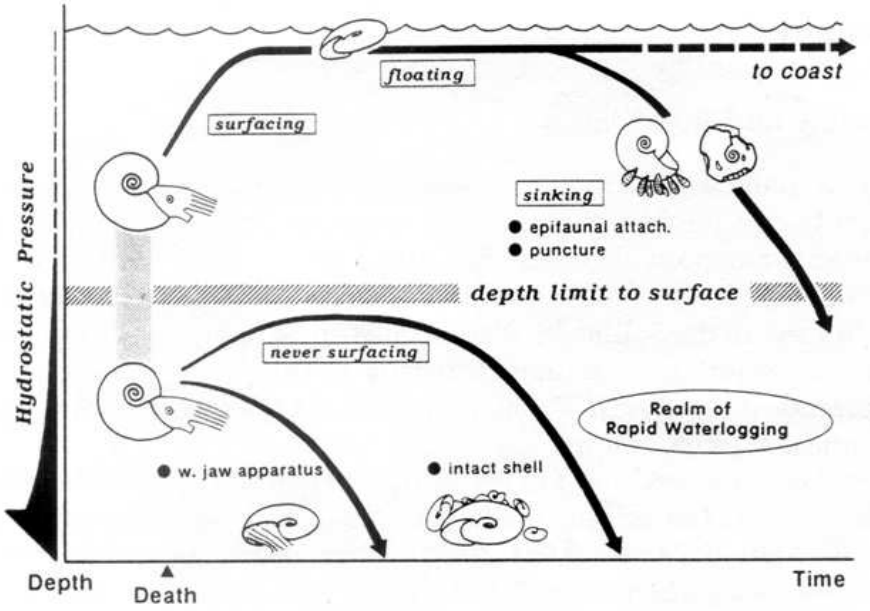
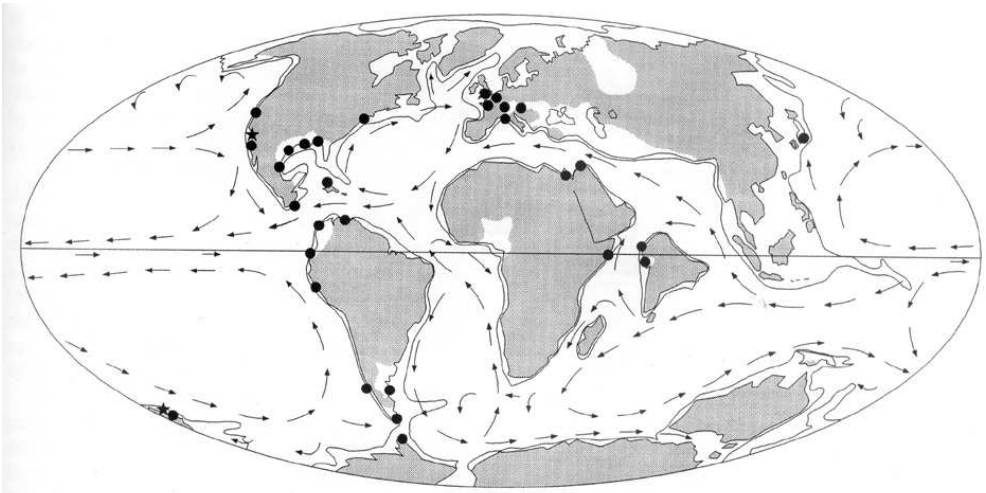


Fig. 319. **Solenochilus springeri* (White & St. John) (Aipocerataceae-Solenochilidae) (p. *K*441).







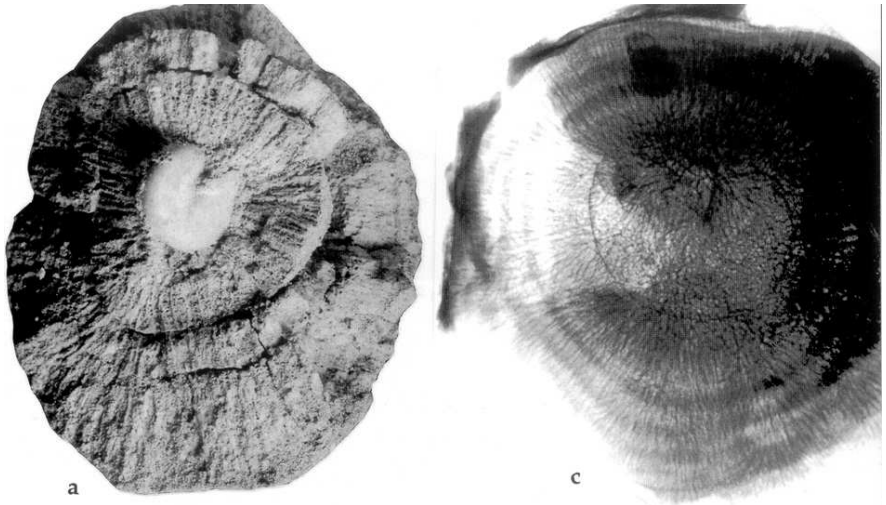


Fig. 2. Distribution of *Aturia* during the Palaeocene (star) and the Eocene (circle) [position of the continents, of the emerged lands and palaeoceanographic reconstructions during the Palaeocene after Haq (1984)].

Nautilus

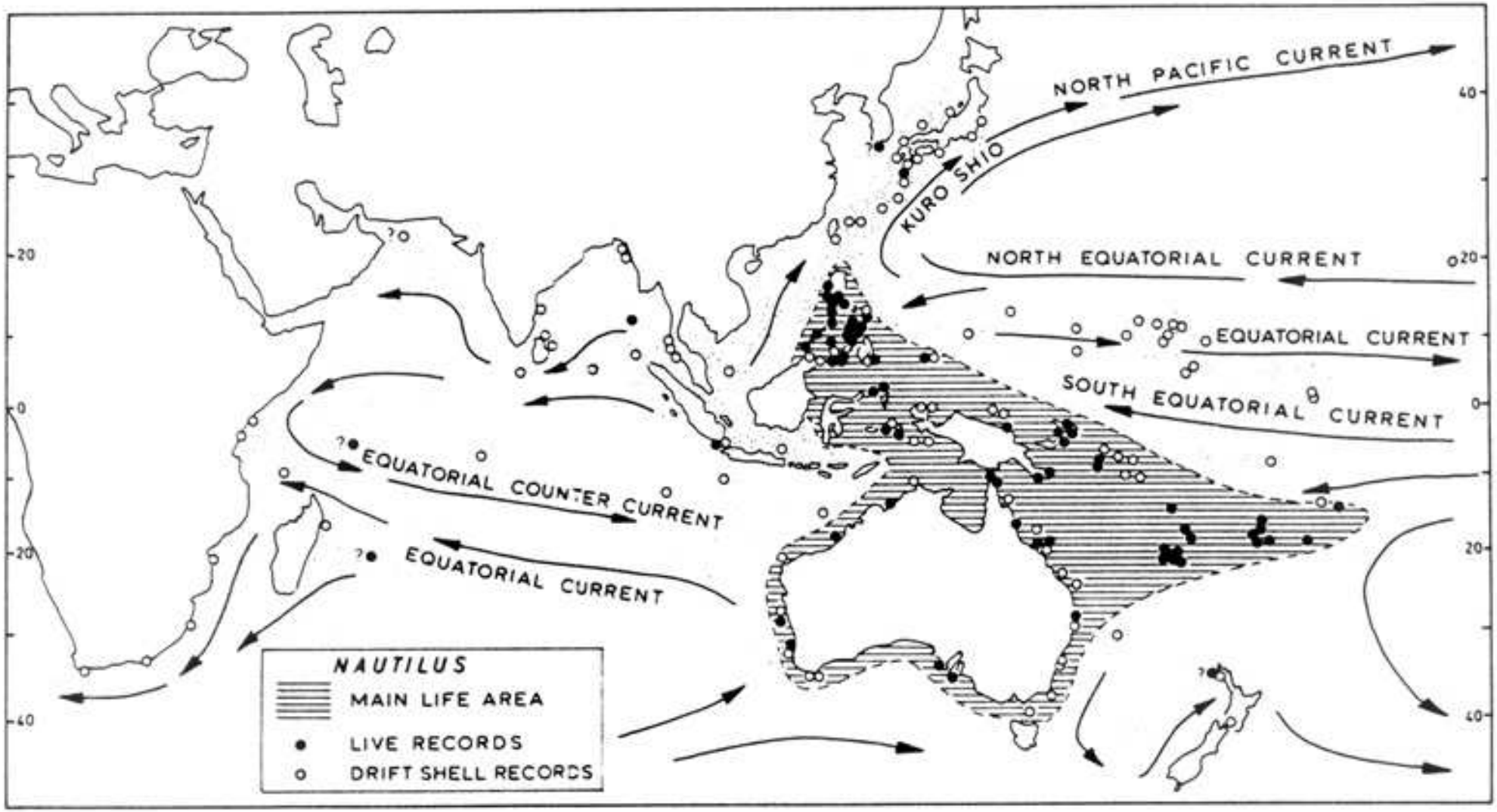
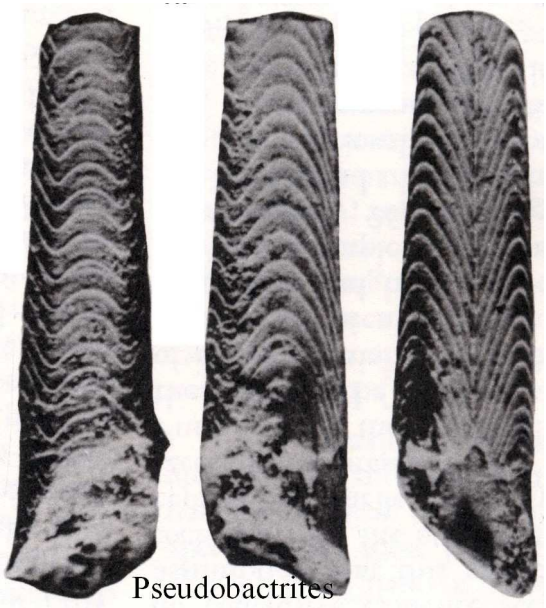


Figure 3. Map showing the relationship of living and postmortem distributions of *Nautilus* to approximate ocean currents. Updated from House (1973).


Pseudobactrites

Pt. **Bactritoidea** devón – sp. trias

-niekedy považovaný za najprim. Ammonoidea
-jeden rad: Bactritida
-uniformné, ortokónne alebo mierne cyrtok. schr.
-malá protokoncha s nep. konstrikcoiu
-veľká obývacia komôrka
-konkávne septá
-subventrálny sifón, presúva sa počas ontog. na ventr.
-jednoduchá sutúra, niekedy plytký ventrál. lalok

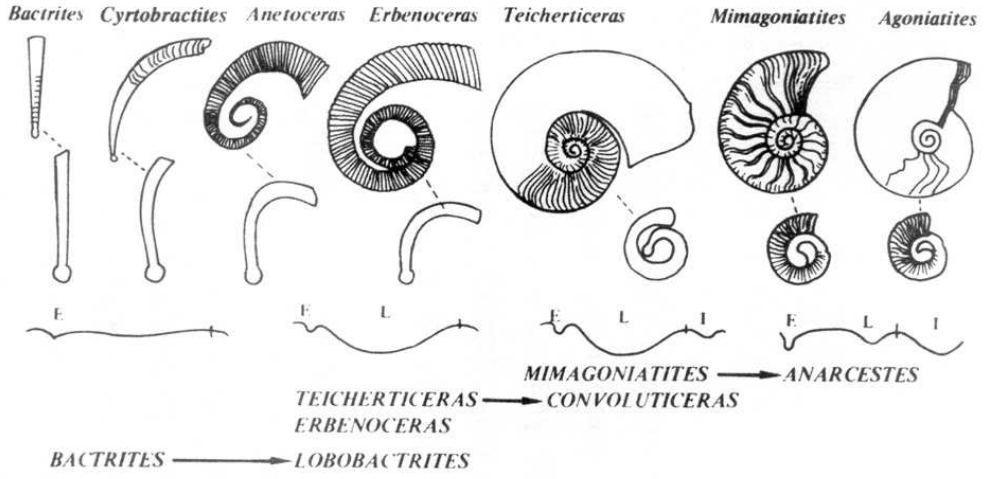
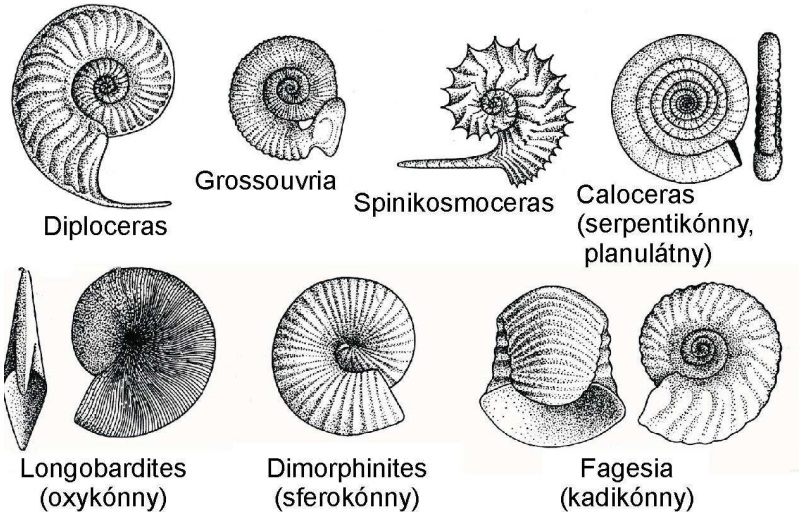
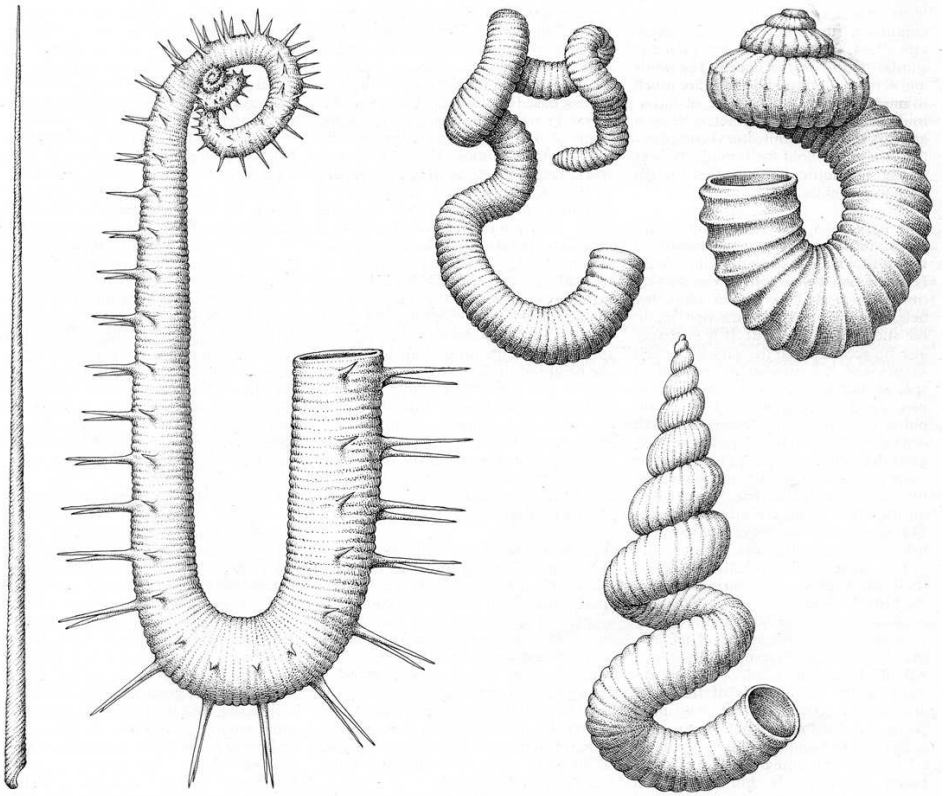


Fig. 5.22. Morphological series of the first, Lower Devonian ammonoids of the main lineage starting from *Bactrites*. Lobe lines and aspects of coiling of the corresponding juvenile portions are shown. *E* External or ventral lobe; *L* lateral lobe; *I* internal or dorsal lobe. (After Teichert, in Teichert and Yochelson 1967 (partly) and Erben 1964)

Ammonoidea

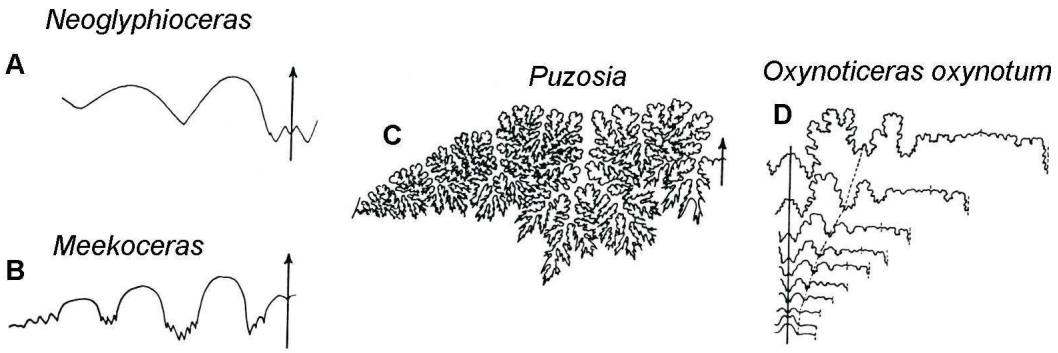
vinutie a tvary schránok

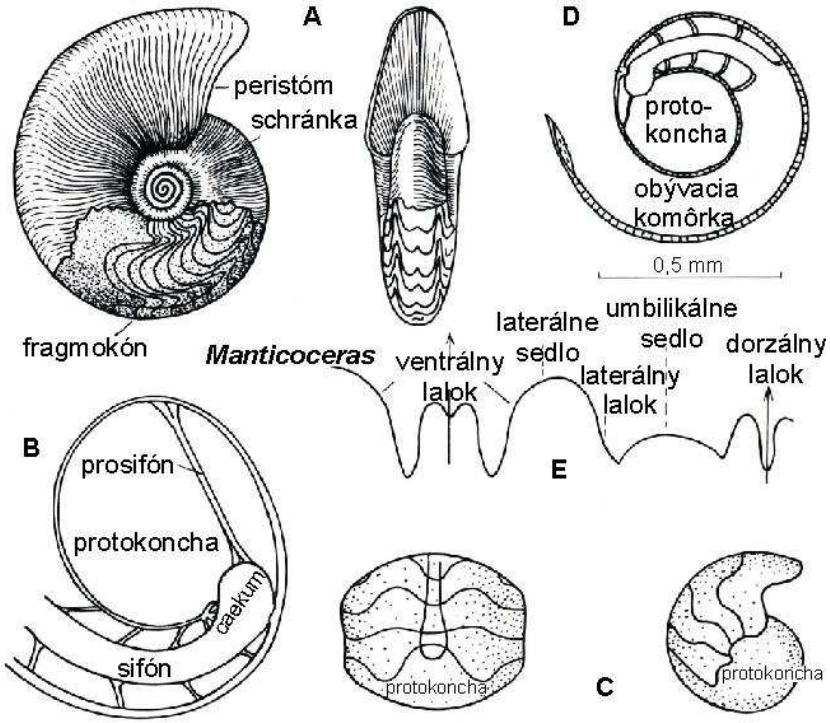


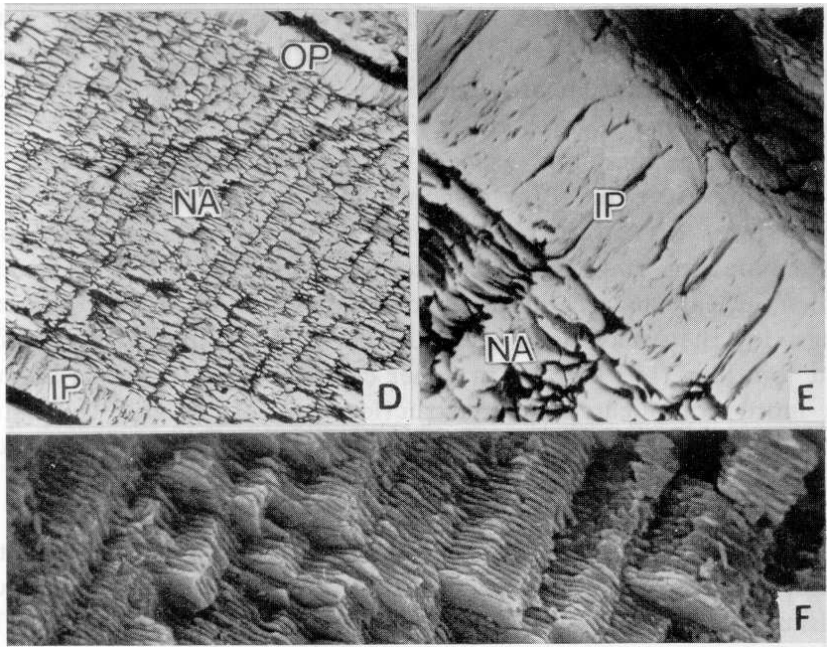


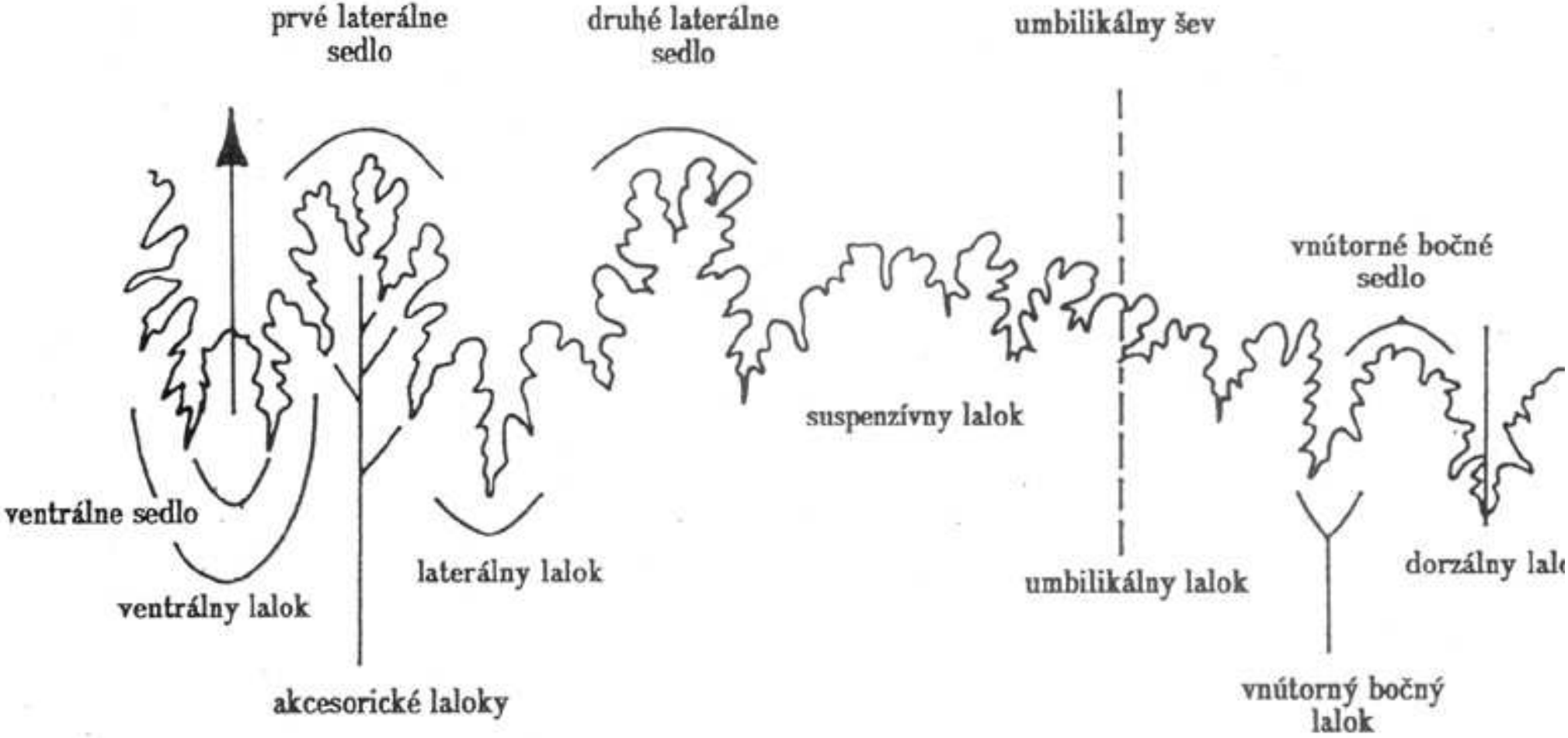
HETEROMORPH AMMONITE SHELLS are in some instances so bizarre that they were once thought to be the product of "genetic exhaustion," foretelling the extinction of the ammonites. Even now the variety of the shell shapes precludes simple generalizations about their adaptive significance. The heteromorphs shown here are (*from left to right*) members of the genera *Sciponoceras, Anisoceras, Nipponites, Nostoceras* and (*lower right*) *Didymoceras*. Most of the heteromorphs probably led passive, floating lives. Many early Cretaceous heteromorphs seem to have depended on shell ornament for protection against predators. Late Cretaceous heteromorphs, however, particularly those with a *U*-shaped hook at the end of their shell, may have floated at middle depths in the ocean and so escaped the continental-shelf habitats of their bottom-dwelling ancestors and perhaps also the predators that invaded them in the Mesozoic era.

Ammonoidea


Neoglyphioceras
A
Meekoceras
B
Puzosia
C
Oxynoticeras oxynotum
D

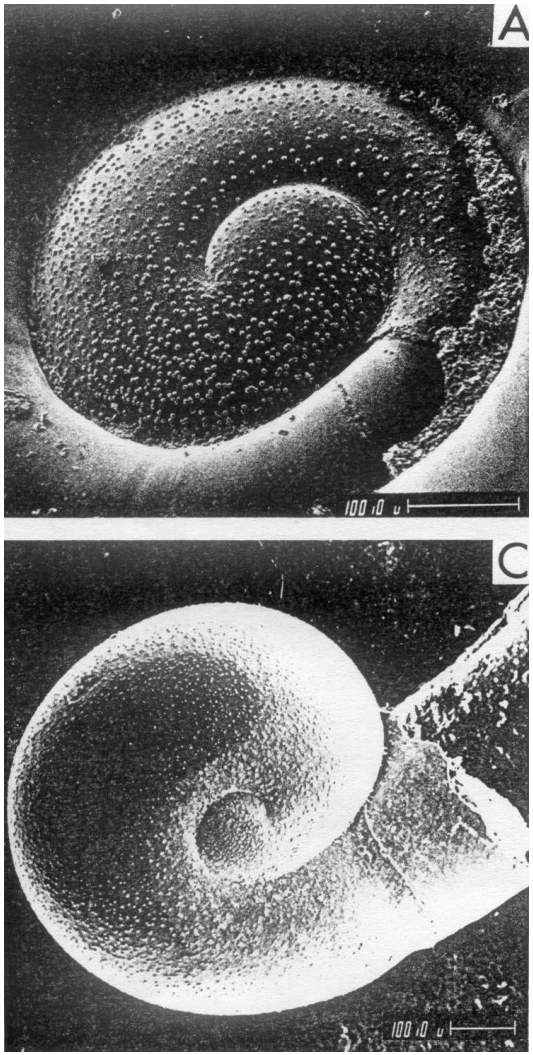

A
peristóm
schránka
fragmokón
D
proto-
koncha
obývacia
komôrka
0,5 mm
Manticoceras
ventrálny
lalok
laterálne
sedlo
laterálny
lalok
umbilikálne
sedlo
dorzálny
lalok
E
B
prosifón
protokoncha
cæcum
sifón
protokoncha
C
protokoncha


OP
NA
IP
D
IP
NA
E
F


prvé laterálne sedlo
druhé laterálne sedlo
umbilikálny šev
vnútorné bočné sedlo
suspenzívny lalok
ventrálne sedlo
laterálny lalok
umbilikálny lalok
dorzálny lal
ventrálny lalok
akcesorické laloky
vnútorný bočný lalok

Ammonoidea

ontogenéza



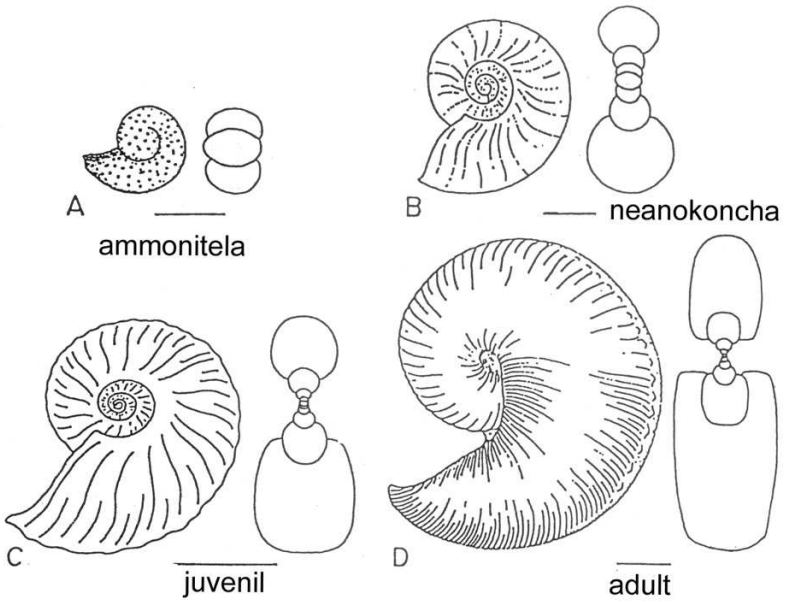
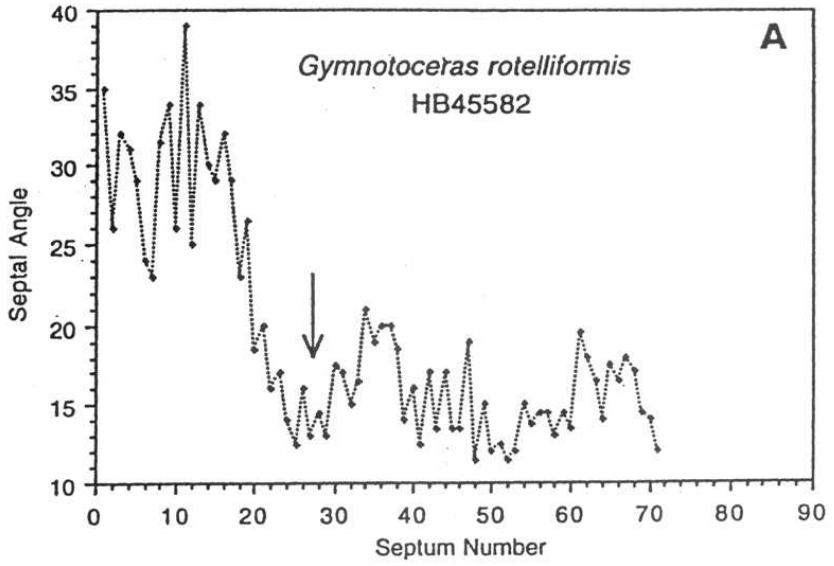
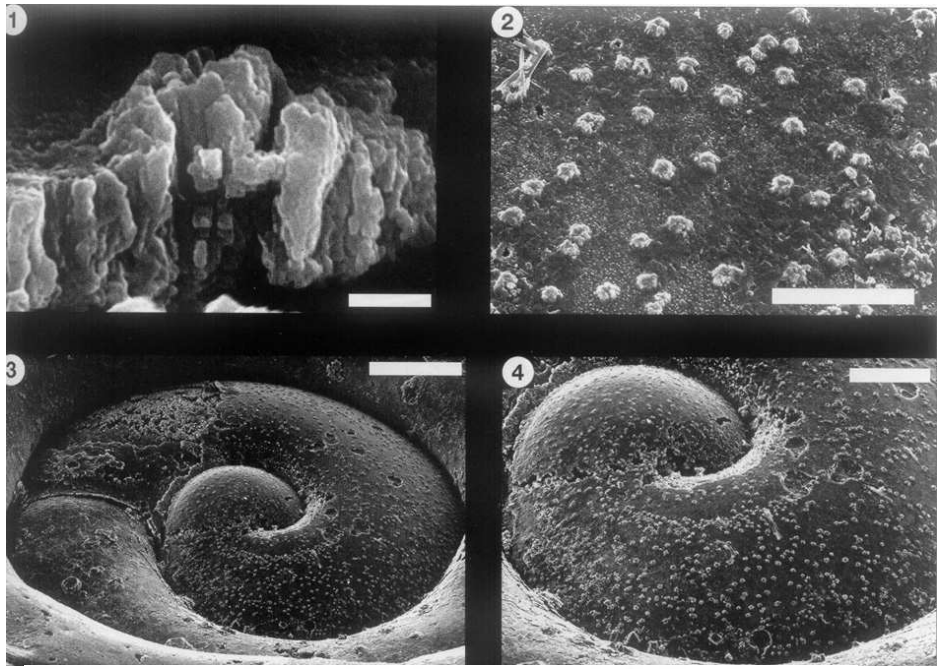
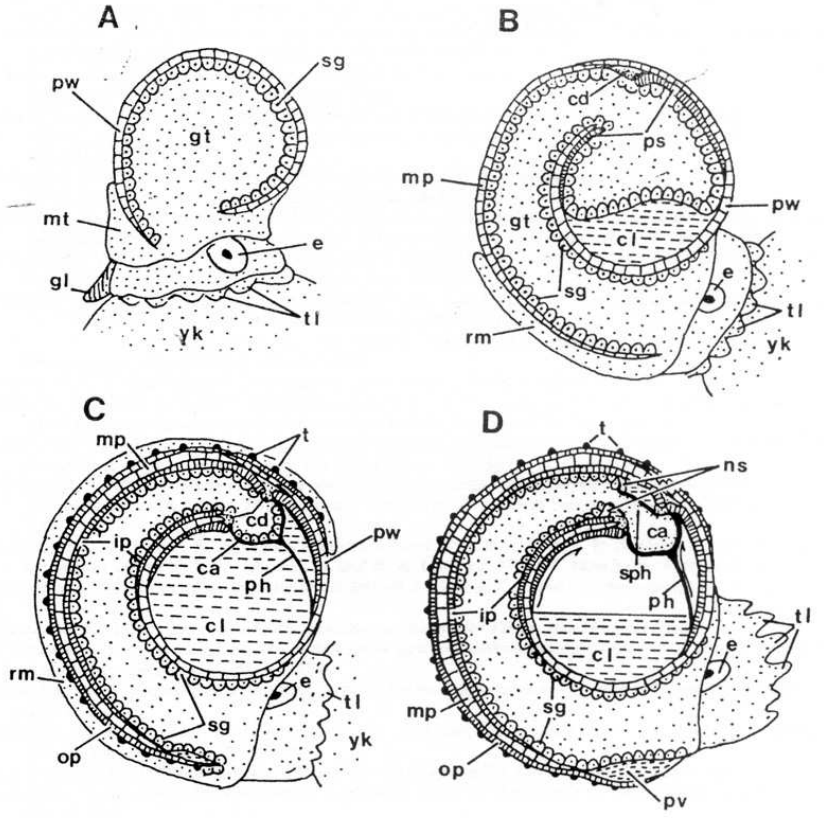


FIGURE 1. Schematic drawings of four growth stages in the ontogeny of *Hoploscaphites nicolletii*, macroconch (Late Cretaceous), in lateral and transverse cross-sectional views. (A) Ammonitella. Scale bar, 500 μm. (B) Neanoconch. Scale bar, 1 mm. (C) Juvenile. Scale bar, 5 mm. (D) Adult. Scale bar, 1 cm.




1
2
3
4


A
pw
sg
gt
mt
e
gl
tl
yk
B
cd
ps
mp
pw
gt
cl
e
sg
tl
rm
yk
C
mp
t
cd
pw
ip
ca
ph
cl
rm
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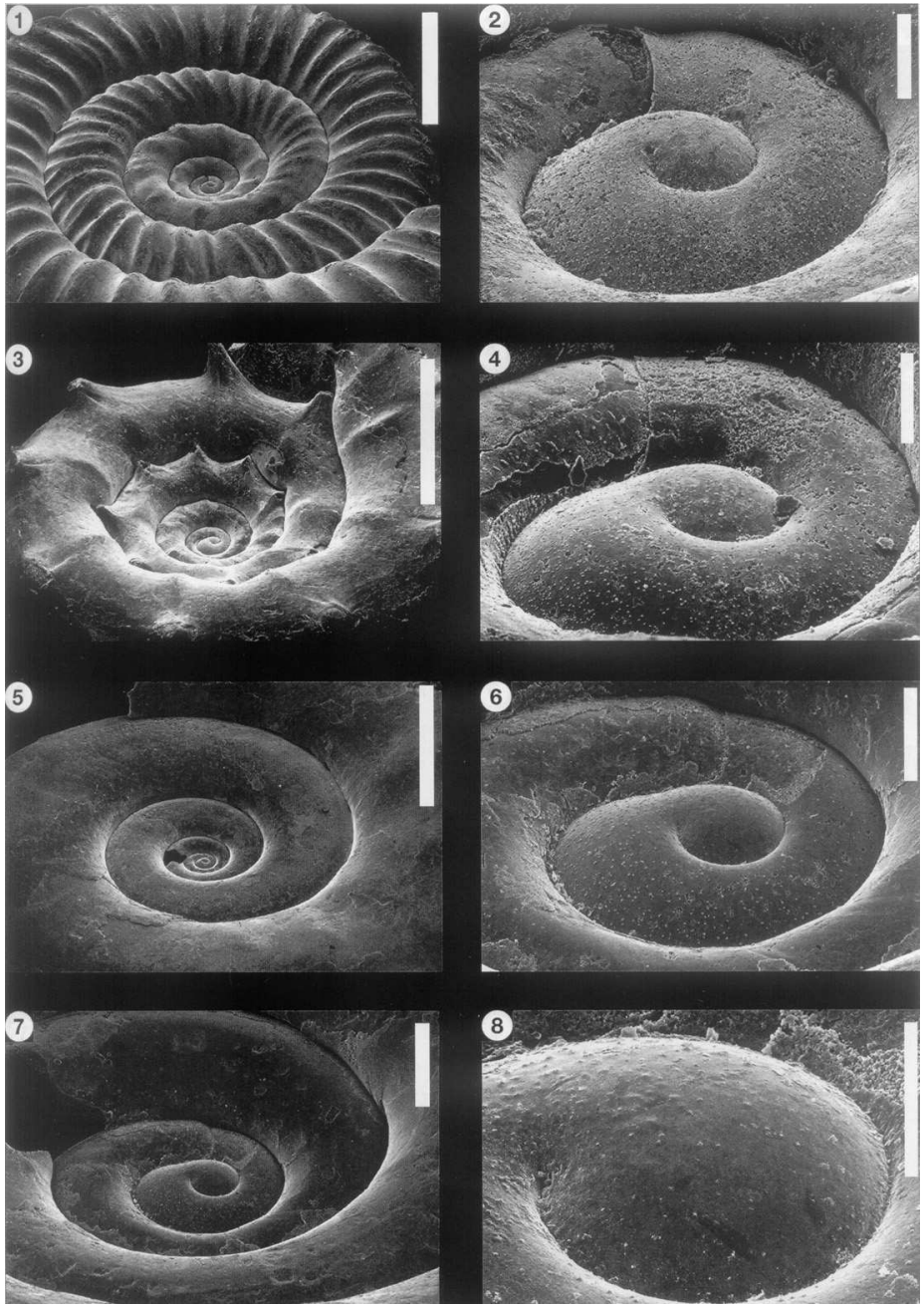
ph
ip
tl
cl
e
mp
sg
op
pv


1
2
3
4
5
6
7
8

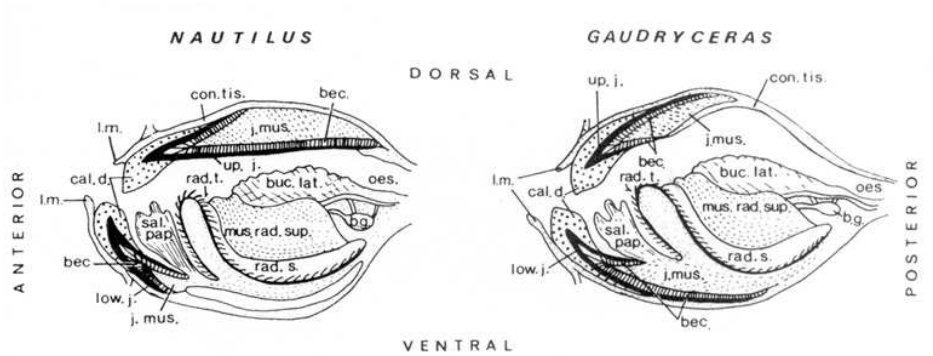
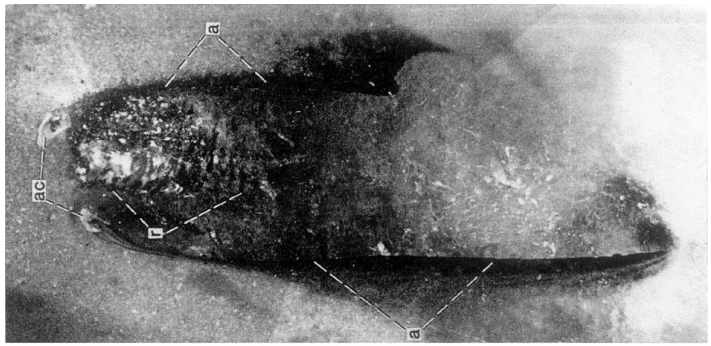
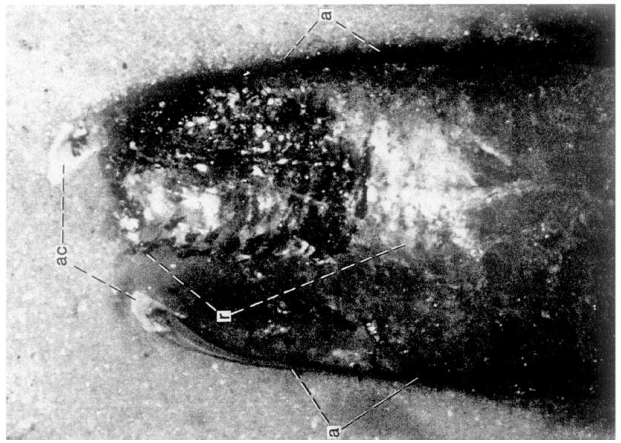
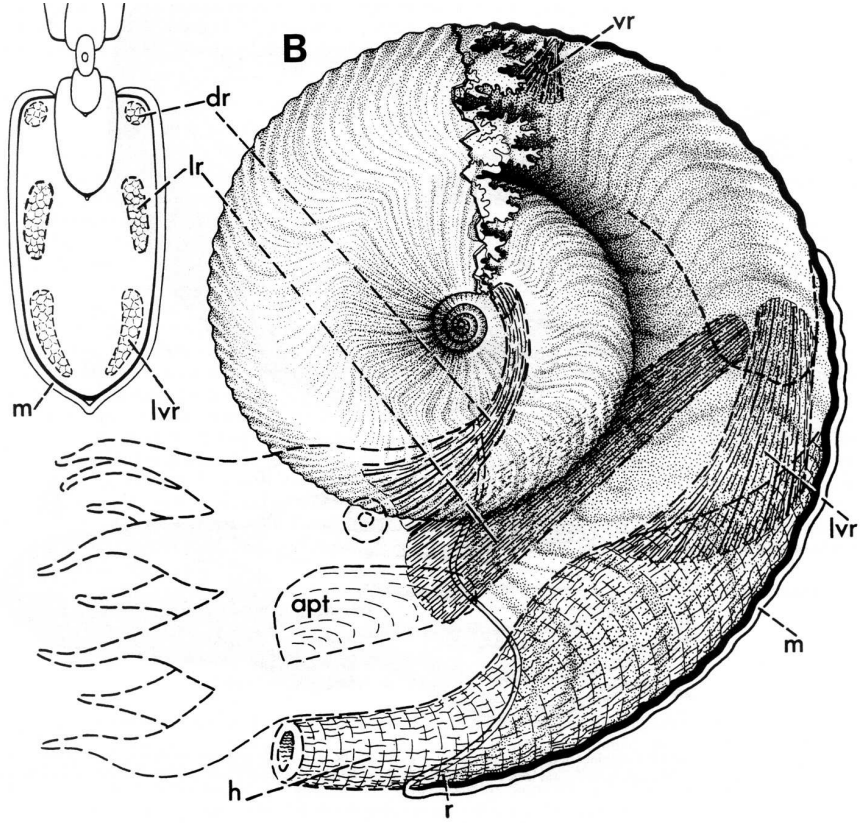


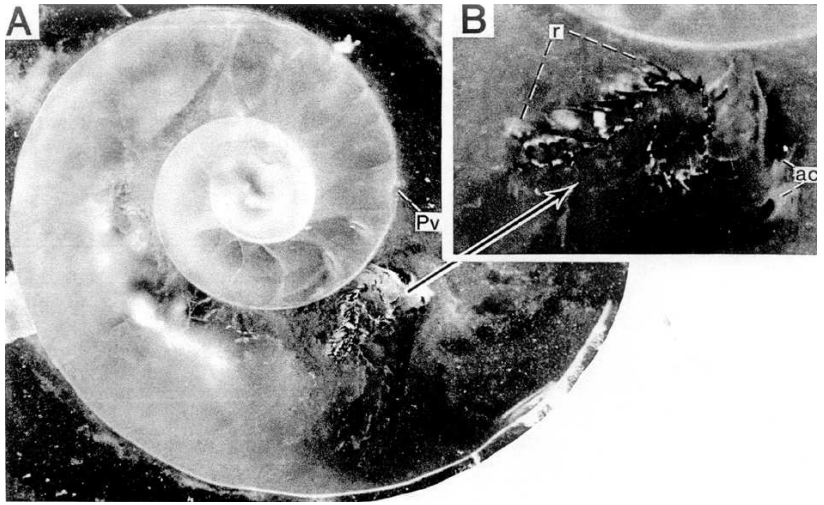
Fig. 5. Diagrams of the restored buccal mass structure of *Gaudryceras* sp. (right) compared with that of *Nautilus pompilius* (median section; left). up. j., upper jaw; low. j., lower jaw; bec., beccublast cells; j. mus., jaw muscles; rad. t., radular teeth; rad. s., radular sac; mus. rad. sup., radular support muscles; sal. pap., salivary papilla; buc. lat., lateral buccal palp; oes., oesophagus; cal. d., calcareous deposits [rhyncholite (upper jaw) & conchorhynch (lower jaw)]; con. tis., connecting tissue with epithelial cells; l. m., labial margin ('lip'); b. g., inferior buccal ganglion. Terminology mostly from Young (1965).



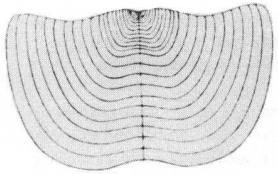




Text-fig. 8. *Aconeceras.* A: reconstruction of the hyponome retractor (lvr), cephalic retractor (lr), dorsal muscle (dr), ventral muscle (vr) and cephalic region of the body; according to this reconstruction, the head and hyponome (h) extended further out from the shell aperture than those in *Nautilus* (compare with Fig. 7); note that the hyponome (h) in *Aconeceras* was large and supported by the rostrum (r), and that the mantle (m) extended in the apertural region over the shell surface; apt, aptychus B: cross-section of the shell with the hyponome retractors, cephalic retractors, dorsal muscles (lvr, lr, dr) and extended mantle (m).

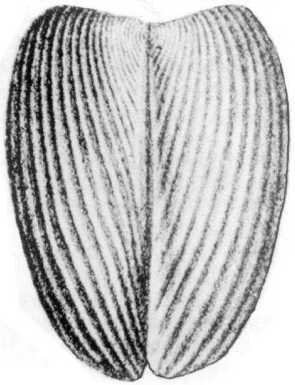


Aptychy

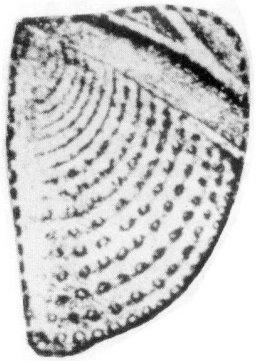


Anaptychus

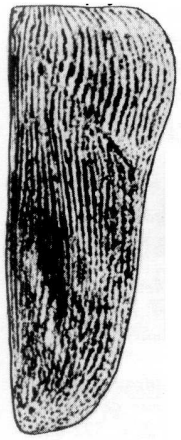
Praestriaptychus



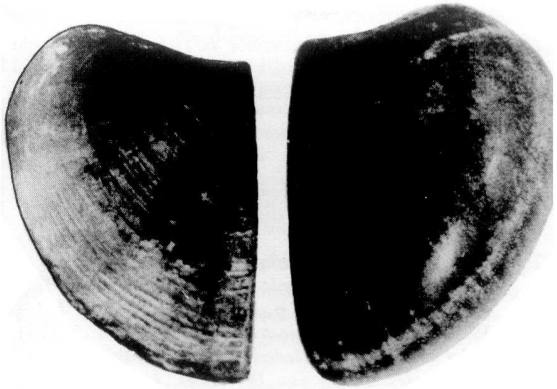
Lamellaptychus



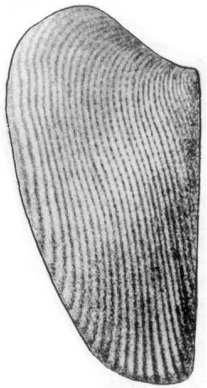
Granulaptychus



Cornaptychus



Laevaptychus



Punctaptychus

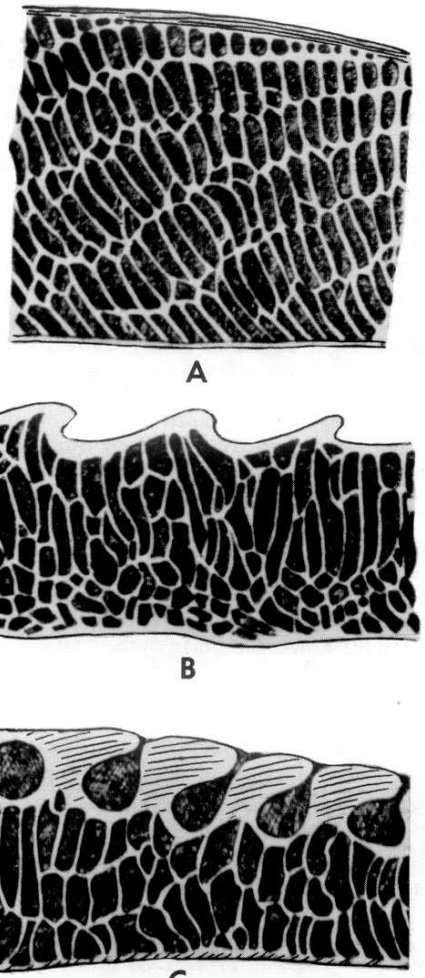


FIG. 147. Magnified cross sections of aptychi, showing internal structure of the shell (661). *A*, Laevaptychus; *B*, Lamellaptychus; *C*, Punctaptychus.

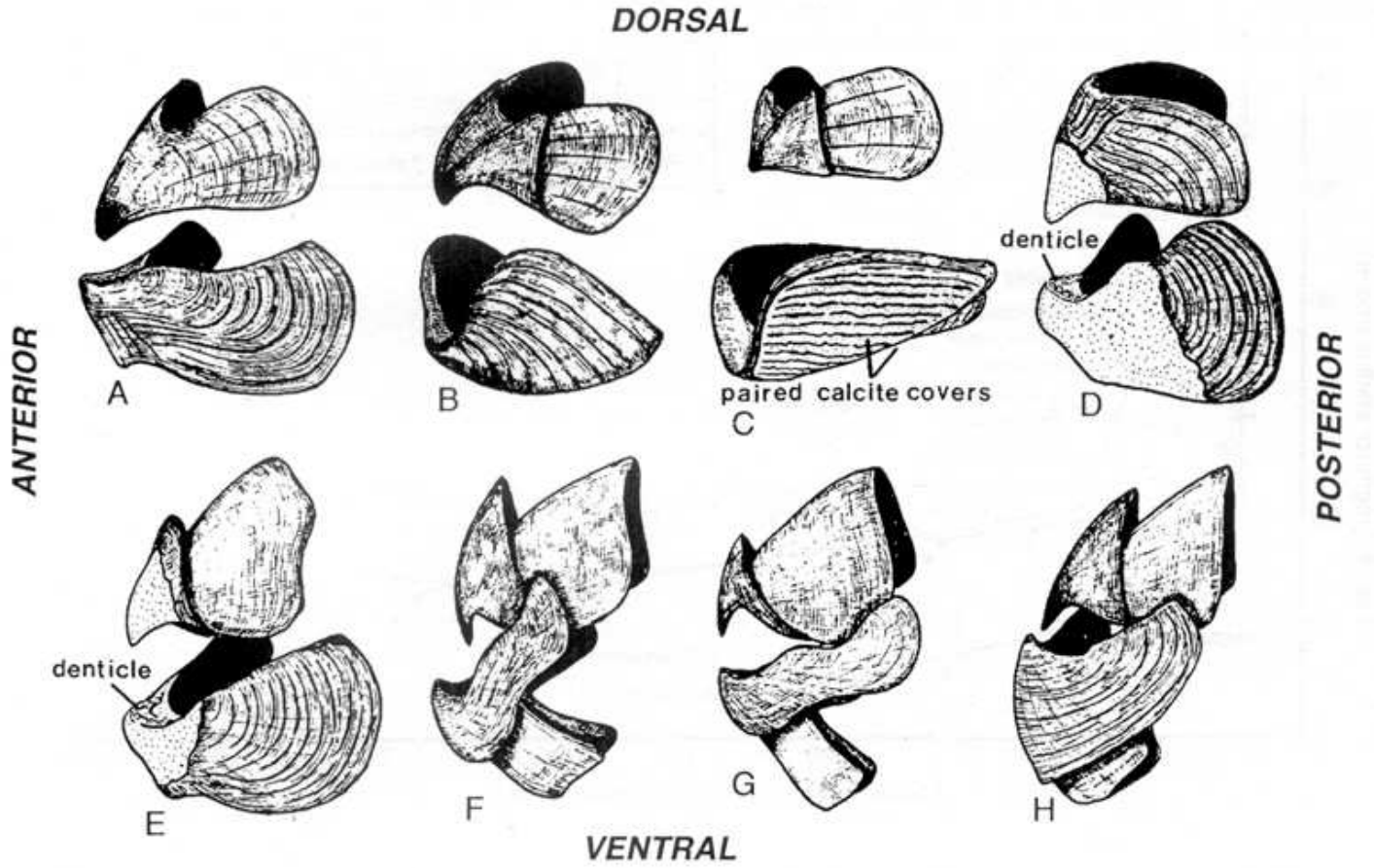


Figure 19.3 *Three-dimensional reconstruction of the jaw apparatuses of selected ammonoids (A–D) and extant cephalopods (E–H) (viewed from the anterolateral side). A.* Eoasianites *(Late Carboniferous Goniatitina; normal type; after Bandel, 1988: fig. 6). B.* Psiloceras *(Early Jurassic Ammonitina; anaptychus type; after Lehmann, 1975: fig. 3). C.* Hildoceras *(Early Jurassic Ammonitina; aptychus type; after Lehmann, 1975: fig. 4). D.* Gaudryceras *(Late Cretaceous Lytoceratina; rhynchaptychus type; after Tanabe et al., 1980a: fig. 9). E.* Nautilus *(Nautilida, Nautiloidea). F.* Sepia *(Sepioidea; Coleoidea). G.* Octopus *(Octopoda, Coleoidea). H.* Vampyroteuthis *(Vampyromorpha; Coleoidea; after Clarke, 1986: figs. 126, 127)*

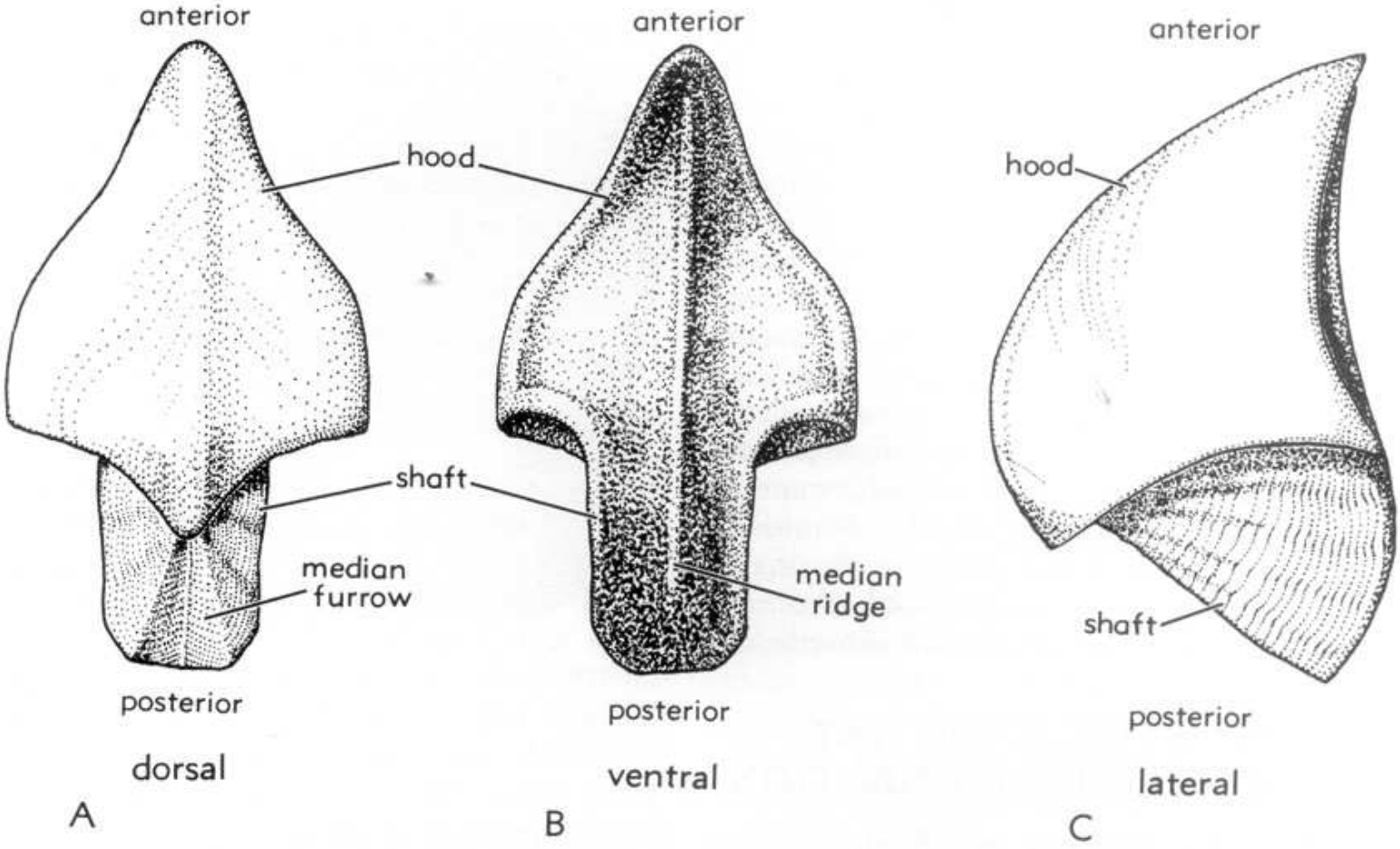
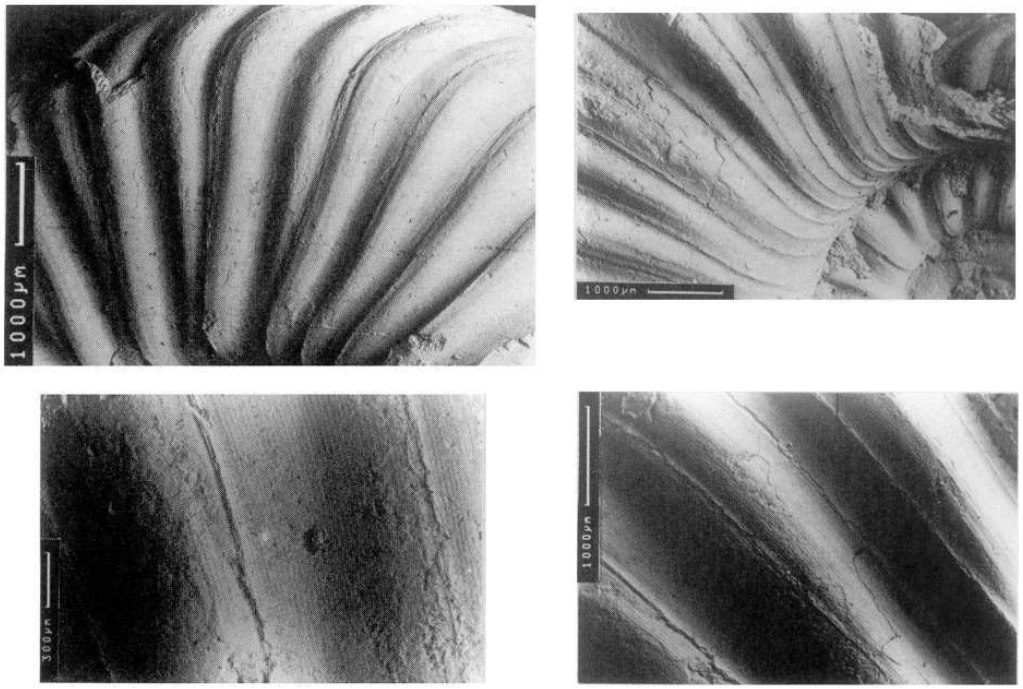
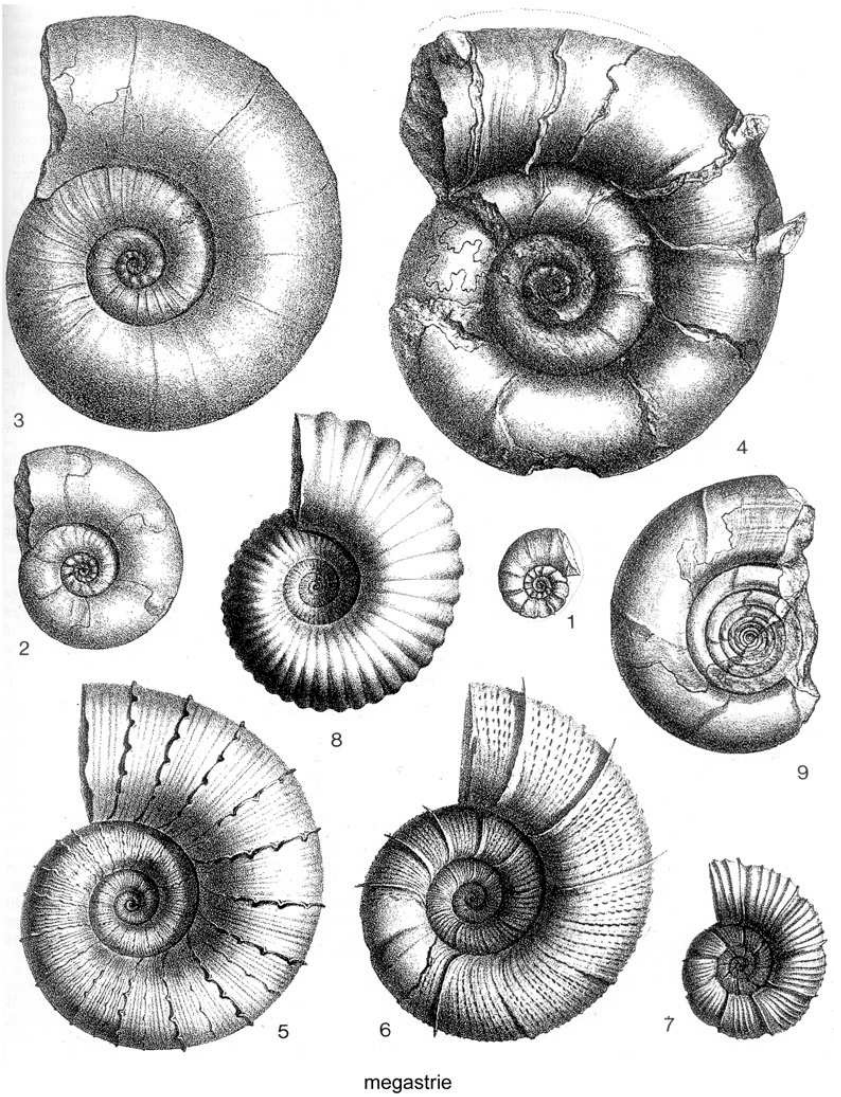


FIG. 342. Rhyncholite terminology. *A*, dorsal view; *B*, ventral view; *C*, lateral view (Teichert, Moore, & Zeller, n).

ornamentácia

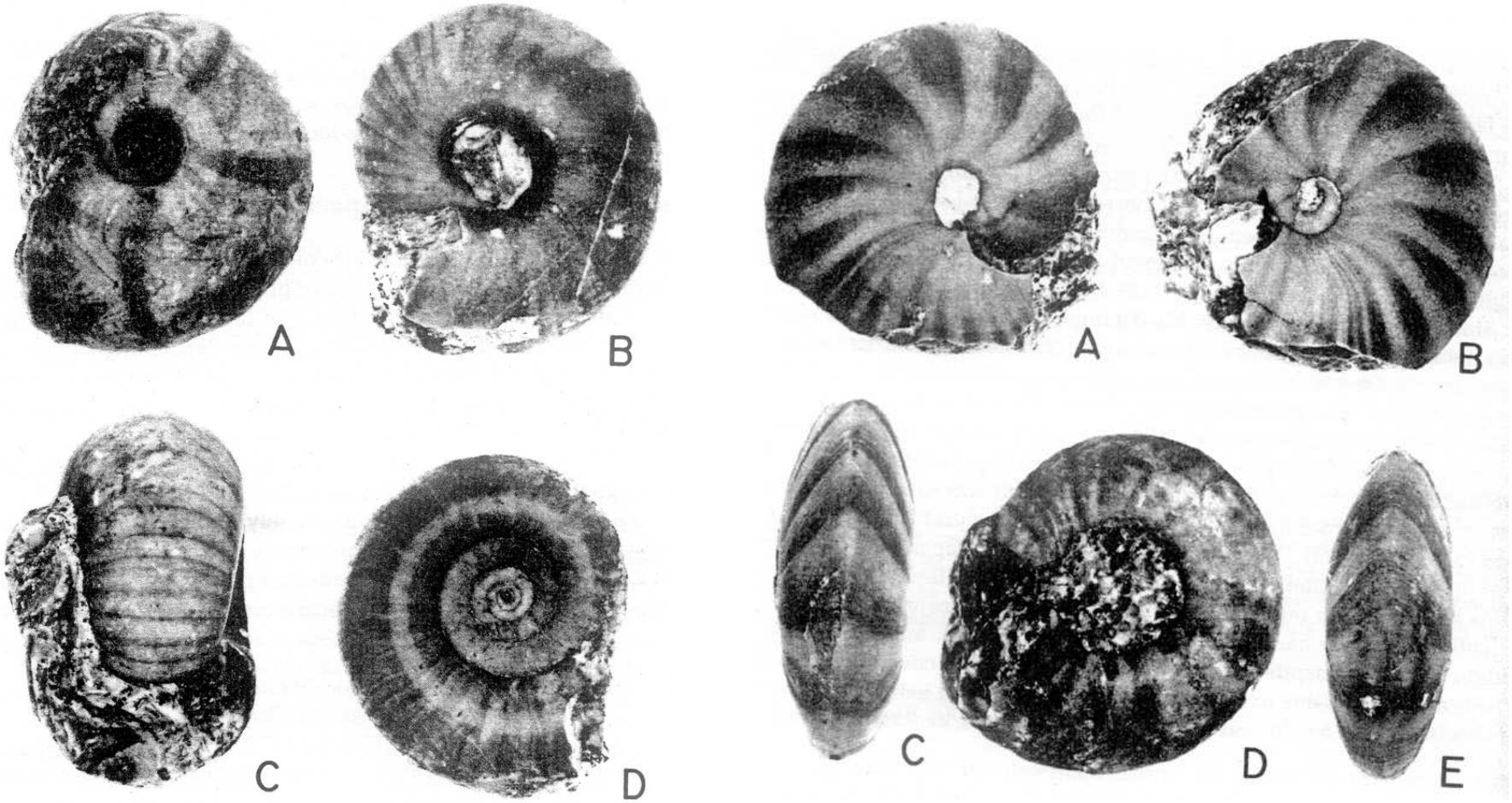




megastrie

rastové línie
megastriácie
rebrá

sfarbenie schránky Goniatitida



Sexuálny dimorphizmus

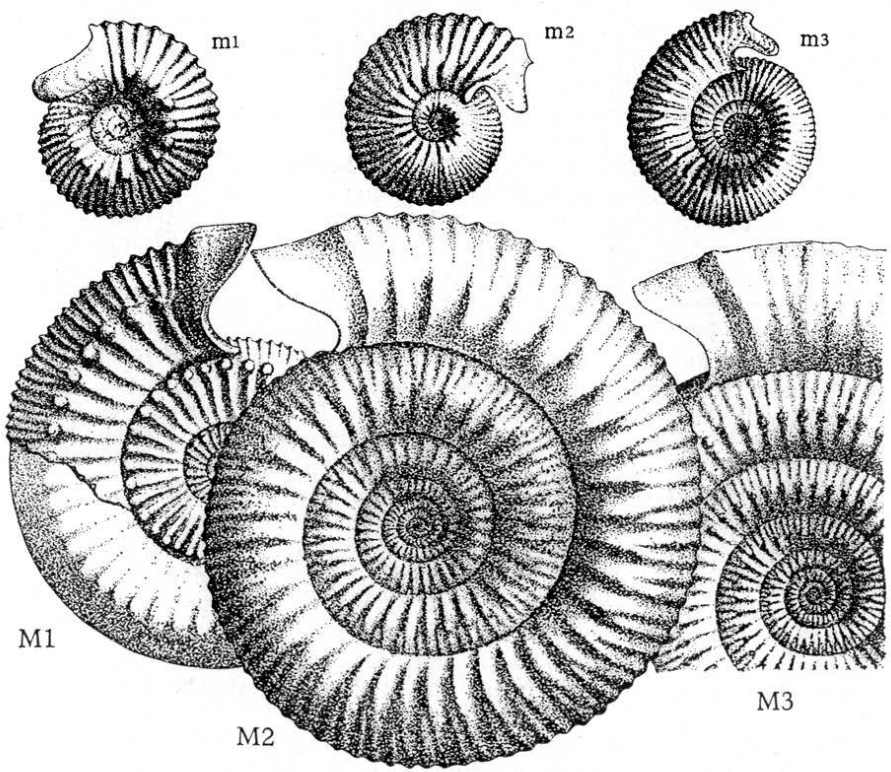


Fig. 4. *Stephanoceras-Otoites/Normannites.* M1: *Amm. Humphriesianus pinguis* Quenstedt, 1886-7, pl. 65, fig. 12. M2: *Amm. Humphriesianus* Quenstedt, ibid., fig. 9. M3: *Amm. Humphriesianus macer* Quenstedt, ibid., fig. 10. Middle Bajocian, Bayeux. m1, 2: *Ammonites contractus* Quenstedt, 1886-7, pl. 64, fig. 16, pl. 65, fig. 1. m3: *Amm. Braikenridgii* Quenstedt, 1886-7, pl. 65, fig. 6. Brown Jura δ, Swabia, ×0·5.

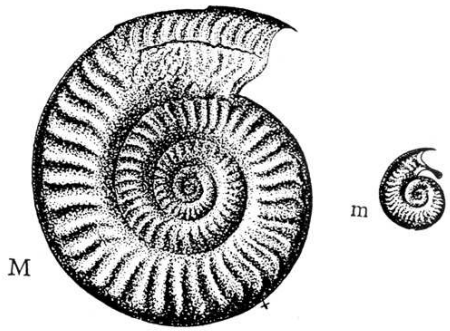


Fig. 2. M: *Grammoceras audax* Buckman (1887-1907, pl. xxviii, fig. 4). m: *Grammoceras arenaceum* (Buckman) (=*Canavarella*? *arenacea* Buckman, 1887-1907, pl. xxviii, fig. 20). Both specimens from the Striatulum Beds, Cotteswold Sands, Gloucestershire,

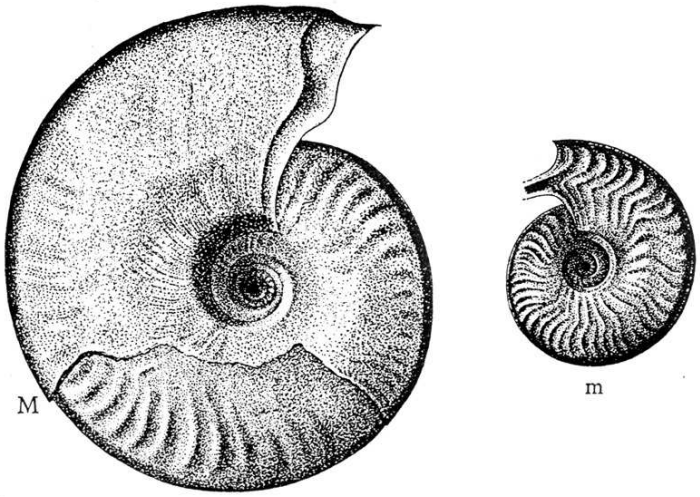


Fig. 3. M: *Graphoceras cavatum* (Buckman) (=*Lioceras concavum* var. *v-scriptum* Buckman, =*Lucya cavata* Buckman, 1887-1909, pl. ix, fig. 1). m: *Ludwigina cornu* (Buckman) (=*Ludwigella cornu* Buckman, 1887-1909, pl. iv, fig. 3). Both specimens from the Concavum Zone, Bradford Abbas.

vnútrodruhová variabilita

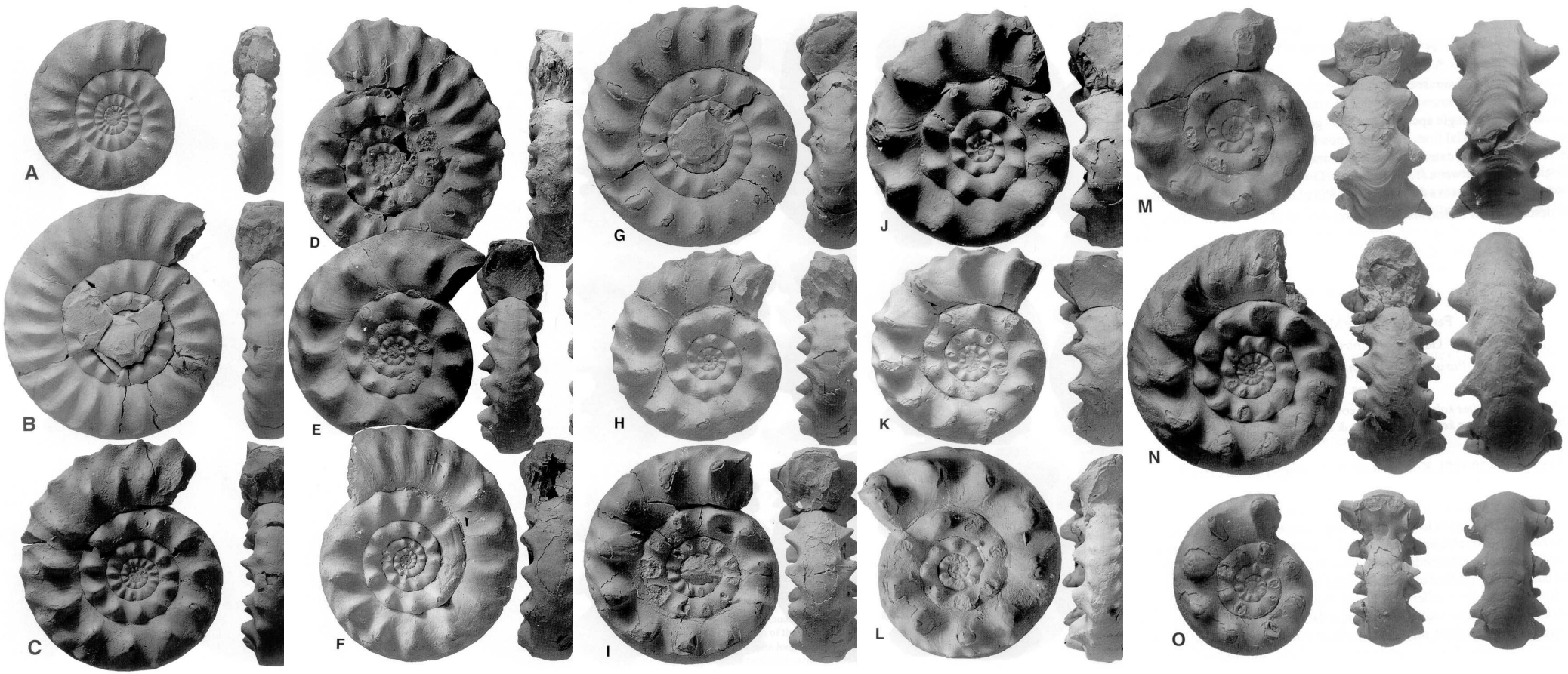


Fig. 8. A-C: *Parasibirites kolymensis* Bychkov, Upper Olenekian, Grambergi Zone, Kolymensis Subzone; Arctic Siberia; basin of the lower reaches of Olenek River, Mene River. Thin ophioconic, ribbed or weakly bullate variants.

Parasimbirskites kolymensis

Anarcestida sp. dev. – vrch. devón

-ventrálny retrochoanitický sifón
-goniatitová sutúra
-planišpirálne vinutie
-hladká, zriedkavo ornamentovaná schr.
-umbilikálna perforácia

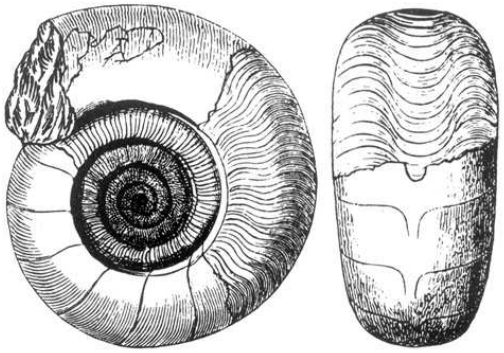


FIG. 21. *Anarcestes (Anarcestes) lateseptatus plebeius* (BARRANDE), M.Dev., Czech.; ×1 (1).

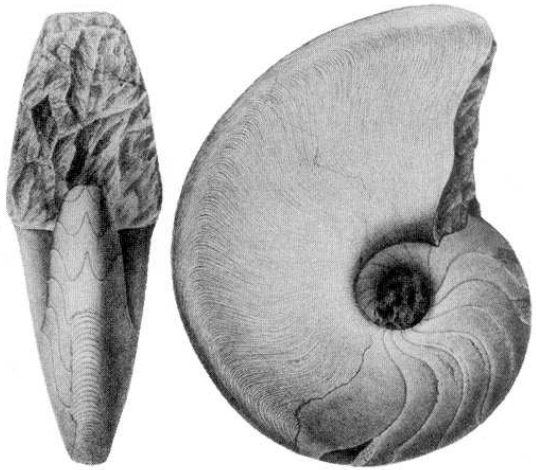


FIG. 17. *Agoniatites vanuxemi* (HALL), M.Dev., N.Y.;

FIG. 18. Suture of *Agoniatites vanuxemi* (HALL), M. Dev., N.Y.;

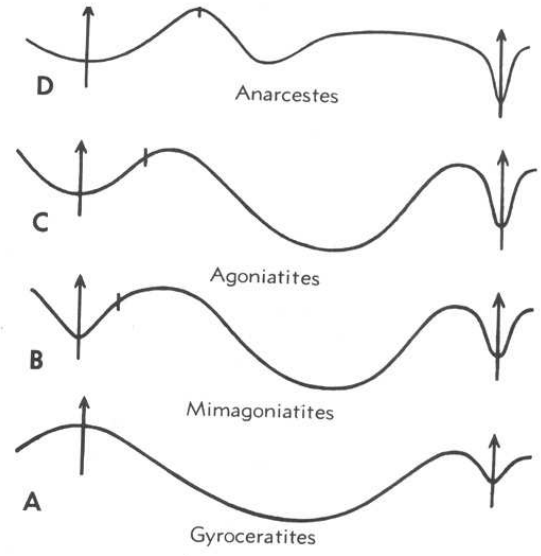


FIG. 13. Sutures of *Gyroceratites (A), Mimagoniatites (B), Agoniatites (C),* and *Anarcestes (D)*

Clymeniida vrch. devón

-planišpirálna schránka

-časté konstrikcie, goniatitová sutúra

-dorzálny, retrochoanitický sifón

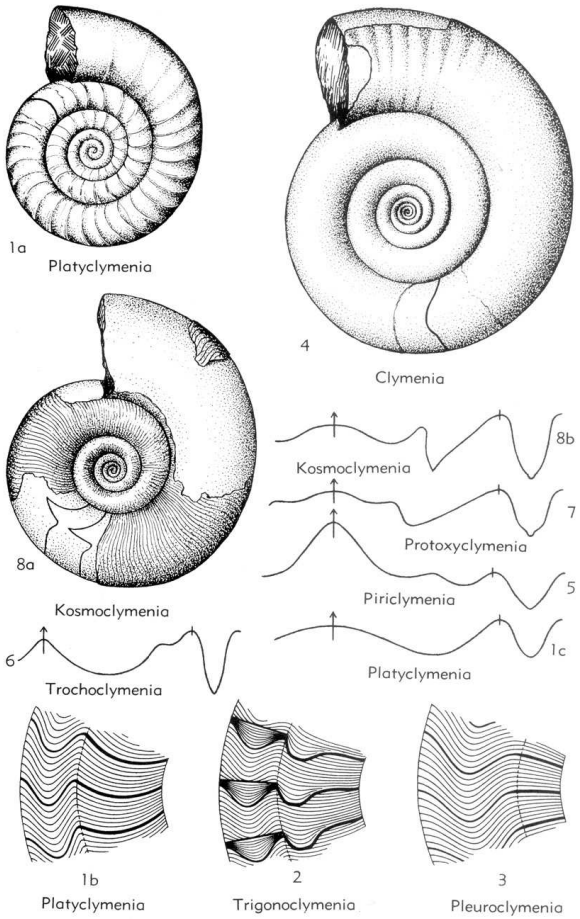


Fig. 41. Clymeniidae (p. L43-L44).

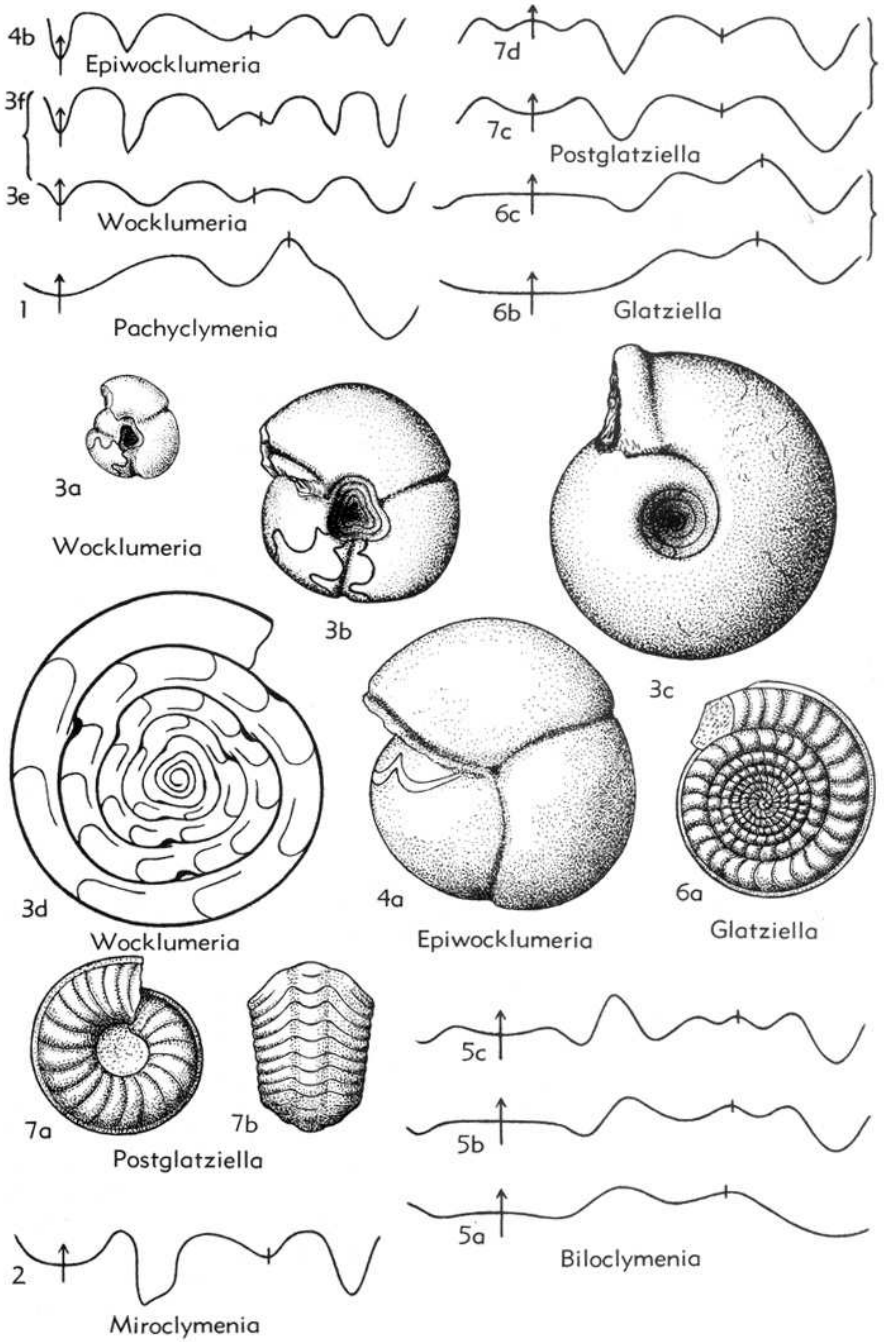


Fig. 40. Wocklumeriidae, Glatziellidae (p. L42).

Goniatitida str. dev. – vrch. perm

-planišpirálne vinutá schránka

-väčšinou hladká

-ventrálny, prochoanitický sifón

-goniatitová sutúra, niekedy ceratitová

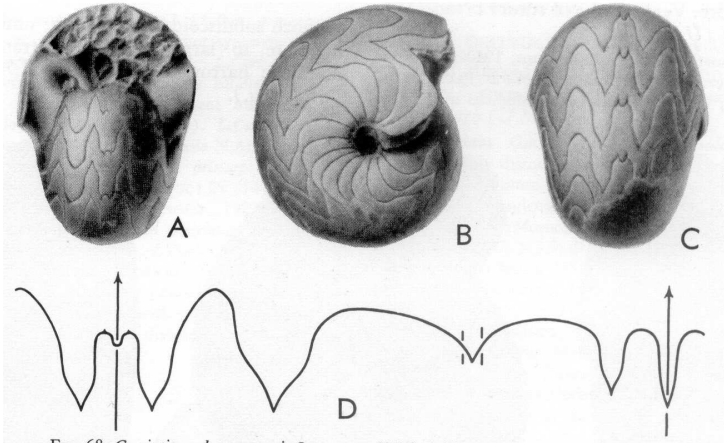


Fig. 68. *Goniatites choctawensis* Shumard, U.Miss., Tex.; *A-C*, ×2; *D*, ×4 (110).

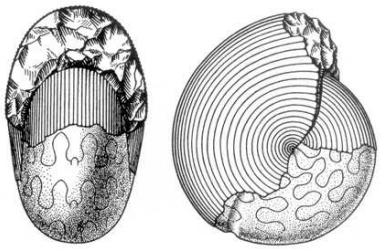


Fig. 57. *Agathiceras suessi* Gemmellaro, M.Perm. Sicily; ×2 (24).

Fig. 58. *Agathiceras frechi* Böse, U.Penn., Tex.; ×2 (54).

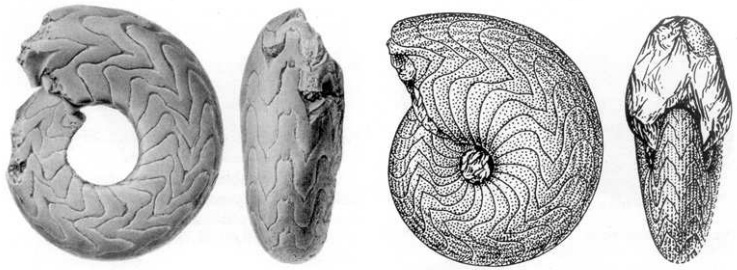


Fig. 85. *Pseudoparalegoceras williamsi* Miller & Downs, L.Penn., Ark.; ×0.6 (110).

Fig. 88. *Pseudogastrioceras abichianum* (Möller), U.Perm., Armenia; ×0.8 (103).

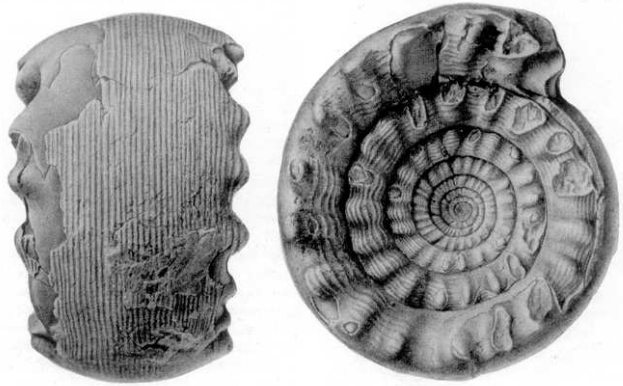


Fig. 86. *Paragastrioceras jossae* (de Verneuil), M.Perm., Urals; ×1.5 (110).

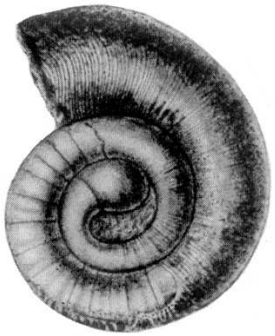


Fig. 19. *Mimagoniatites zorgensis* (Roemer), L. Dev., Ger.;

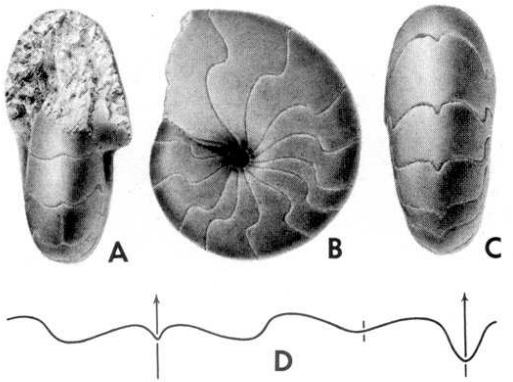


Fig. 48. *Tornoceras (Tornoceras) crebriseptum* Raymond, U.Dev., Mont.; *A-D*, enlarged (110).

Prolecanitida sp. karb. – sp. trias

-ploché, diskovité schránky, široký umb.
-väčšinou hladké
-ventrálny, retrochoanitický sifón
-goniatitová alebo ceratitová sutúra
-predkovia všetkých mezozoických amonoidov

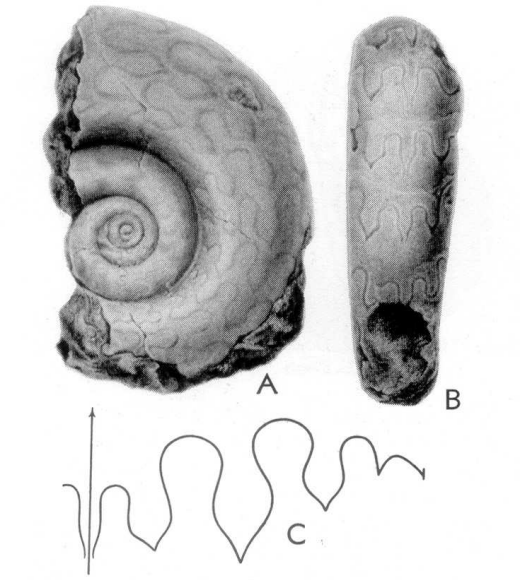


FIG. 111. *Prolecanites americanus* MILLER & GARNER, U.Miss., Ind.; *A,B*, ×1; *C*, ×2 (110).

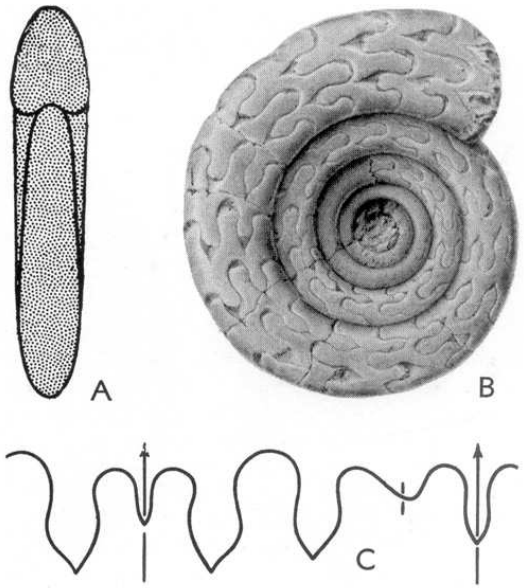


FIG. 112. *Protocanites lyoni* (MEEK & WORTHEN), L.Miss., Mo.; *A,B*, ×1; *C*, ×2 (110).

Ceratitida vrch. perm – vrch. trias

-planišpirálne vinutie, heteromorphy
-ornamentované
-ventrálny, prochoanitický sifón
-ceratitová, zriedkavo amonitová sutúra

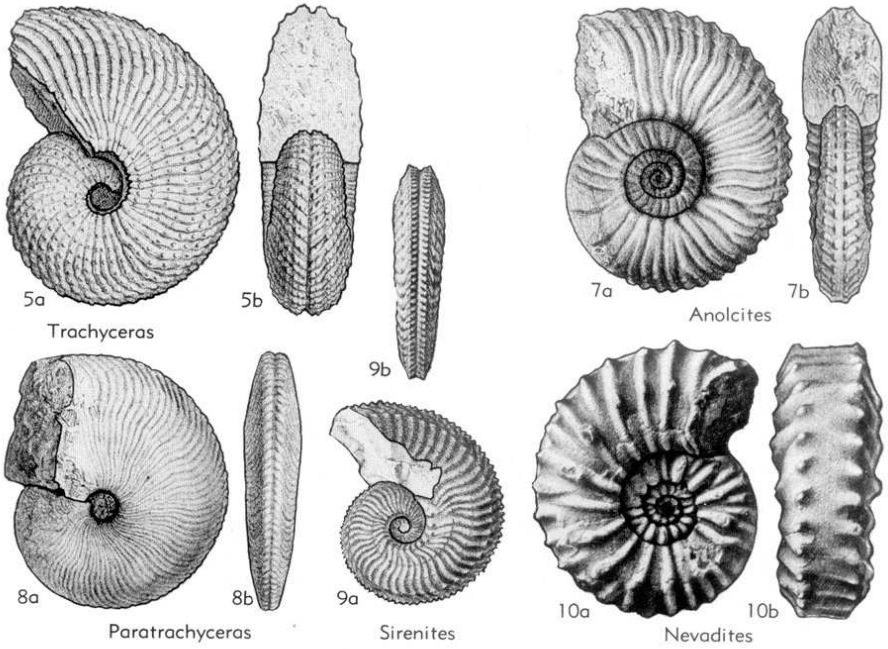


Fig. 190. Trachyceratidae (p. L158-L160).

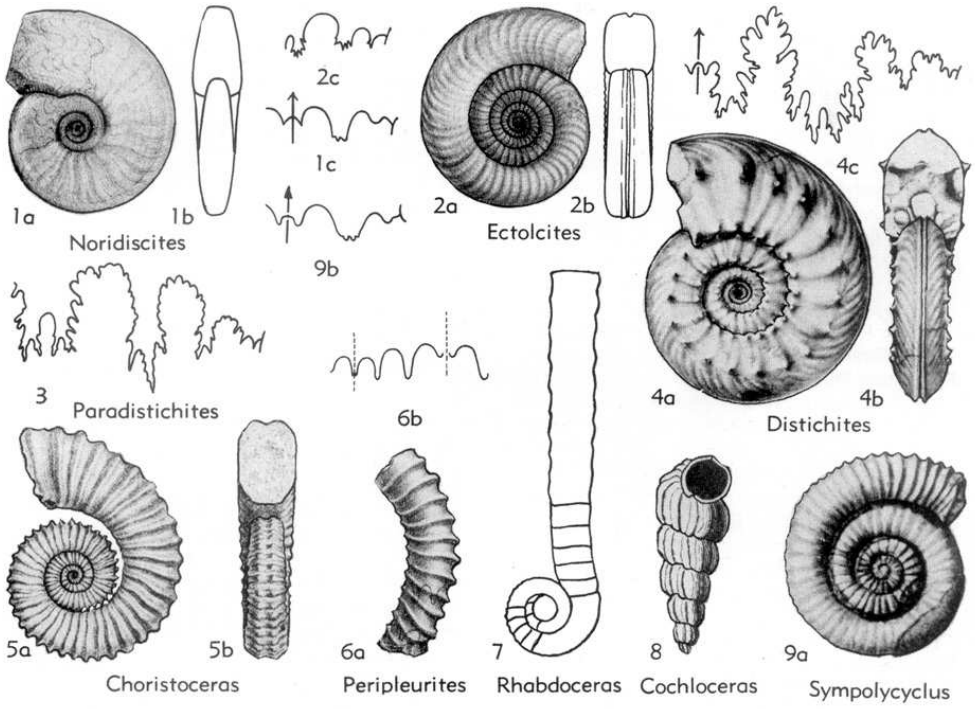
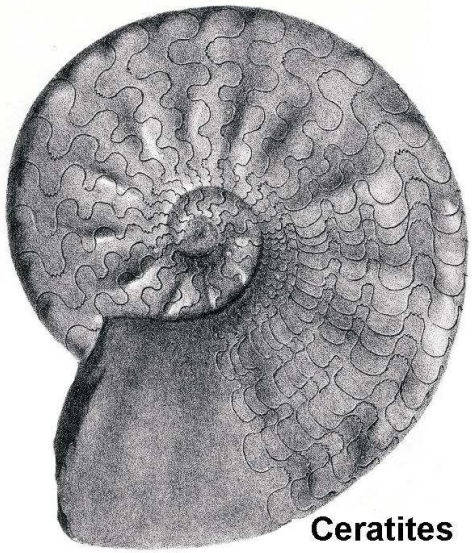


Fig. 199. Noridiscitidae, Distichitidae, Choristoceratidae, Cochloceratidae (p. L167-L169).



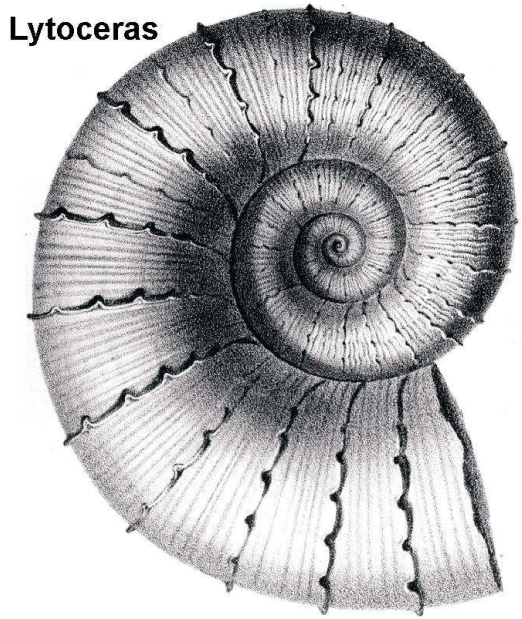
Ceratites

Ammonitida

Phylloceratina

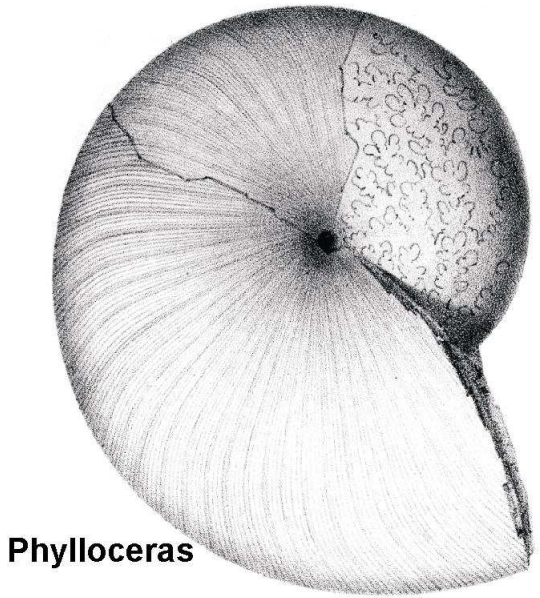
(trias – krieda)

-involútne schránky
-ventrálny sifón
-jednoduchá ornamentácia
-zložitá amonitová sutúra
s fyloidálnymi ukončeniami
-taxóny s dlhým stratigraf. r.



Ammonitina

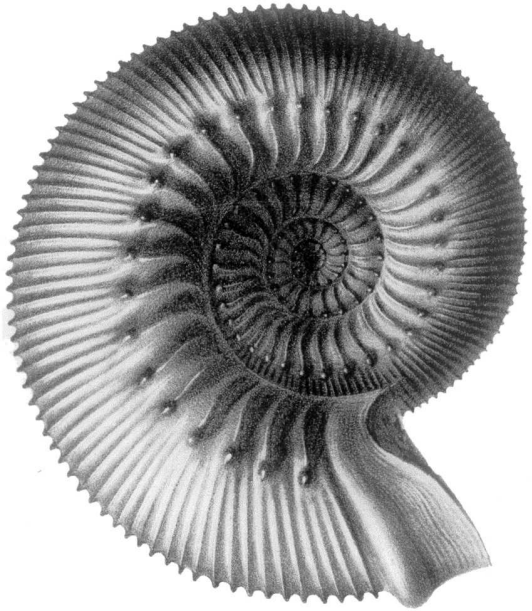
(sp. jura – vrch. krieda)
-evolútne i involútne
-heteromorfné
-ornamentované
-amonitová, v kriede
aj pseudoceratitová sut.
-polymorphismus



Lytoceratina

(jura – krieda)

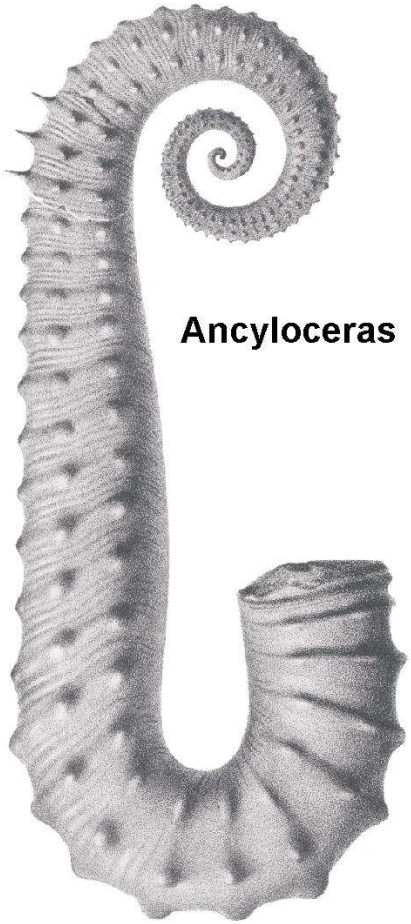
-evolútne schránky
-ventrálny sifón
-jednoduchá ornamentácia
-najkomplikovanejšie amon.
sutúry

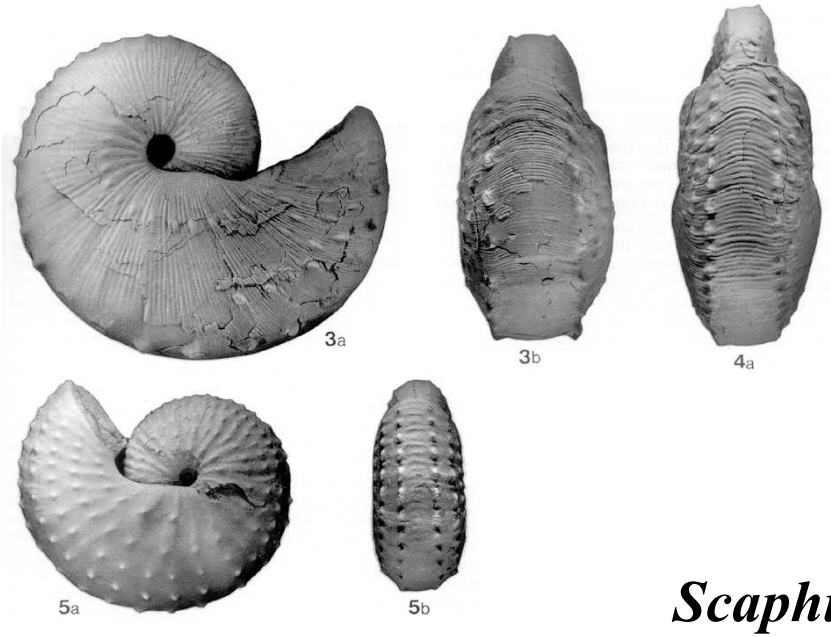


Cadomites psilacanthus (Wermbter, 1891), Upper Bajocian, Bayeux

Ancyloceratida (krieda)

-väčšinou heteromorfné schránky
-závity sa odlepujú
-často priama alebo hákovite zahnutá obýv. komôrka
-ornamentované
-sutúra amonitová, blízka lytoceratidnej





Scaphites

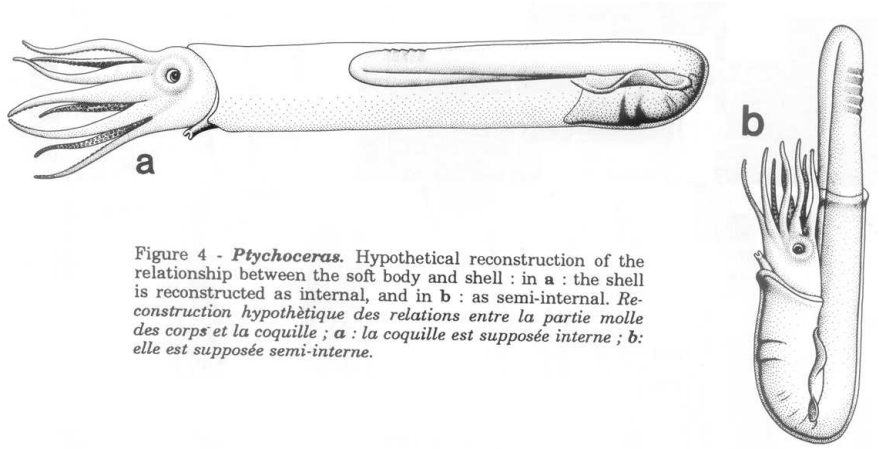


Figure 4 - ***Ptychoceras.*** Hypothetical reconstruction of the relationship between the soft body and shell : in **a** : the shell is reconstructed as internal, and in **b** : as semi-internal. *Reconstruction hypothètique des relations entre la partie molle des corps et la coquille ; **a** : la coquille est supposée interne ; **b**: elle est supposée semi-interne.*

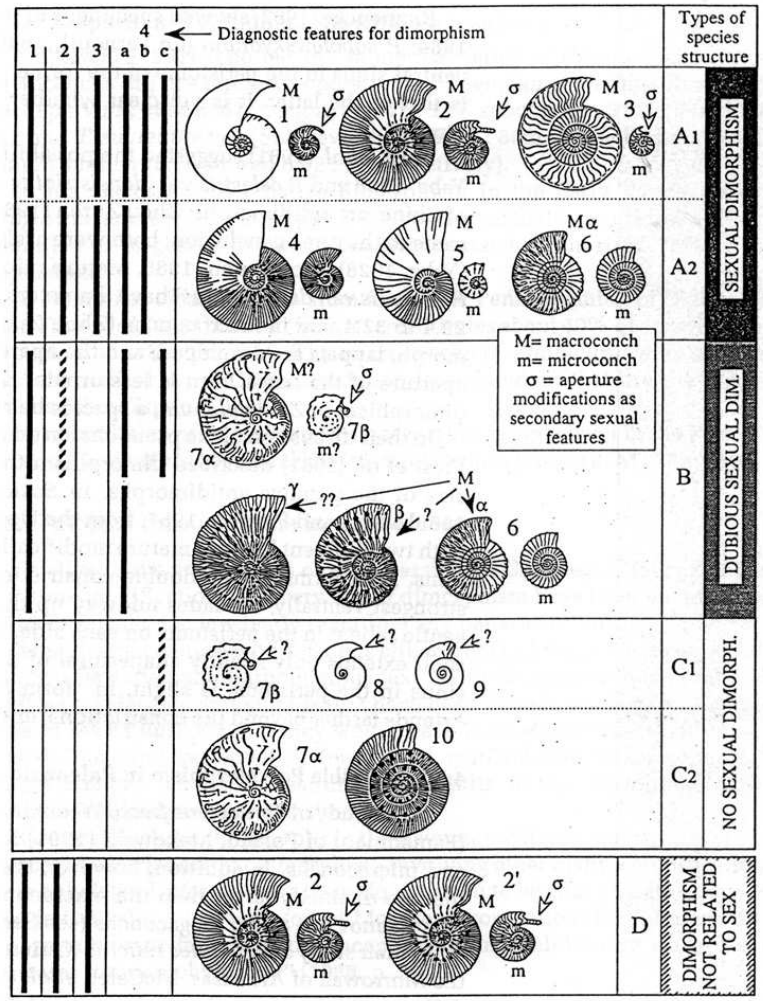


FIGURE 4. Significance of the main types of species structure in Jurassic ammonoids related to dimorphism, with an indication of their diagnostic features (striped bars indicate a level of uncertainty) and illustrations of some selected characteristic examples: 1 M and m, *Cardioceras* Neumayr and Uhlig, 1881; 2 M and m, *Kosmoceras* Waagen, 1869; 3 M and m, *Hildaites* Buckman, 1921; 4 M and m, *Macrocephalites* Zittel, 1884; 5 M and m, *Phricodoceras* Hyatt, 1900; 6 Mα and 6 m, *Aegoceras* Waagen, 1869; 6 Mβ, *Liparoceras* Hyatt, 1867; 6 Mγ, *Becheiceras* Trueman, 1918; 7α, *Taramelliceras* Del Campana, 1904; 7β, *Creniceras* Munier-Chalmas, 1892; 8, *Cymbites* Neumayr, 1878; 9, *Gemmellaroceras* Hyatt, 1900; 10, *Prodactylioceras* Spath, 1923. The types of species structure (A–D) and the diagnostic features for dimorphism (1–4) are discussed in the text.

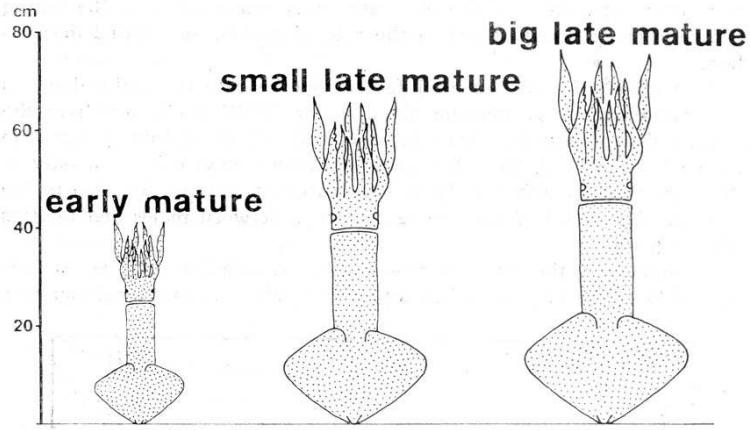
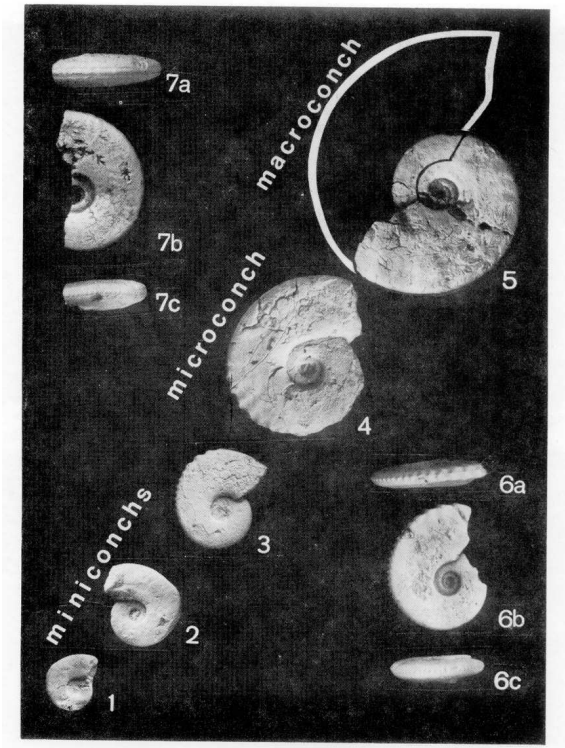
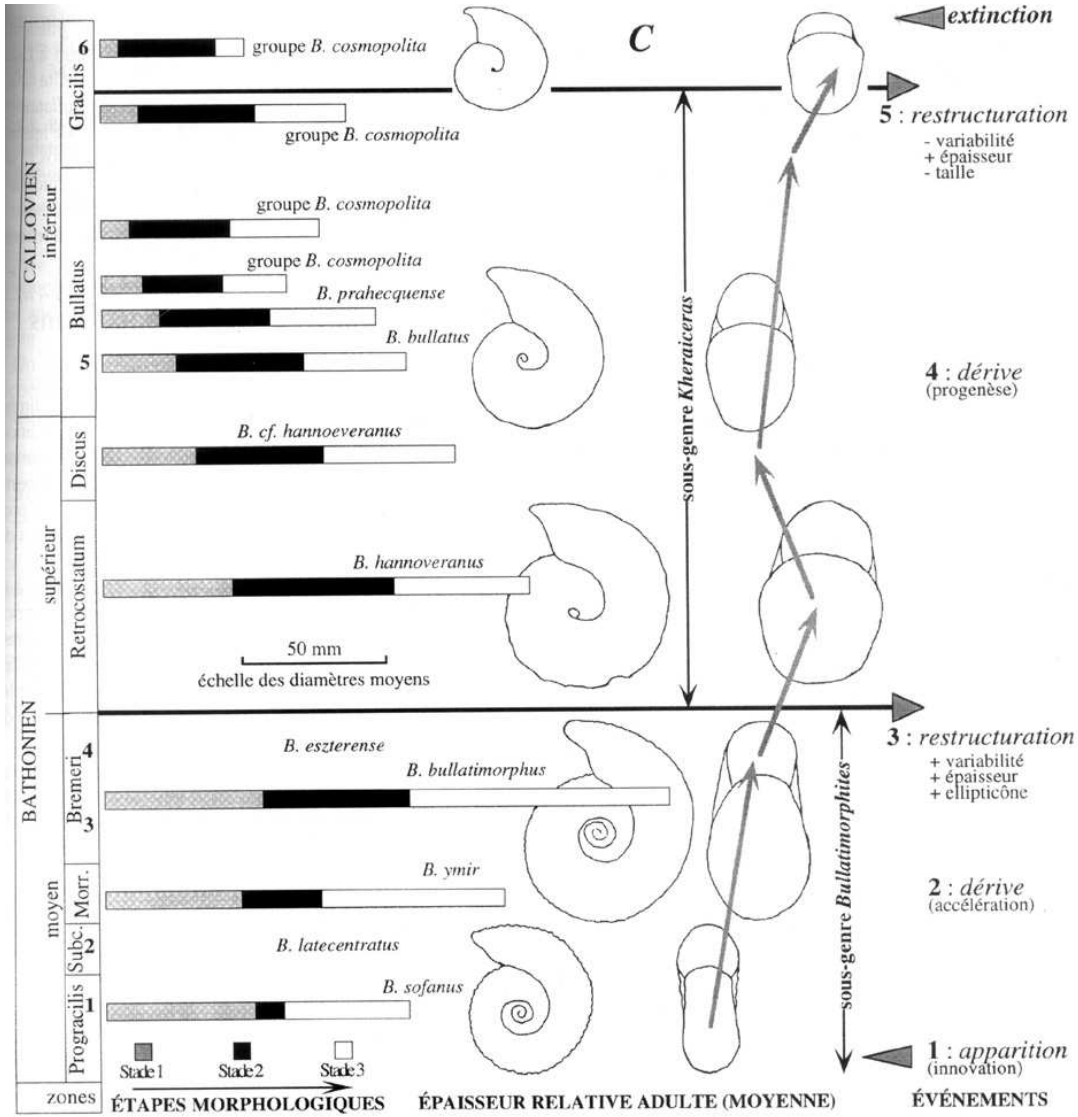


Fig. 9. Three-sized mature females of *Sthenoteuthis pteropus* from the tropical Atlantic (based on the data presented by ZUEV 1976)



Polymorphism among *Bukowskites distortum* (BUKOWSKI) and *Neocampylites* aff. *girardoti* (de LORIOL)



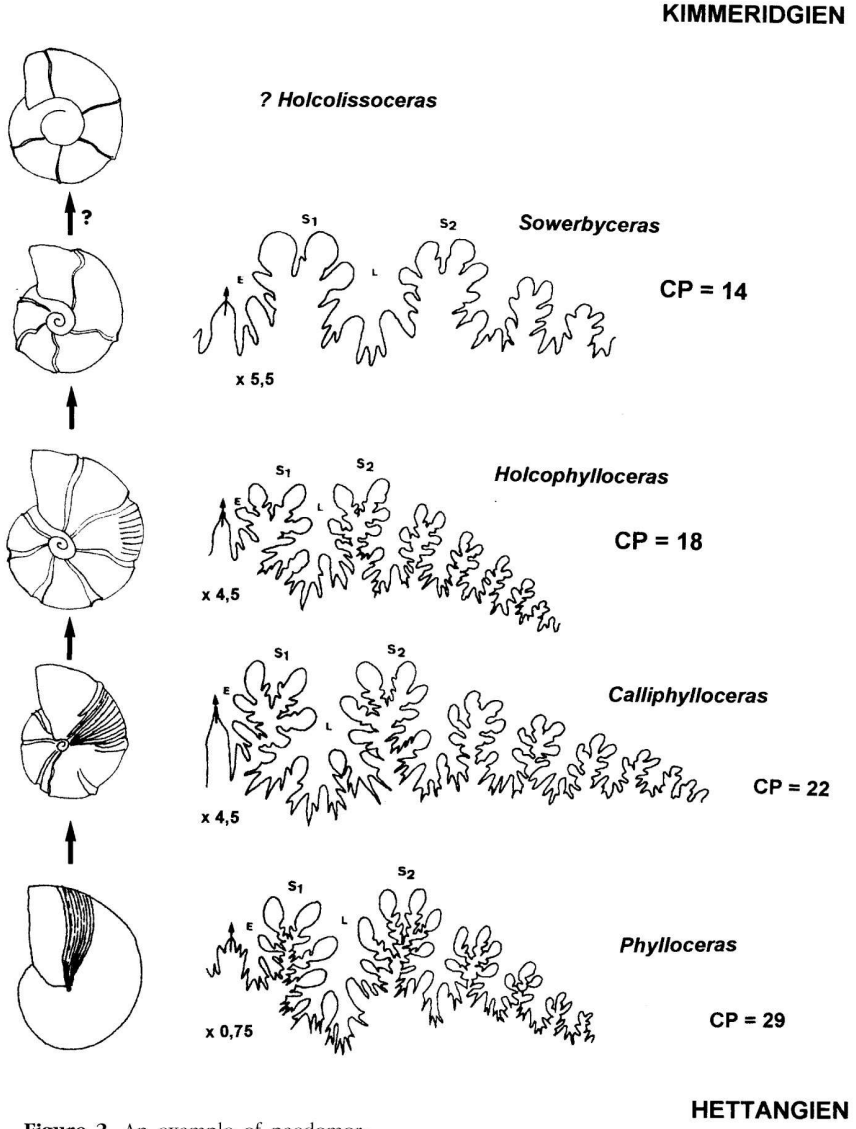


Figure 2. An example of paedomorphosis at the Calliphylloceratinae [10, modified].

Ammonoidea - evolúcia

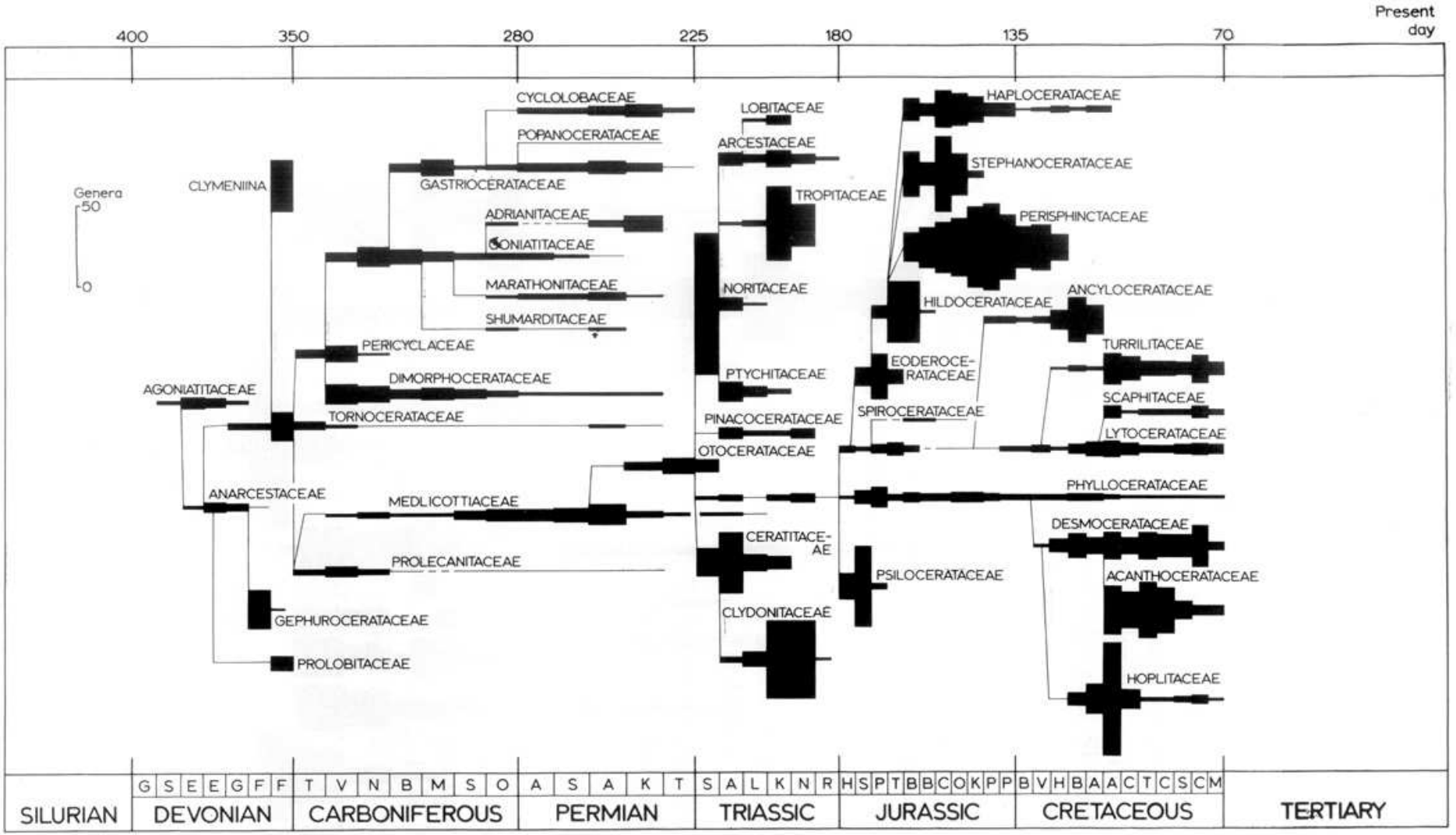


Fig. 3. Diagram showing the evolutionary relations of the major groups of ammonoid cephalopods as envisaged by authors of the first edition of the ammonoid *Treatise* (based on data in Moore, 1957).

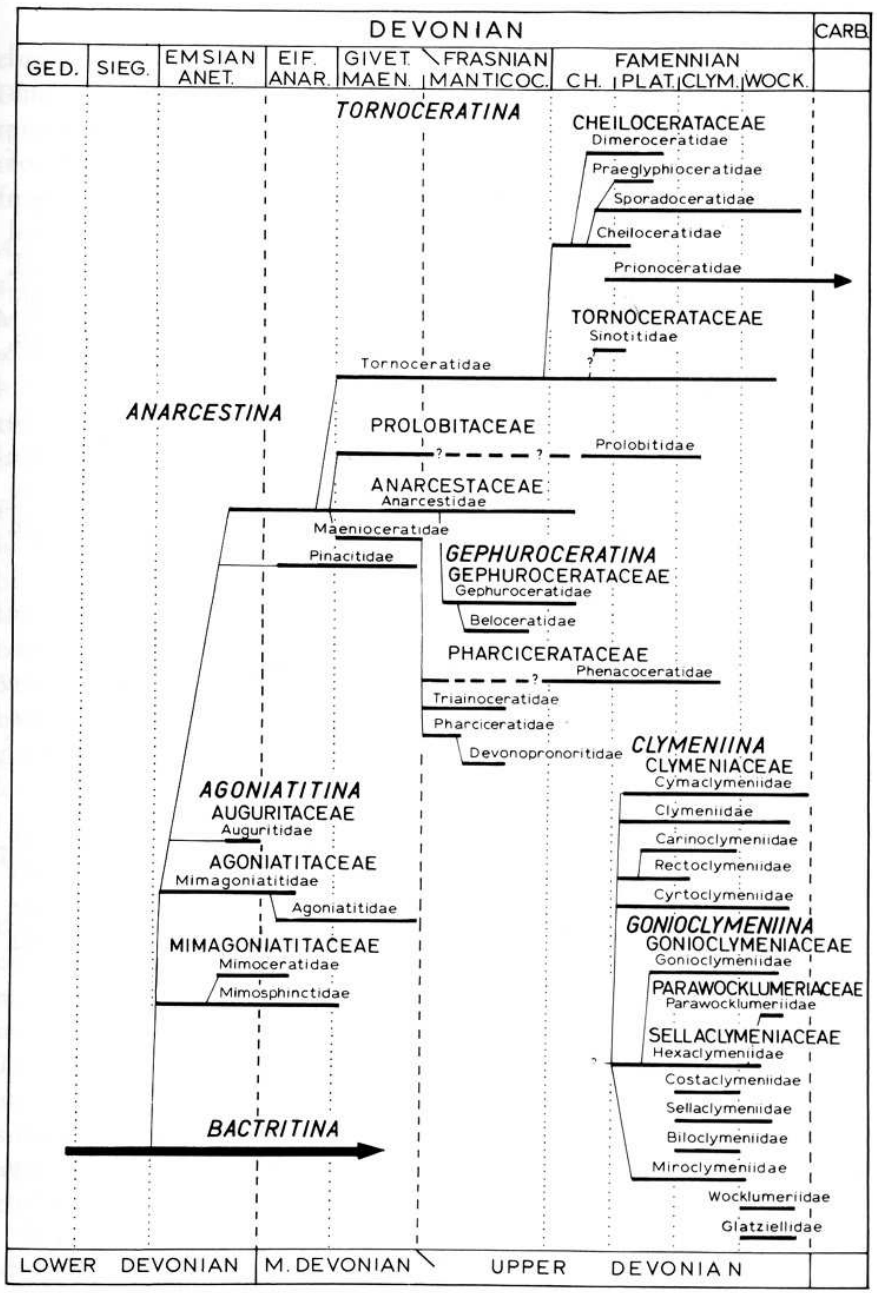


Fig. 4. Diagram showing the supposed evolutionary relations of Devonian ammonoid groups (excluding Bactritina).

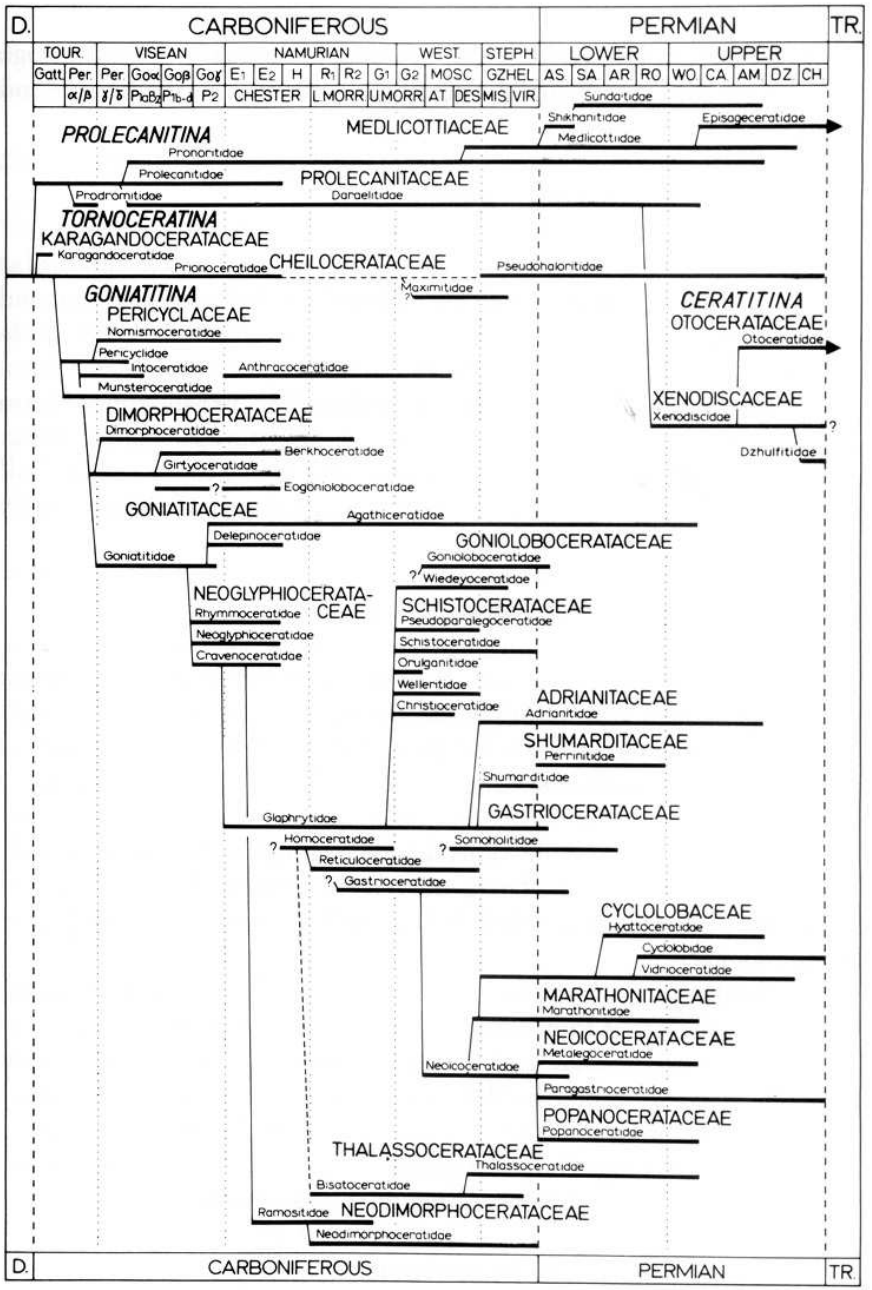


Fig. 1. Chart showing the phylogeny and range of the Carboniferous and Permian ammonoid families and superfamilies.

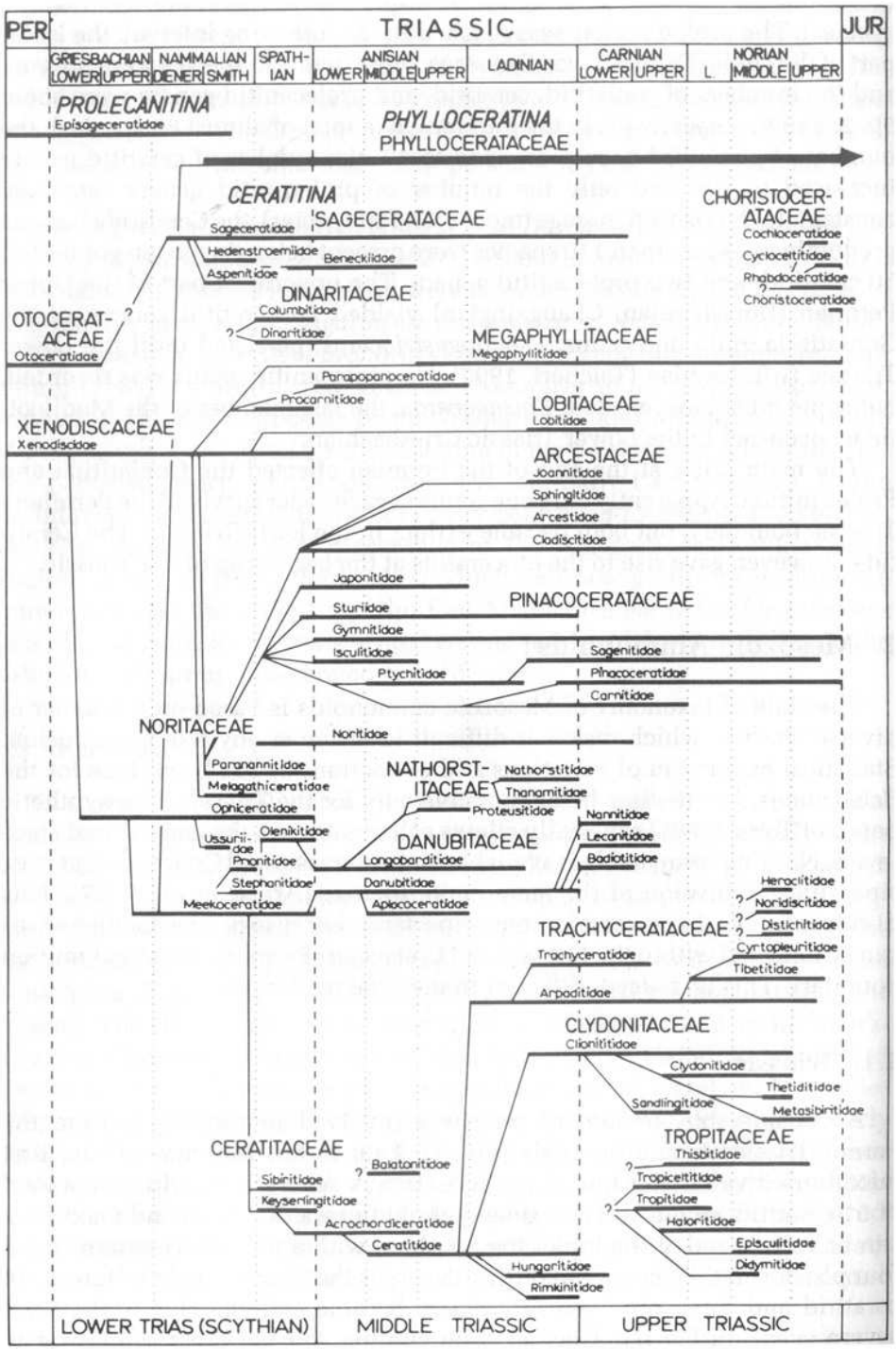


FIGURE 1. Evolution of Triassic ammonoid families (after Tozer, 1981)

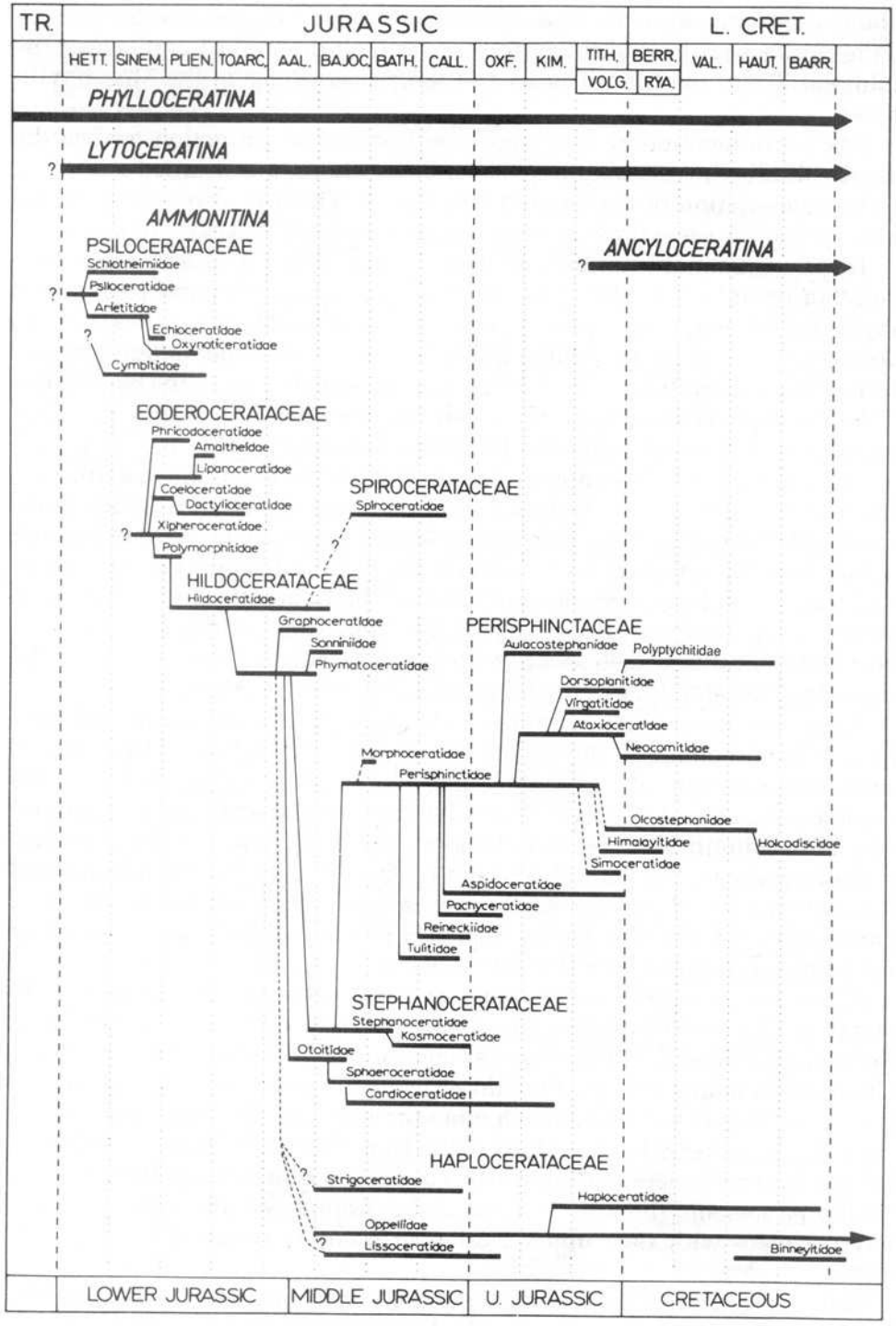


FIGURE 2. Evolution of Jurassic and Lower Cretaceous ammonoid families (after Donovan *et al.*, 1981).

Extinction

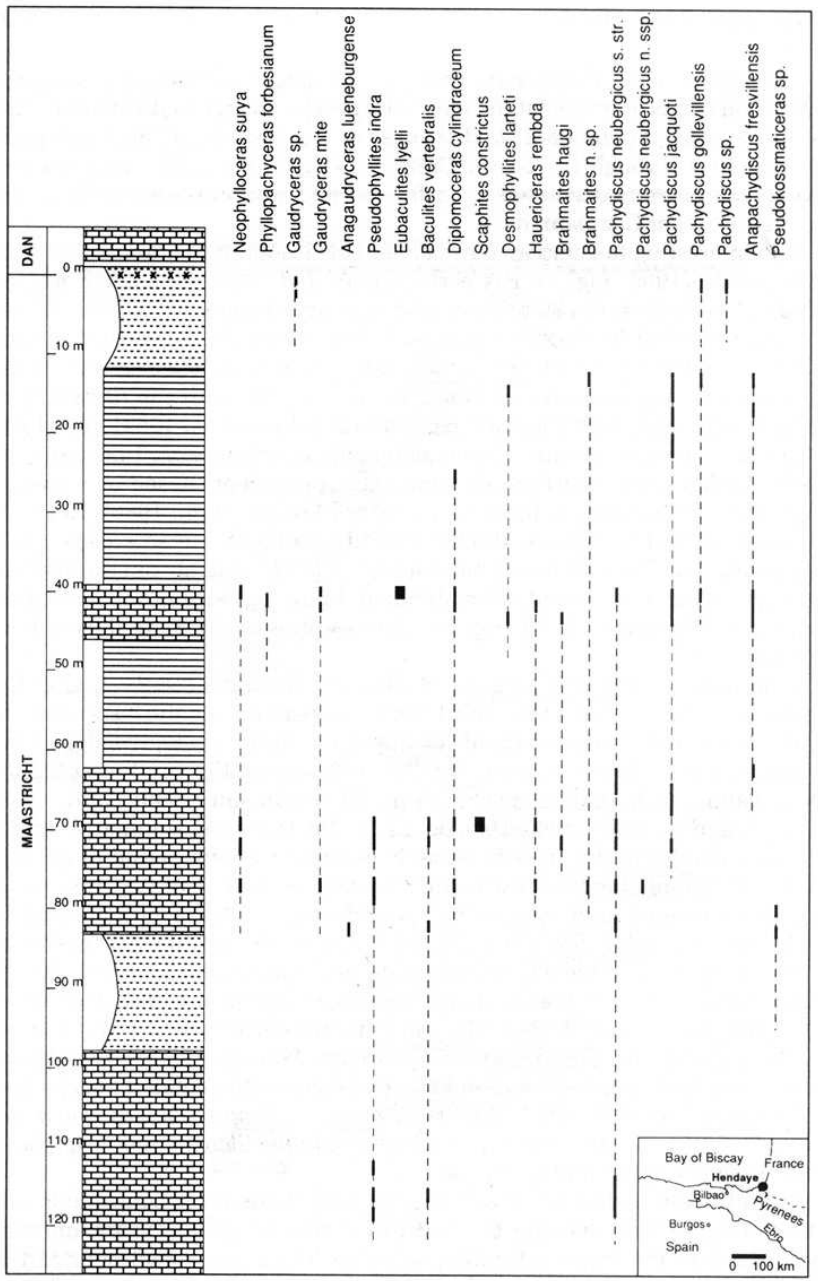


FIGURE 4. Ranges and decline of late Maastrichtian ammonoids in the Hendaye section, southwestern France.

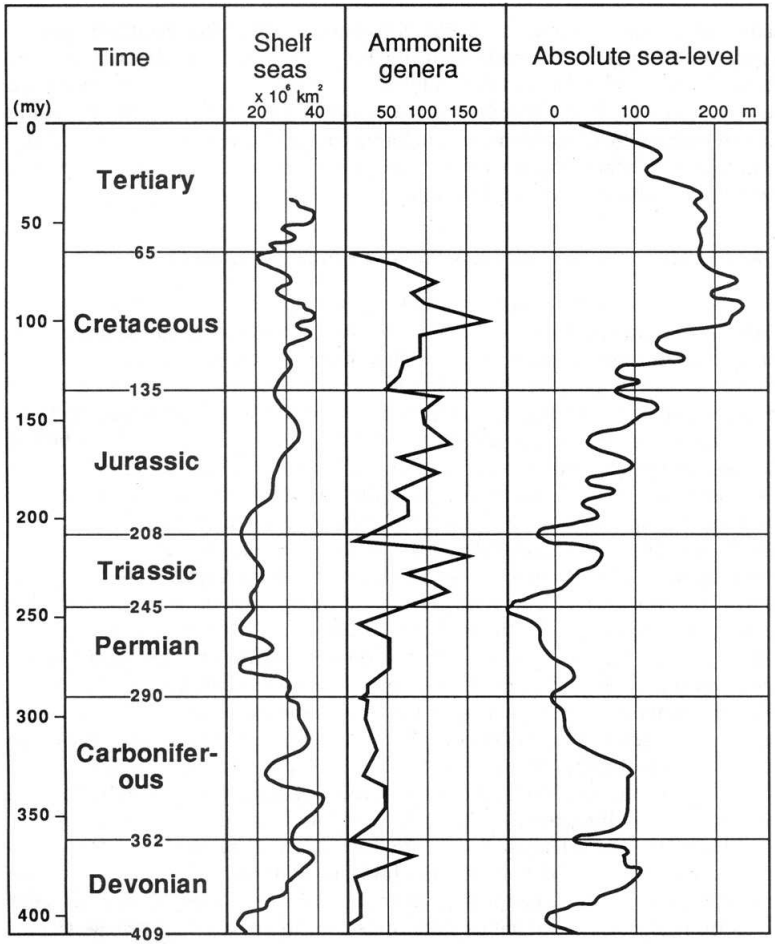


FIGURE 5. Comparison of ammonoid diversity through time (after House, 1985b) with sea-level fluctuations of shelf seas (after Sliter, 1976; Yanshin, 1973) and long-term eustatic sea-level changes (after Haq *et al.*, 1987; House, 1989).

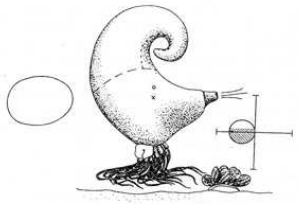
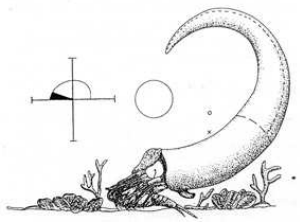


Figure 20.13 Brevicones: the endogastric cyrtobrevicone Phragmoceras of the Discosorida, with a compressed shell of almost one whorl, has the hyponome at the height of the dynamic centre. It is here seen as a moderately good forward swimmer above a shallow substrate with brachiopod prey (for diagram explanation, see Figure 20.9)



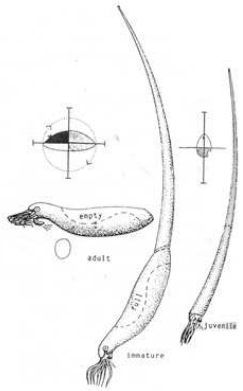


Figure 20.15 Juvenile and adult Ascoceras of the Ascocerida. The curvi-longiconic juvenile, without deposits, as in Figure 20.9, is followed by a unique Sepia-like adult stage. After truncation of the (?)planktic juvenile stage, the adult shell becomes an efficient design for horizontal swimming in the forward and backward directions, as well as for inclined and vertical swimming after rotation (for diagram explanation, see Figure 20.9)

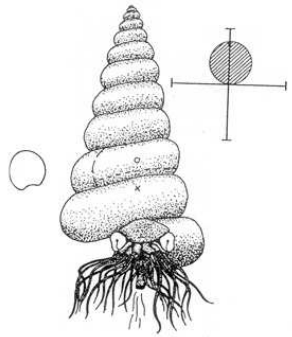


Figure 20.16 Torticones: the high-spired Foersteoceras of the Oncocerida, with strong, circular whorls. It is here seen swimming upwards, escaping benthic predators (for diagram explanation, see Figure 20.9)

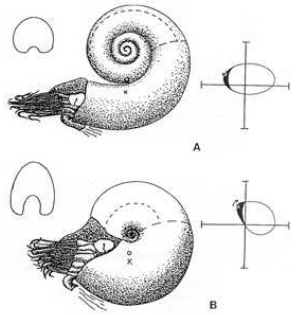
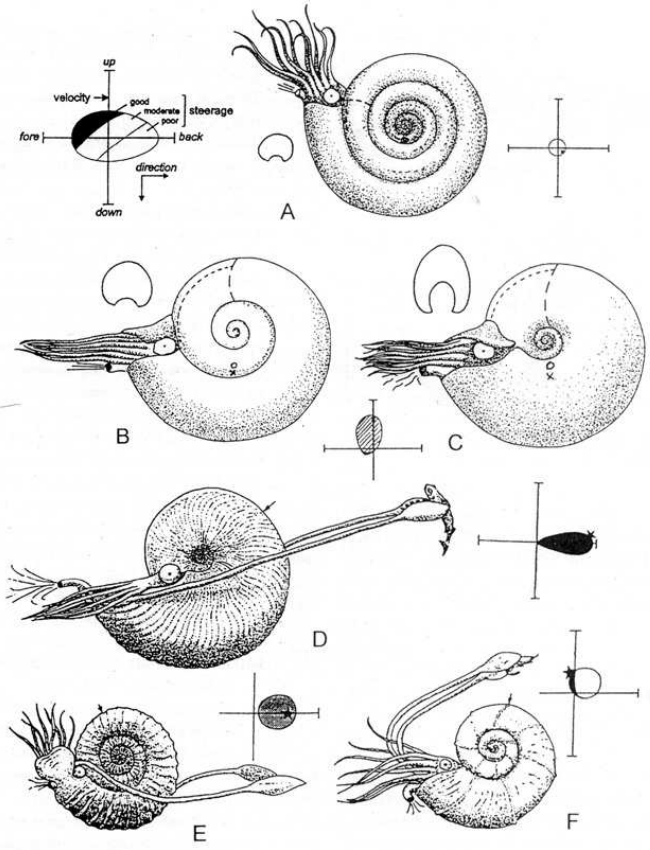


Figure 20.17 Nautilicones. A. The evolute tarphyceric Curtoceras, with depressed (planorbiconic) whorls and uncoiling (egressing) body chamber. B. The involute Nautilus, with compressed (discoconic) whorls. Both have good stability because of the "short" body chamber (brevidome), and are adapted for swimming forward and backward, with "rocking" but good forward steerage (for diagram explanation, see Figure 20.9)



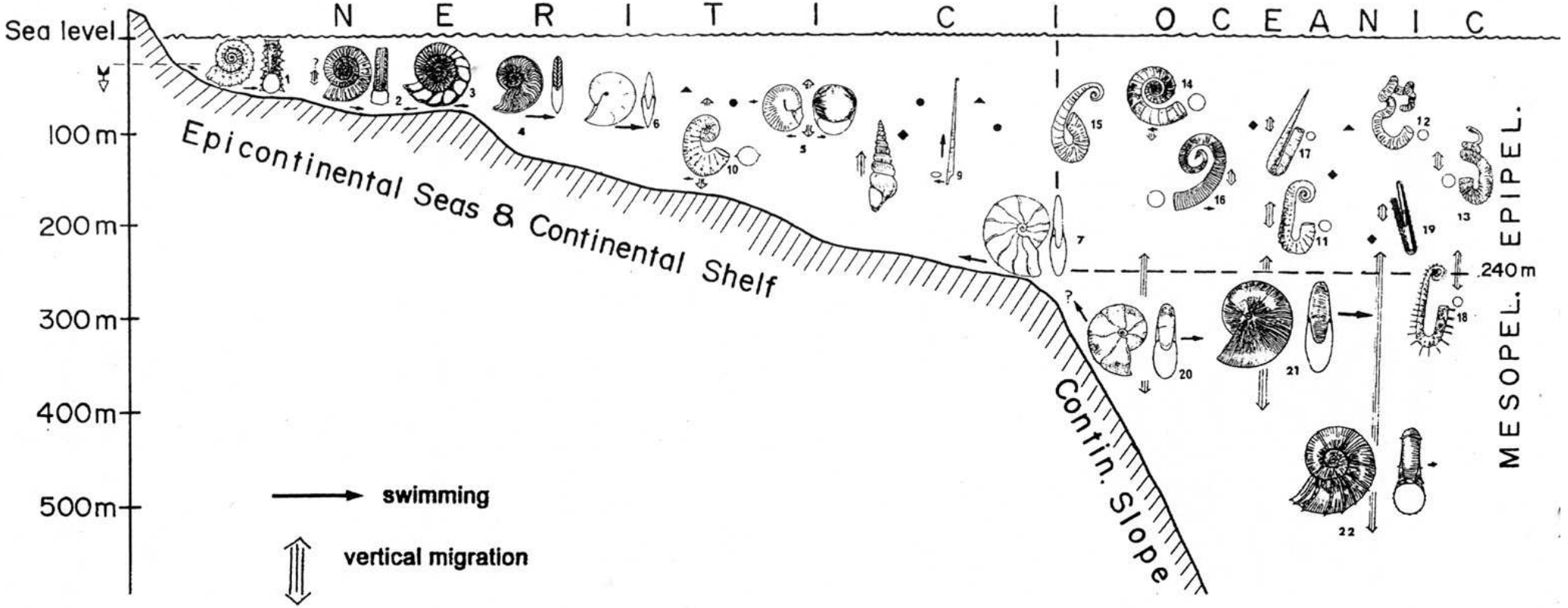
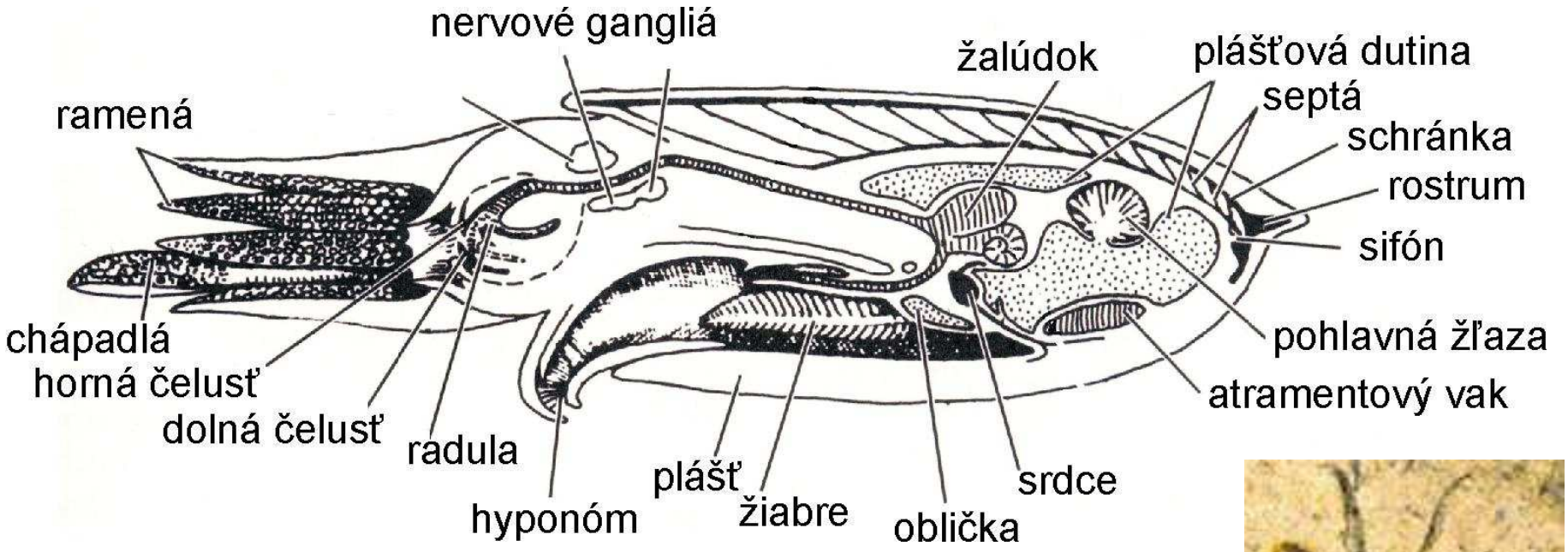


FIGURE 14. Stylized panorama of Jurassic–Cretaceous ammonoid habitats (with substantial modifications of Westermann, 1990, Fig. 7). As for the Triassic (Fig. 13), present interpretations suggest more pelagic, often shallower habitats and more frequent vertical migration. Ammonitina: 1, *Peltoceras*; 2, *Arietites*; 3, *Perisphinctes*; 4, *Harpoceras*; 5, *Sphaeroceras*; 6, *Oxycerites*; 7, *Barremites*. Ancyloceratina: 8, *Turrilites*; 9, *Baculites*; 10, *Scaphites*; 11, *Ancyloceras*; 12, *Nipponites*; 13, *Didymoceras*; 14, *Crioceratites*; 15, *Labeceras*; 16, *Glyptoxoceras*; 17, *Hamulina*; 18, *Anisoceras*; 19, *Pseudoxybeloceras*. Phylloceratina: 20, *Holcophylloceras*; 21, *Phylloceras*. Lytoceratina: 22, *Lytoceras*.

Coleoidea

Sepia officinalis



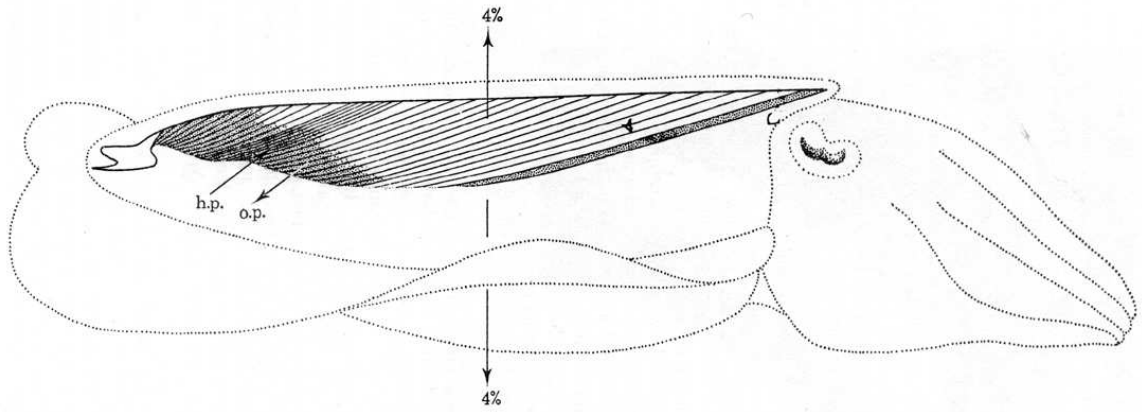
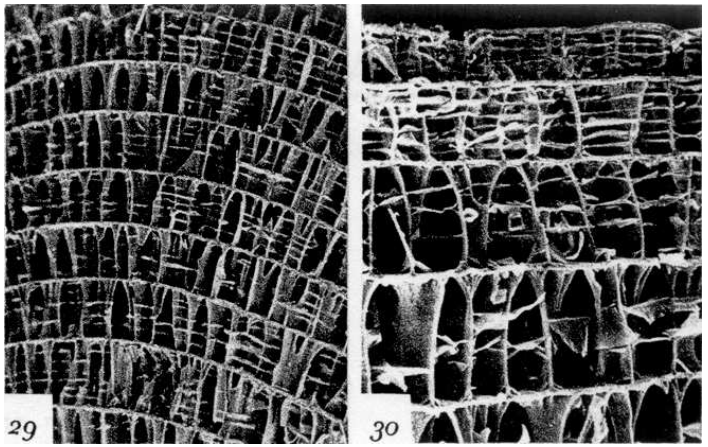
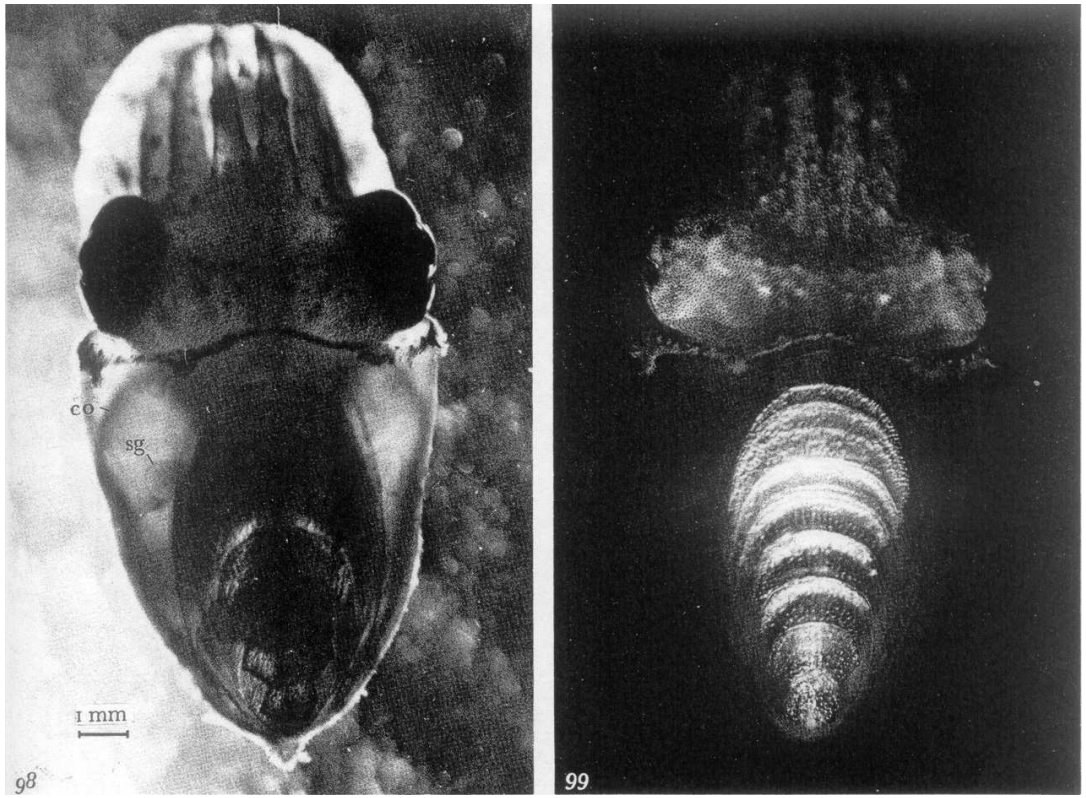
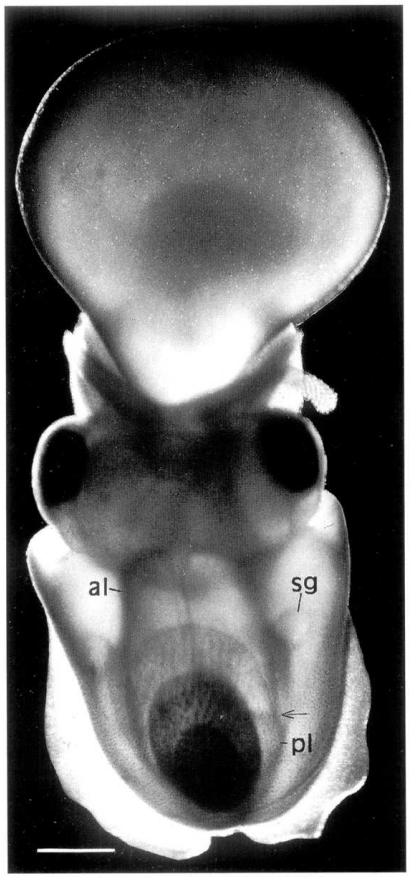


Figure 2.1 *Sepia*, showing position of cuttlebone. The chambers contain both liquid (stippled) and gas. Hydrostatic pressure (h.p.) tends to force liquid into the chambers, while osmotic pressure (o.p.) causes liquid to move out of the chambers and into the siphuncle (figure from Denton 1974).

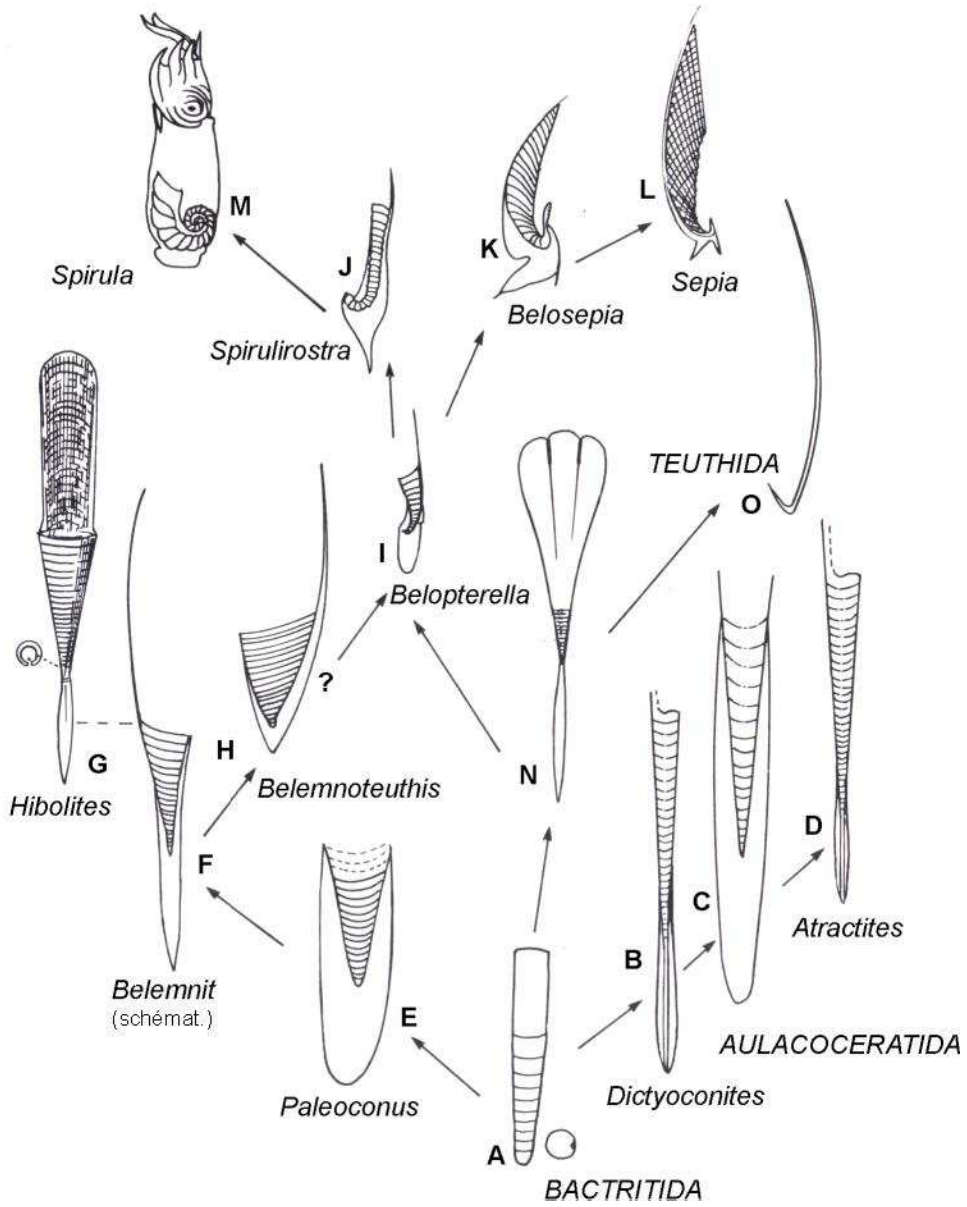




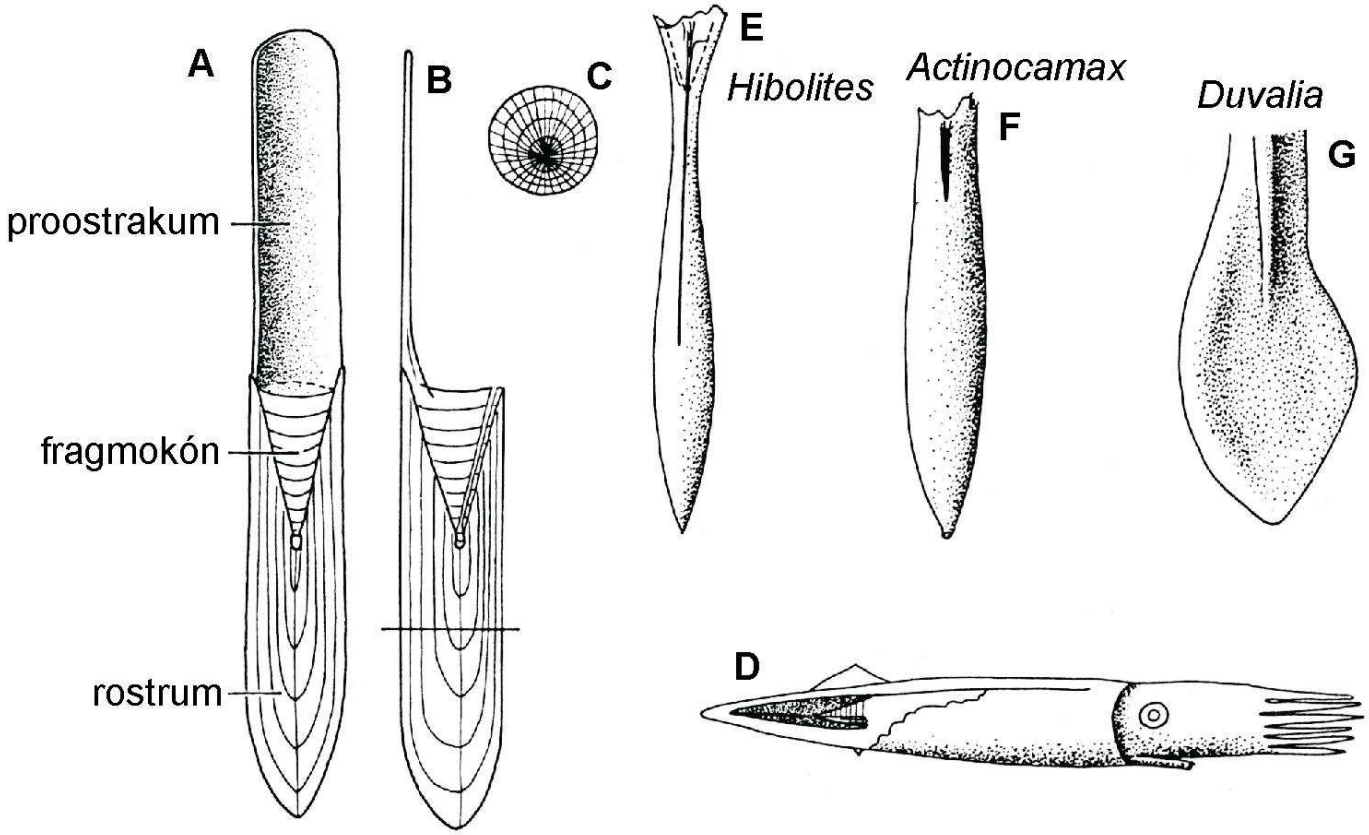


Text-Fig. 10.
An embryo of *Sepia officinalis* at stage XVIII of NAEF, in dorsal view.
The outer yolk sac (above) is still very large.

Nadrad **Belemnoidea** (?dev., karb. - krieda**)**
  Rad **Aulacoceratida** (?dev., karb. – jura**)**
  Rad **Belemnitida** (jura – krieda)
  Rad **Diplobelida** (jura – krieda)
Neisté taxonomické postavenie**:**
  Rad **Phragmoteuthidida** (perm - jura**)**
Nadrad **Decabrachia** (krieda - recent)
  Rad **Spirulida** (krieda – recent)
  Rad **Sepiida** (krieda – recent)
  Rad **Sepiolida** (recent)
  Rad **Teuthida** (jura – recent)
Nadrad **Octobrachia** (trias - recent)
  Rad **Loligosepiida** (trias – neogén)
  Rad **Vampyromorpha** (recent)
  Rad **Octopoda** (neogén – recent)
  Rad **Cirroctopoda** (jura/kr. – recent)



Belemnitida (jura – krieda)



Octobranchia - Octopoda

Argonauta sp.

Octopus vulgaris

Hapalochlaena lunulata

Bathypolypus arcticus

Sepiida

Sepia apama

Sepioloidea lineolata

Sepia officinalis

Sepia pharaonis

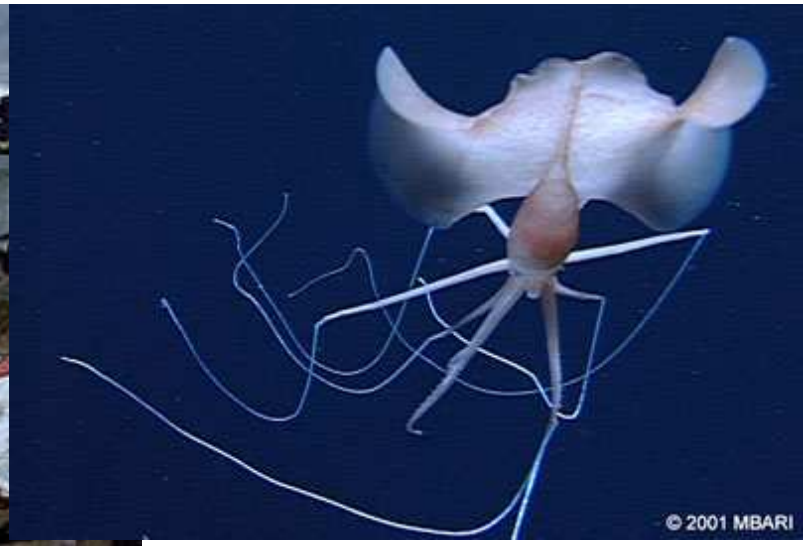
Sepioloidea

Rossia pacifica

Euprymna scolopes

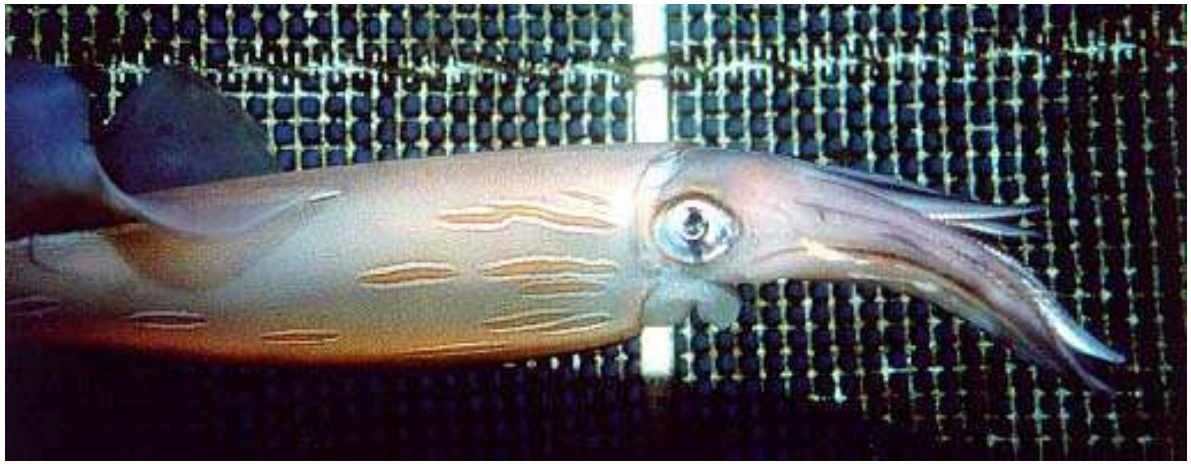
Teuthida

Architeuthis dux



deap-sea squid

Loligo forbesi



Vampyromorpha

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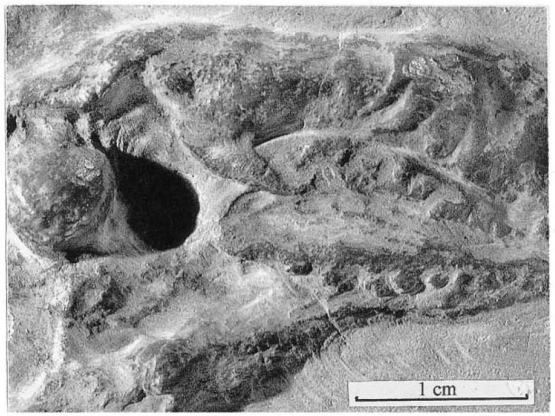
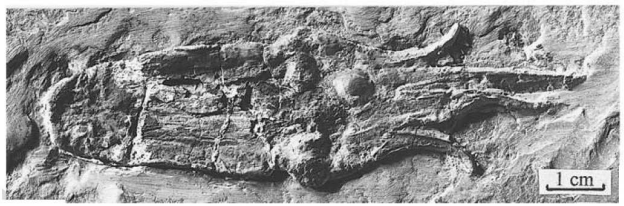
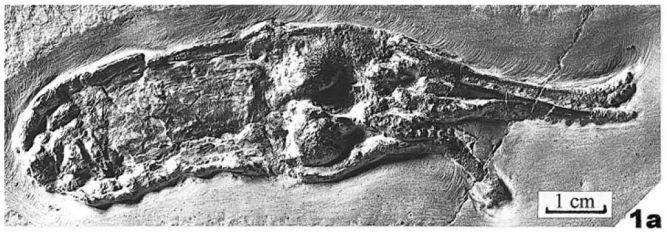
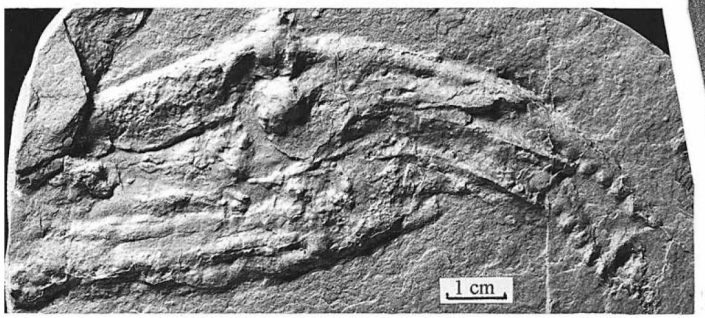
Photograph by Kim R. Reisenbichler, MBARI. ©1996

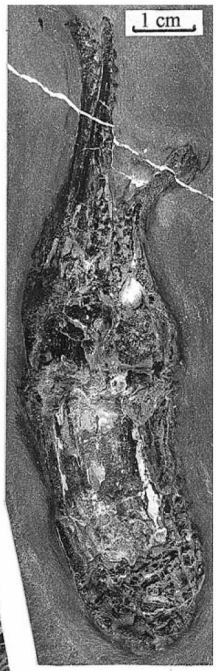
Vampyromorpha











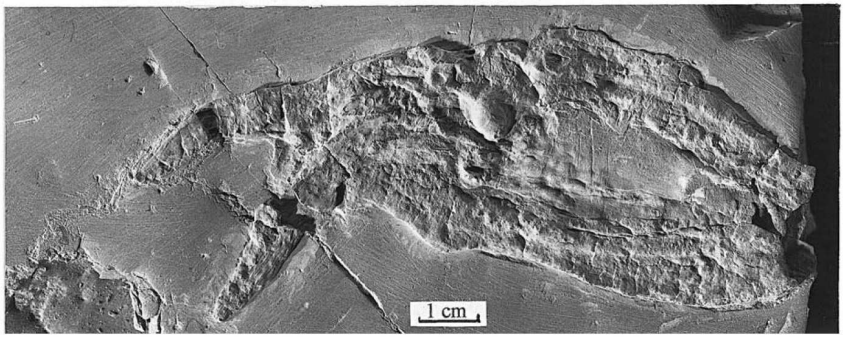


Planche I. *Vampyronassa rhodanica* nov. gen., nov. sp.