Echinodermata

- П/т Homalozoa (Camb.-Dev.)
  - Ctenocystoidea
  - Homostelea
  - Stylophora
  - Homoiostelea

- П/т Blastozoa
  - Eocrinoidea (Camb.-Sil.)
  - Blastoidea (Camb.-Perm.)
  - Parablastoidea (Ord.)
  - Cystoidea (Ord.-Dev.)
    - Rombifera
    - Diploporita

- П/т Crinozoa (Pelmatozoa)
  - Paracrinoidea (Ord.-Sil.)
  - Crinoidea (Camb.-pr.)

- П/т Echinozoa
  - Camptostromatoidea (Camb.)
  - Helicoplacoidea (Camb.)
  - Edrioasteroidea (Camb.-Carb.)
  - Edrioblastoidea (Ord.)
  - Cyclocystoidea (Ord.-Dev.)
  - Ophiocystoidea (Ord.-Carb.)
  - Echinoidea (Ord.-pr.)
  - Holothuroidea (Ord.-pr.)

- П/т Asterozoa (Stelleroidea)
  - Somasteroidea (Ord.)
  - Asteroidea (Ord.-pr.)
  - Ophiuroidea (Ord.-pr.)

Chordata Echinodermata

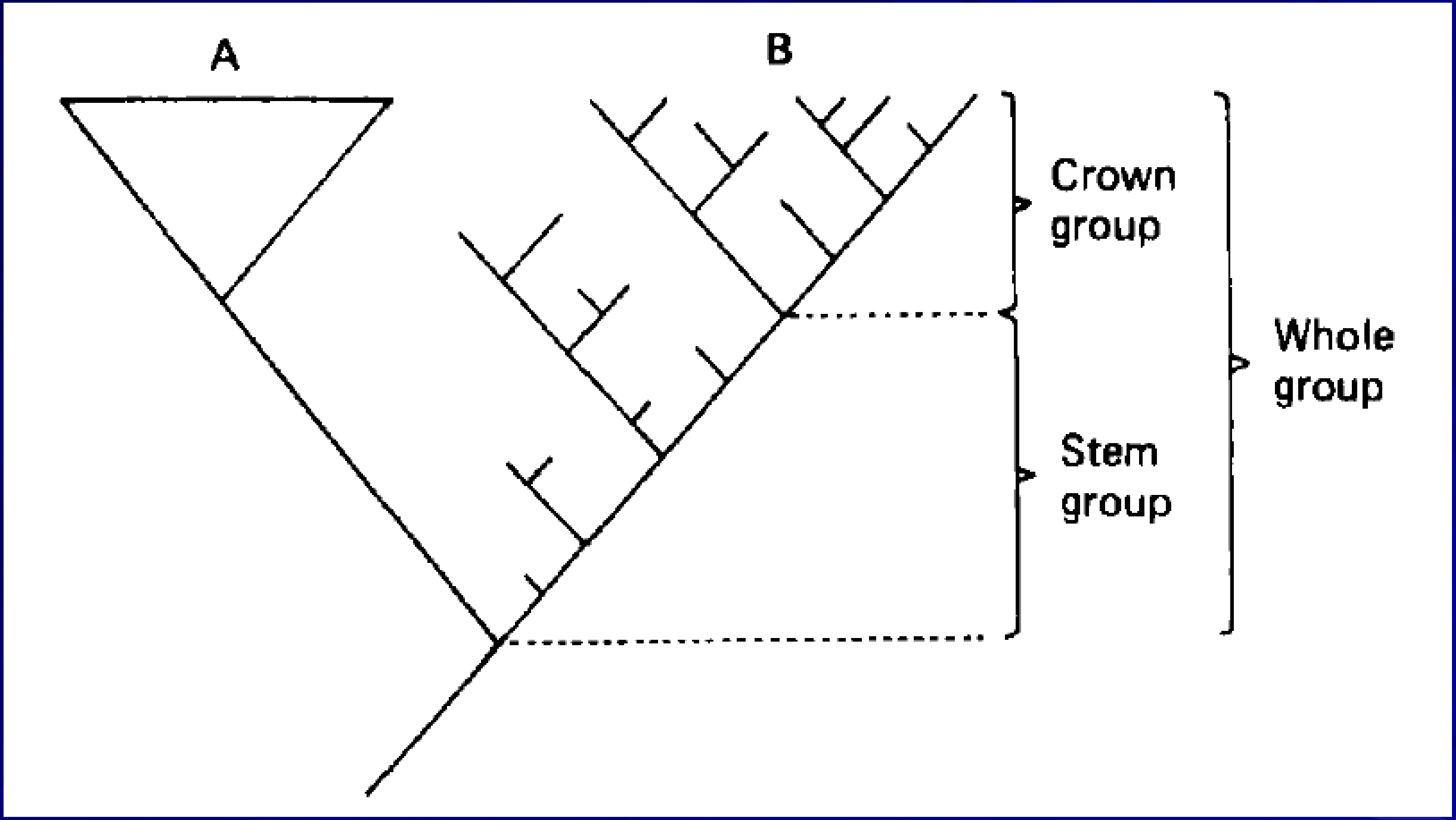
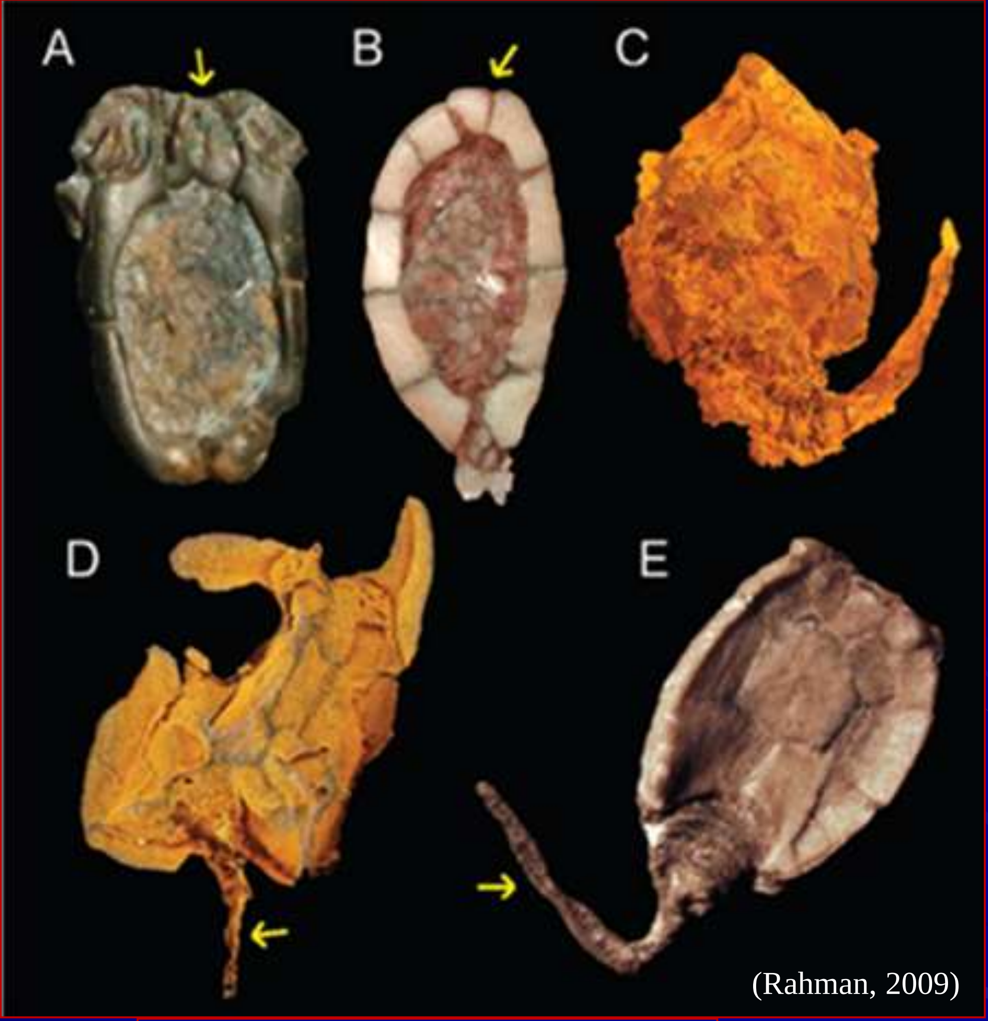


Diagram to show the relationship between stem and crown groups (Paul, Smith, 1984).

Тип Echinodermata (Ubaghs, 1978)

- П/т Homalozoa = Carpoida = Calcichordata
  - Ctenocystoidea
  - Homostelea (**Cincta)**
  - Stylophora (**Cornuta +Mitrata)**
  - Homoiostelea (Soluta)

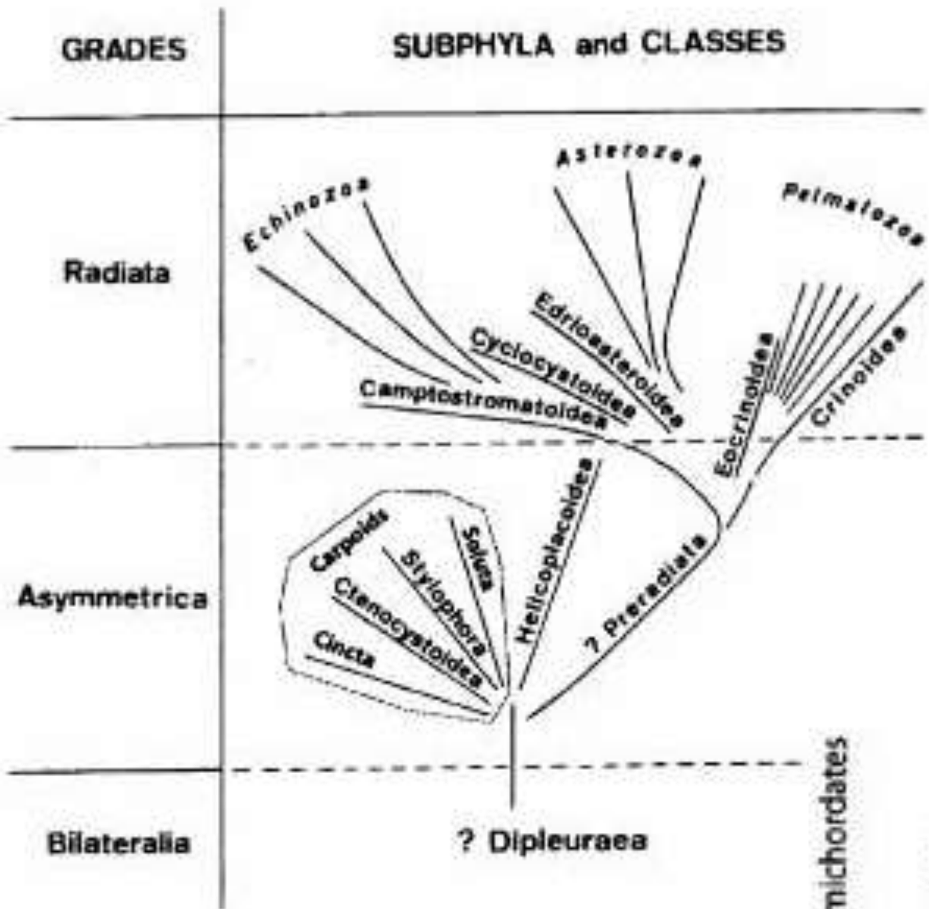
- П/т Pelmatozoa
  - Eocrinoidea
  - Rombifera
  - Diploporita
  - Blastoidea
  - Parablastoidea
  - Paracrinoidea
  - Crinoidea

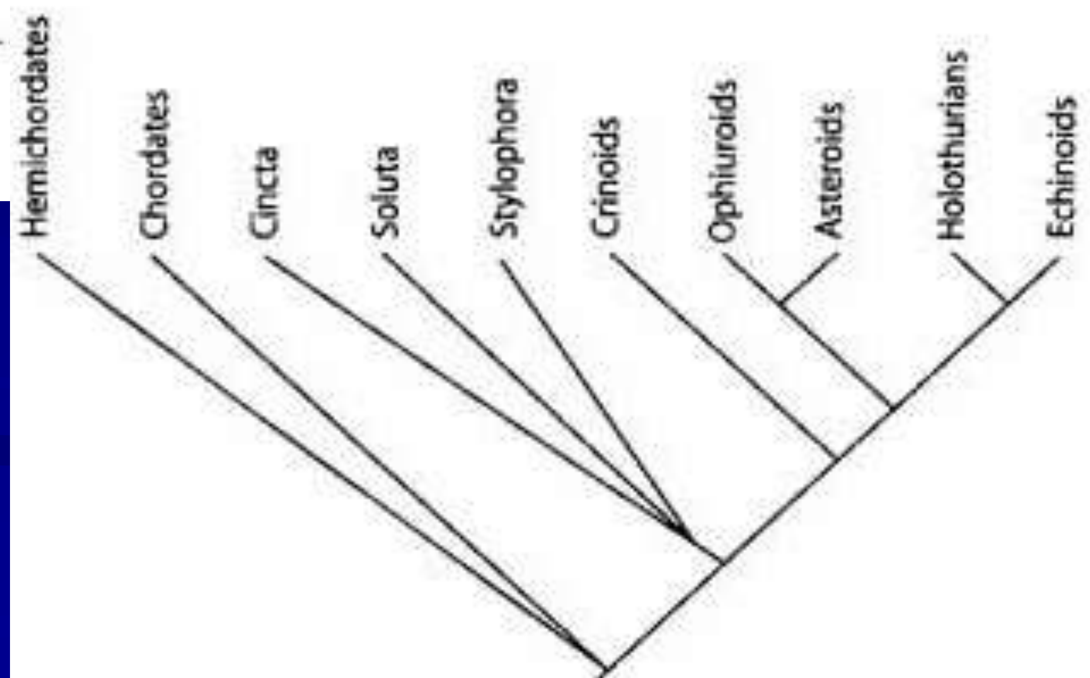


(Rahman, 2009)

A, Ctenocystoidea,
B, Homostelea
C, Homoiostelea,
D, E, Stylophora

Rival hypotheses concerning the position of carpoids (Smith, 2003)



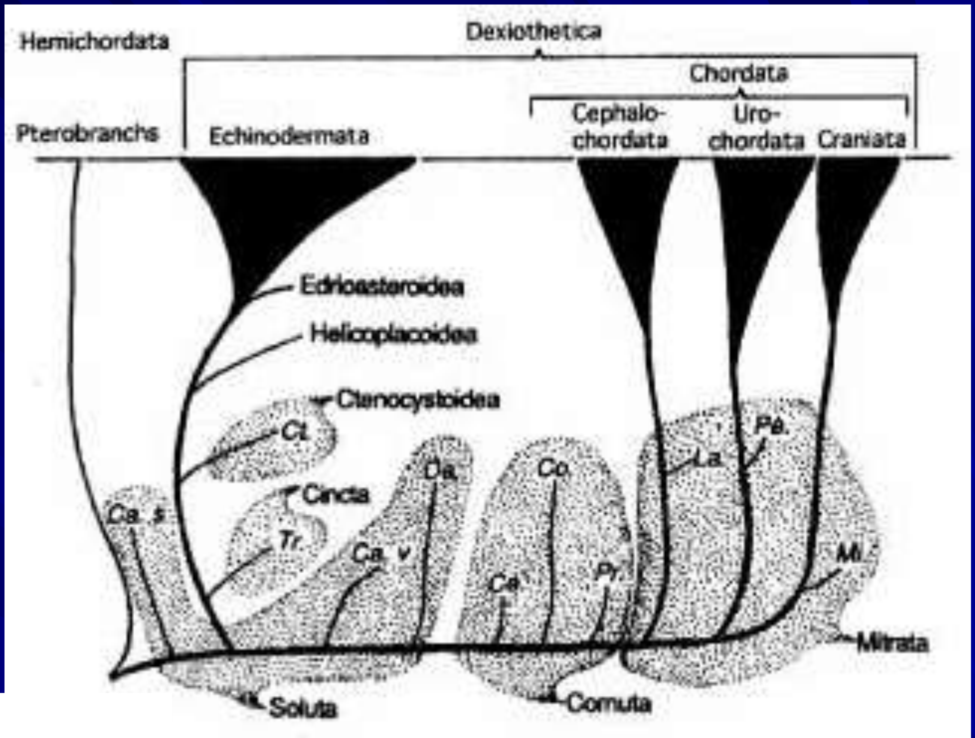


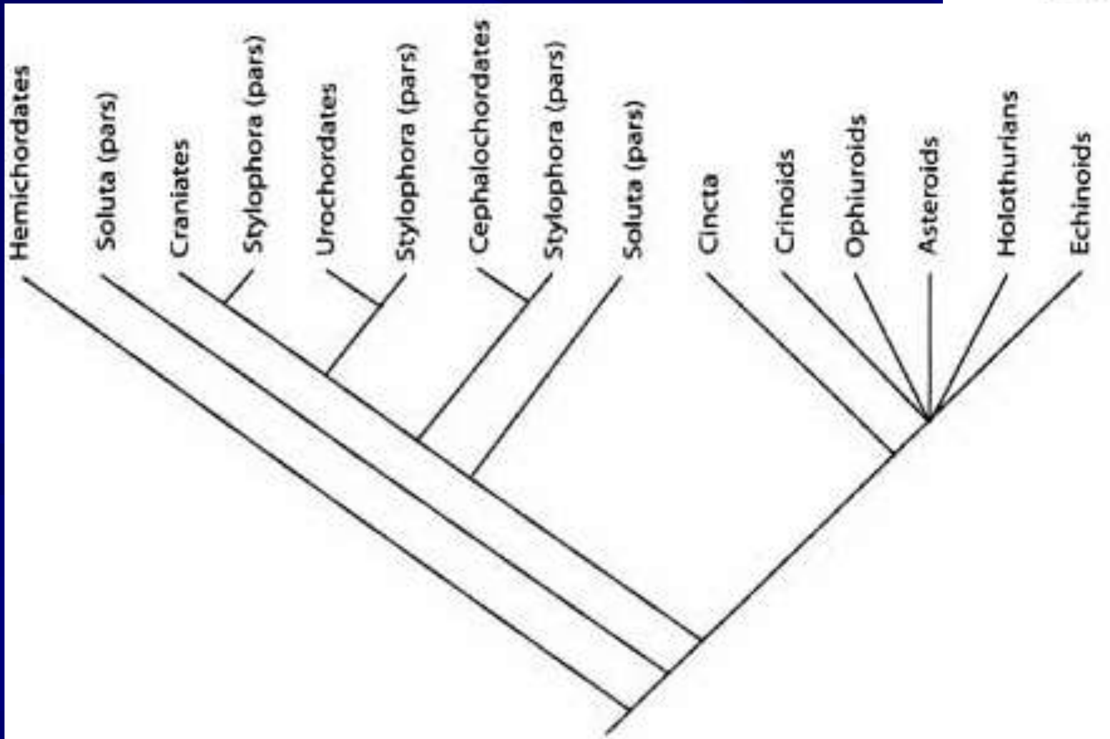
(A) Carpoids as stem-group echinoderms (modified from Ubaghs, 1975).

Карпоидеи представляют собой примитивную стеблевую группу иглокожих, не обладающих радиальностью строения тела. Возможно, у некоторых (Stylophora) не было амбулакральной системы.

Rival hypotheses concerning the position of carpoids (Smith, 2003)

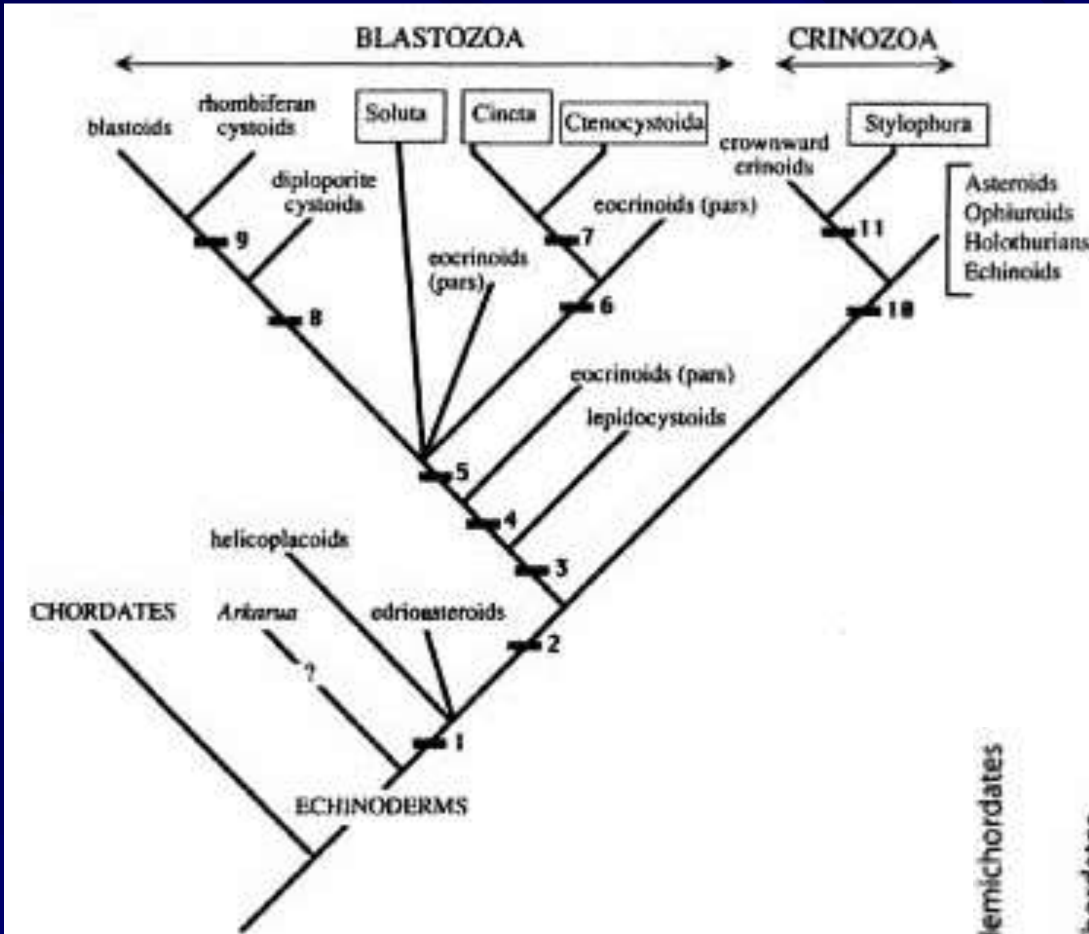
B) Carpoids as stem-group vertebrates and echinoderms (modified from Jefferies et al., 1996) = Calcichordata theory

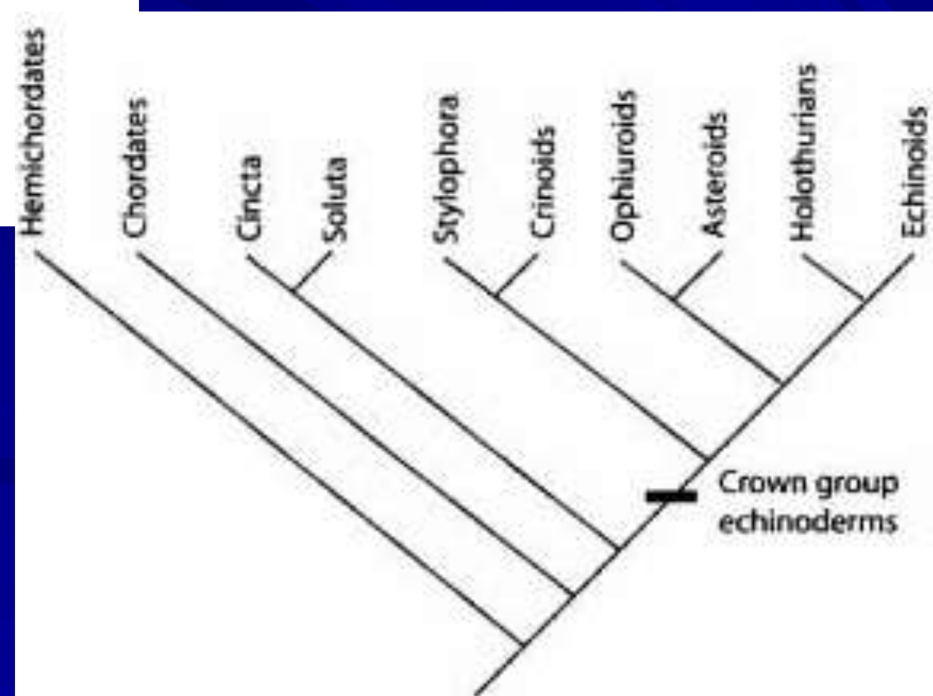




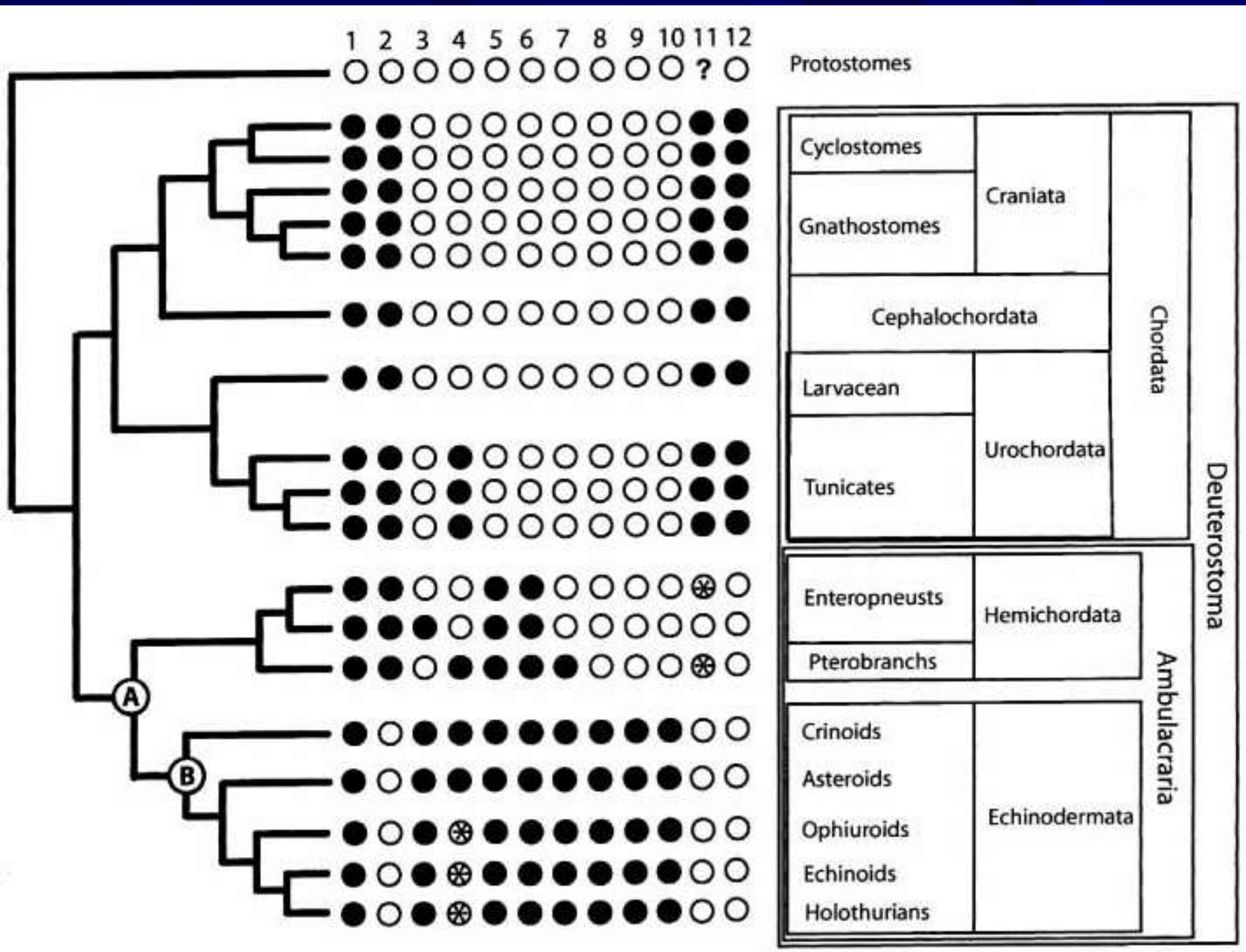
Карпоиды формируют парафилетическое смешение примитивных вториноротых, идентифицированных как стеблевая группа иглокожих (Cinctan, Ctenocystoida), стеблевая группа Acraniata, Craniata или Tunicata (Mitrata), стеблевая группа хордовых (Cornuta, большинство Soluta) или стеблевая группа Dexiotheta (Echinodermata+Chordata)

Rival hypotheses concerning the position of carpoids (Smith, 2003)





(C) Carpoids as derived crown-group echinoderms
(modified from David et al., 2000)



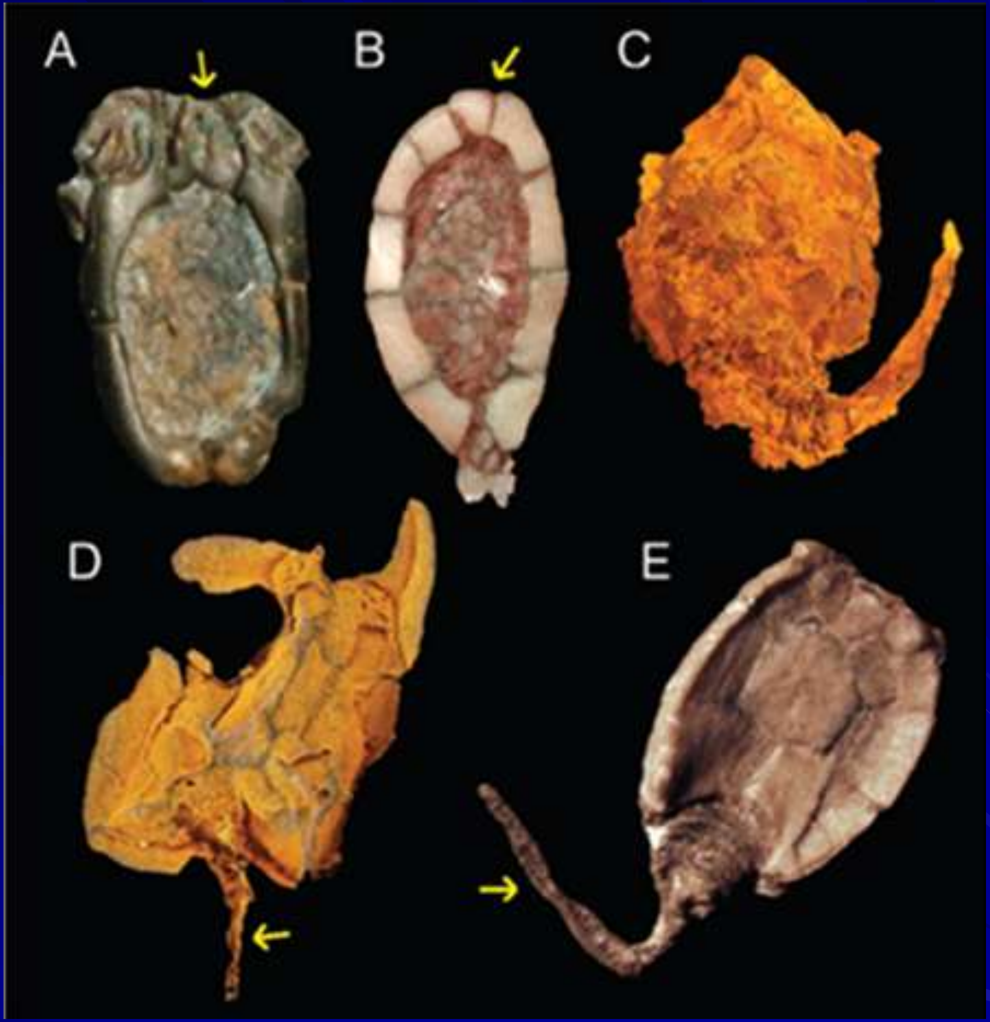
Phylogenetic relationships of extant deuterostomes (Smith, 2005).

Phylogenetic relationships of extant deuterostomes base on combined LSU and SSU ribosomal RNA sequence data with spectral analysis of LogDet distances (from Winchell et al., 2002). Morphological characters have been optimized on this topology and are as follows. 1, Larval blastopore develops into the mouth (WD-white dot); larval blastopore continues as anus, mouth forms secondarily (BD-black dot). 2. Pharyngeal gill slits absent (WD); present (BD). 3, Larva develops indirectly forming neothroch: no (WD), yes (BD). 4, Larval to adult transition: does not involve attachment and torsion (WD); involves attachment and torsion (BD); involves torsion without attachment (*). 5, Body plan tricoelomate: no (WD); yes (BD). 6, Axial complex: absent (WD); present (BD). 7, Mesocoel (=hydrocoel) developed as a tentacular hydrovasuclar system: no (WD); yes (BD). 8, Body plan bilateral, with paired organs and bilaterally organized nervous system (WD); adult body plan radiate (BD). 9, Torsion results in vertical stacking of body coeloms and complete suppression of right hydrocoel development (i.e. water vascular system derived from single hydrocoel and with single hydropore): no (WD); yes (BD). 10, Calcitic mesoskeleton constructed of stereom: no (WD); yes (BD). 11, No post-anal appendage during development (WD); present, as muscular tail (BD); present as muscular stalk with attachment sucker (*). 12, Notochord present; no (WD); yes (BD). Between node A and node B in this figure we should expect to see the following four characters: appearance of a skeleton constructed of stereom; loss of pharyngeal openings; loss of bilateral symmetry and its replacement with asymmetry followed by radial symmetry; acquisition of an echinoderm-style water vascular system built entirely from the left hydocoel-axocoel.

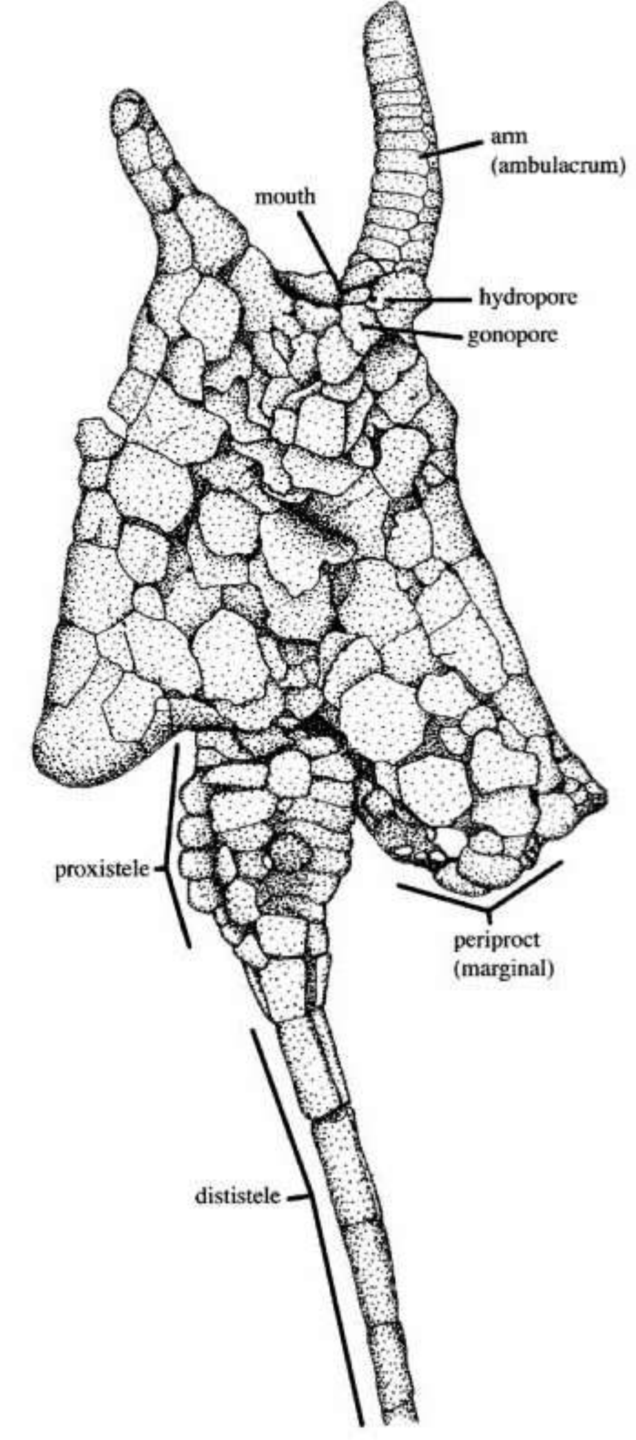
Тип Echinodermata (Ubaghs, 1978)

- П/т Homalozoa = Carpoida = Calcichordata
  - Ctenocystoidea
  - Homostelea (**Cincta**)
  - Stylophora (**Cornuta +Mitrata**)
  - Homoiostelea (Soluta)

- П/т Pelmatozoa
  - Eocrinoidea
  - Rombifera
  - Diploporita
  - Blastoidea
  - Parablastoidea
  - Paracrinoidea
  - Crinoidea

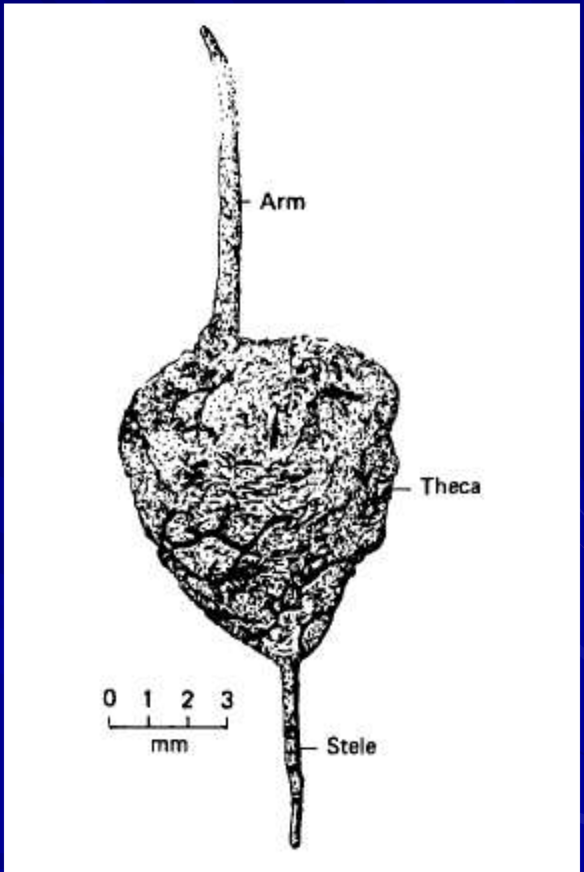


A, Ctenocystoidea,
B, Homostelea
C, Homoiostelea,
D, E, Stylophora



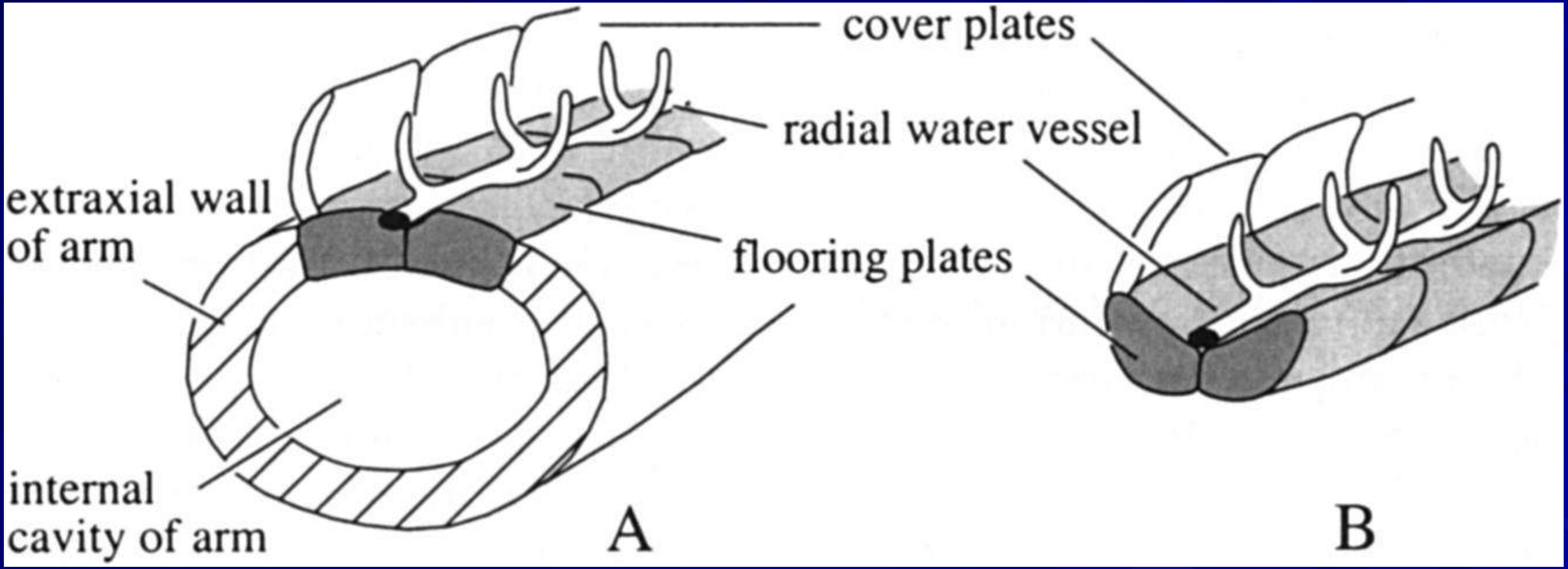
Soluta
(=Класс Homoiostelea Gill et Caster, 1960).

Unnamed Lower Cambrian solute, Kinzers Formation, Pennsylvania, U.S.A. Drawn from a photograph of a latex cast of the specimen in the North Museum, Lancaster, Penn (Paul, Smith, 1984).



The solute *Dendrocystoides scoticus* (Bather) in lateral view, based on specimen in the collection of The Natural History Museum, London E28794 (Smith, 2005).

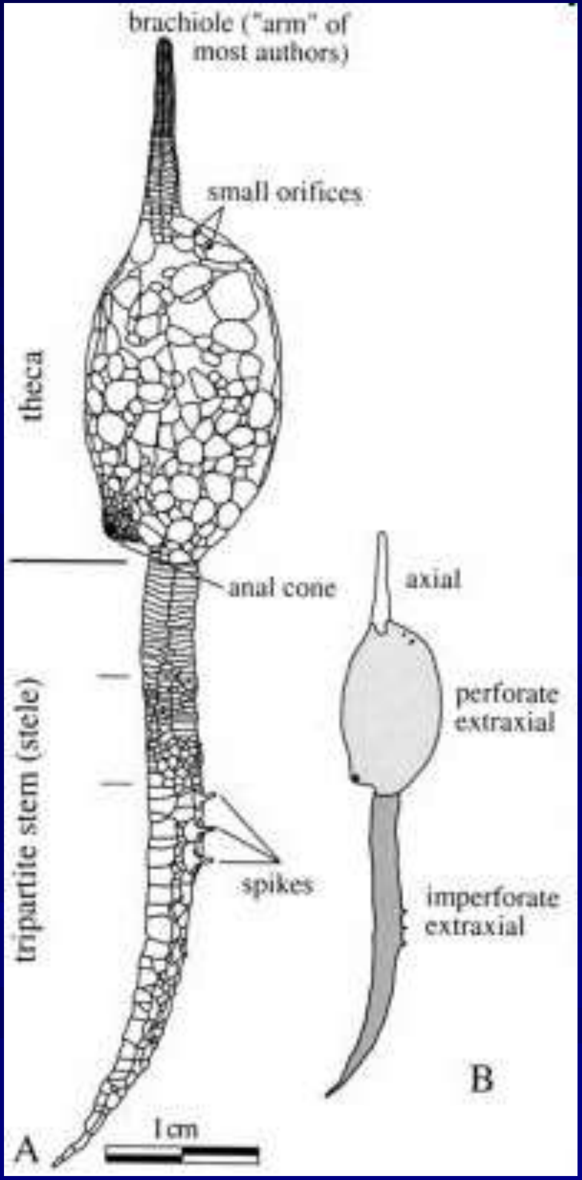
Generalized view of an asterozoan or crinozoan arm and a blastozoan brachiole.



A, Generalized view of an asterozoan or crinozoan arm. Note that in most crownward crinozoans, the flooring plates are not calcified and are represented only by a soft-tissue shelf. B, Generalized view of a blastozoan brachiole. Ambulacral plates shaded, extraxial body wall cross-hatched, cover plates omitted from one side of ambulacrum (David et al., 2005).

Soluta
(=Класс Homoiostelea Gill et Caster, 1960)

Тело состоит из теки, стелы и рукоподобного придатка, тека от умеренно асимметричной до почти билатерально симметричной; маргинальный скелет, как правило, не выражен; рот интратекальный, по–видимому, вблизи проксимального конца руки; анус, обычно, около левого постеролатерального края; стела подразделена на 3 отдела.
Верхний кембрий – нижний девон.
Один отряд Soluta (7 семейств).



Самыми примитивными считаются "карпоидеи" - свободно лежавшие на дне, часто ассиметричные существа с одним или двумя придатками (то ли локомоторными, то ли пищесобирающими). Некоторые исследователями считали карпоидей ближайшими родственниками хордовых (отсюда появилось название Calcichordata). В кембрии было много проблематичных, ни на что не похожих и потому трудно интерпретируемых иглокожих.

Реконструкция типичного представителя Homoiostelea: *Castericystis vali*

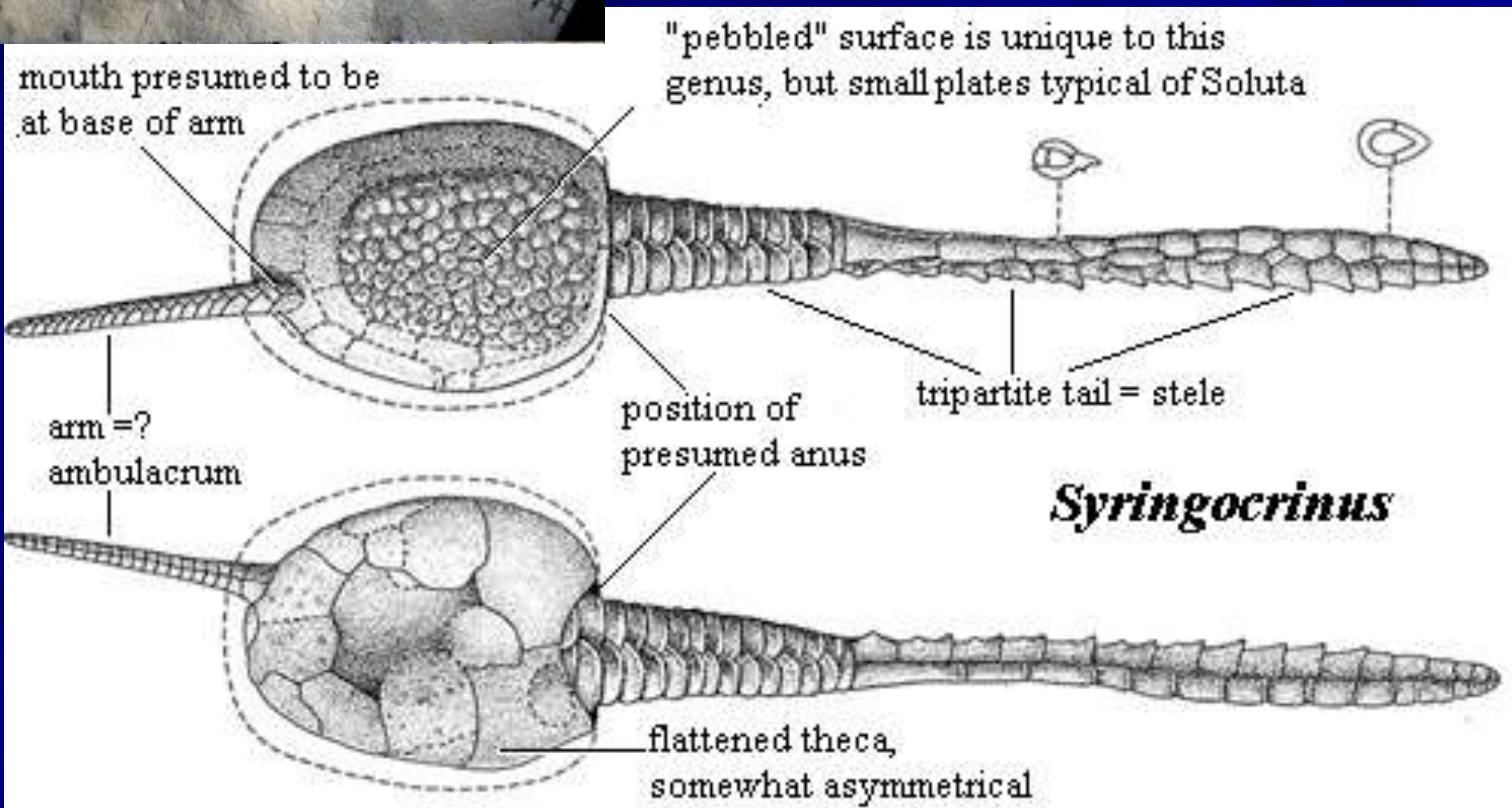
Dendrocystites sedgwicki

Soluta =

= Класс Homoiostelea Gill et Caster, 1960.

=Carpoidea?=Calcichordata?

Reconstruction of *Syringocrinus*



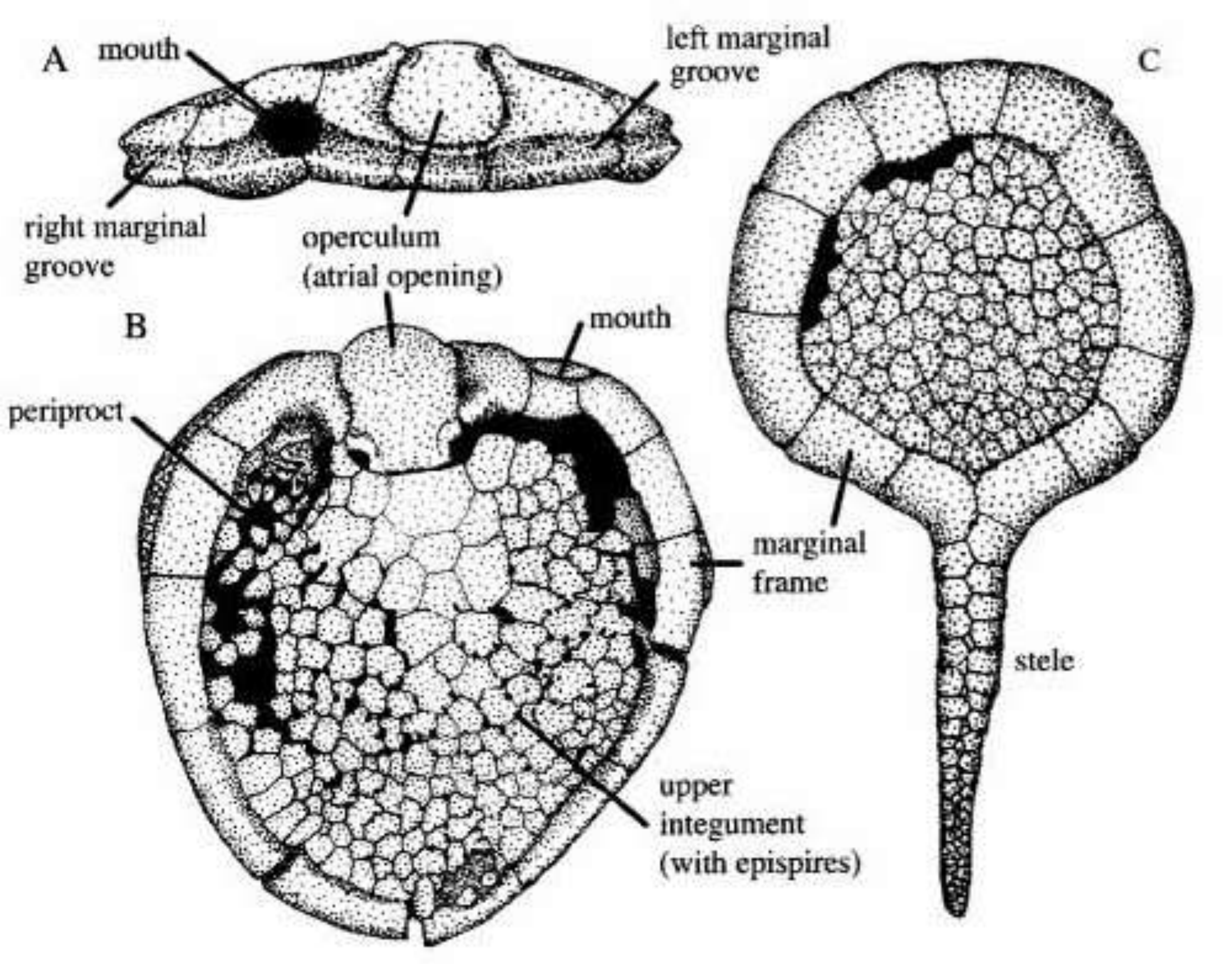
Soluta =

= Класс Homoiostelea Gill et Caster, 1960.

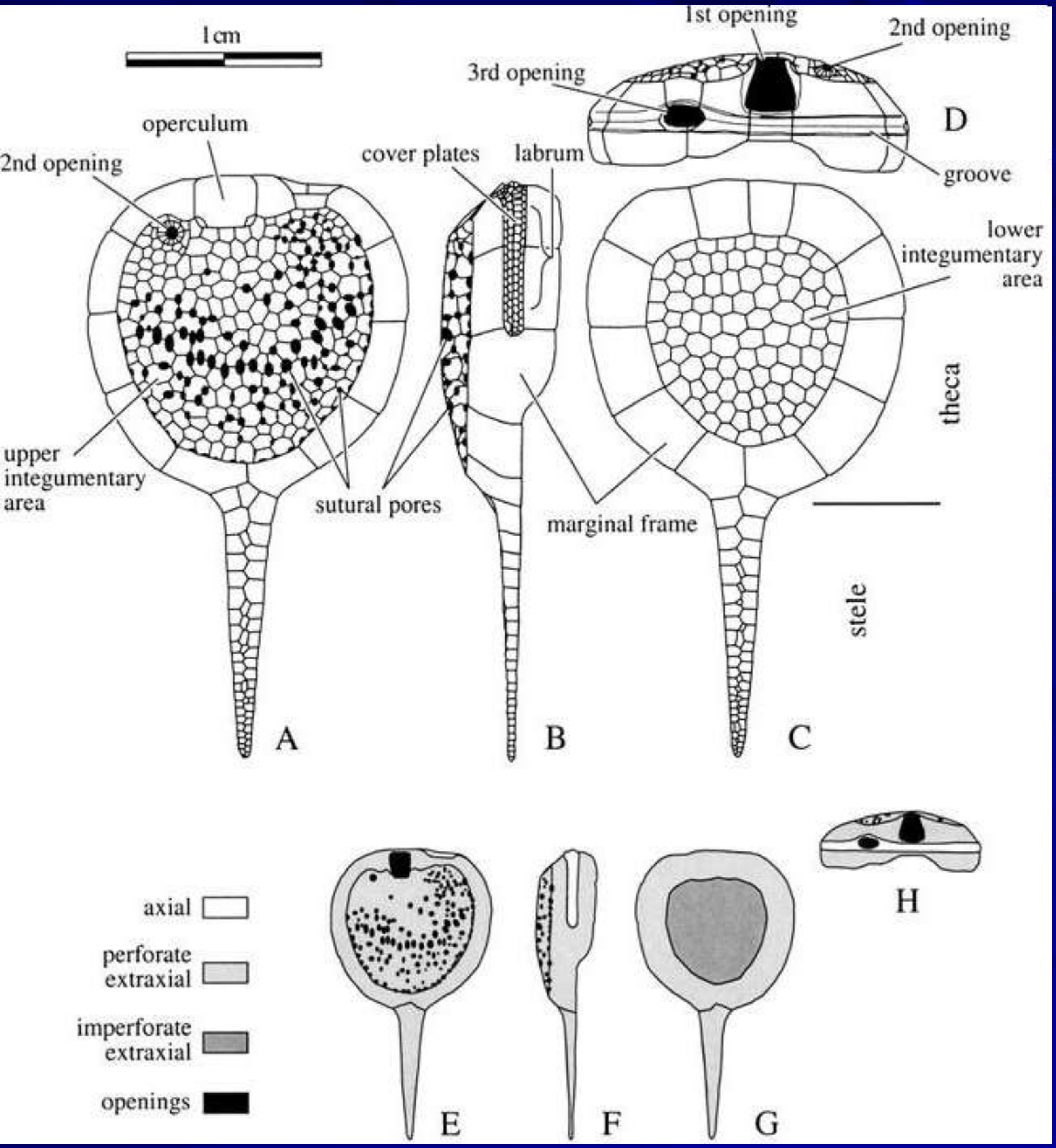
=Carpoidea?=Calcichordata?

Более поздние карпоидеи (квадрисериальное расположение пластинок в рукоятке (или хвосте?)

Cincta =
= Класс Homostelea Gill et Caster, 1960.



The cinctan *Trochocystites bohemicus* Barrande: (A) anterior profile; (B) upper face; (C) lower face. Drawn from latex casts of specimen supplied by G.Ubaghs (Smith, 2005).



Cincta =
= Класс Homostelea Gill et Caster, 1960.

Тело состоит из теки и стелы; рукоподобный придаток присутствует; очертания теки умеренно симметричные; маргинальный скелет однорядный, строго дифференцированный; одно большое и одно маленькое отверстия находятся на краю, противоположном стеле; один иди два эпитекальных (амбулакральных?) желобка подходят к маленькому отверстию; стела не подразделена на отделы. Средний кембрий.
Один отряд Cincta (с двумя семействами).

Morphology of a homostelean (cinctan), *Trochocystites bohemicus*, Middle Cambrian, Bohemia, modified from Friedrich 1993. A-D, Body-wall anatomy and nomenclature with views toward the upper (A), lateral (B), lower (C), and oral (D) surfaces. E-H, Reinterpretation using the EAT with views from the upper (E), lateral (F), lower (G), and oral (H) surfaces (David et al., 2000).

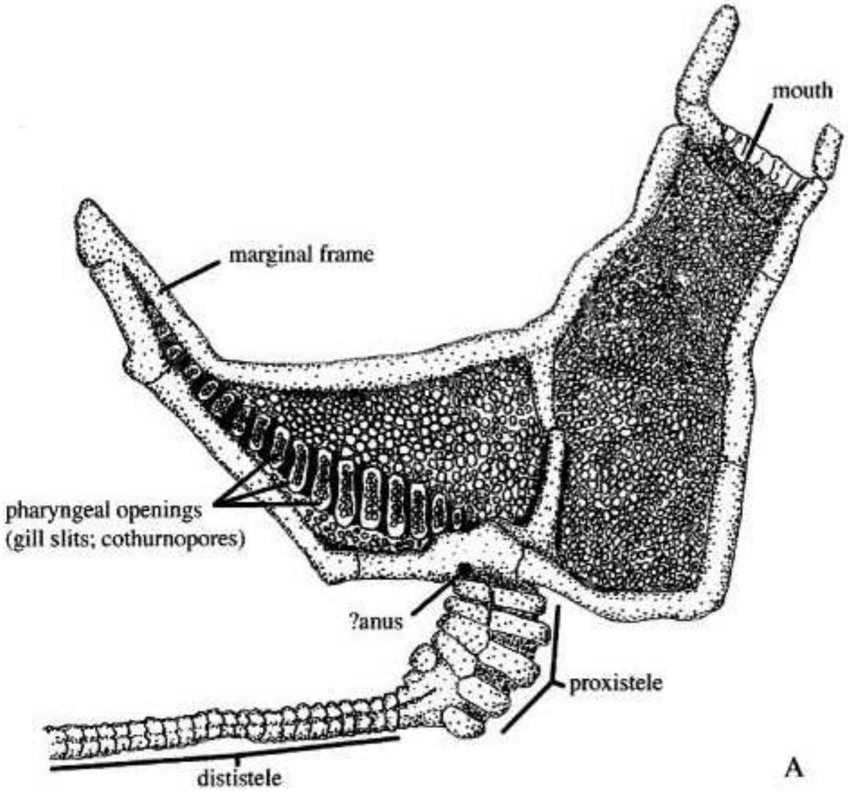
Cincta =

= Класс Homostelea Gill et Caster, 1960.

=Carpoidea?=Calcichordata?

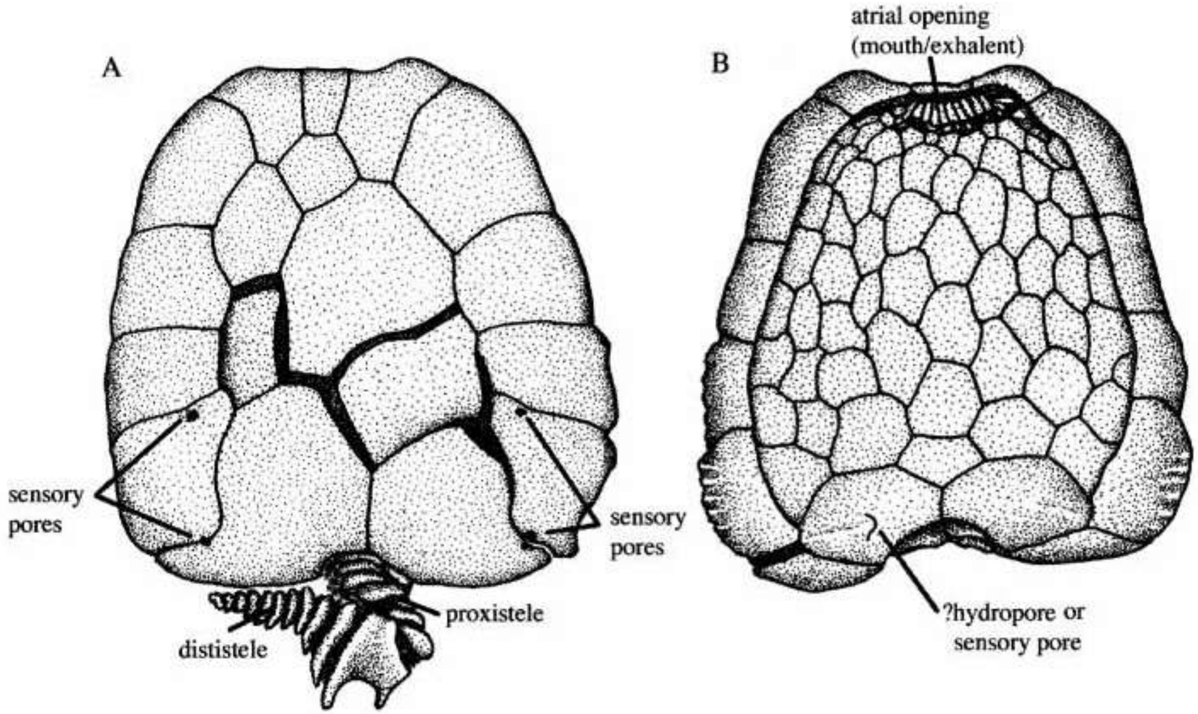
Gyrocystis

Stylophora = Cornuta +Mitrata
=Класс Stylophora Gill et Caster, 1960.



Cornuta

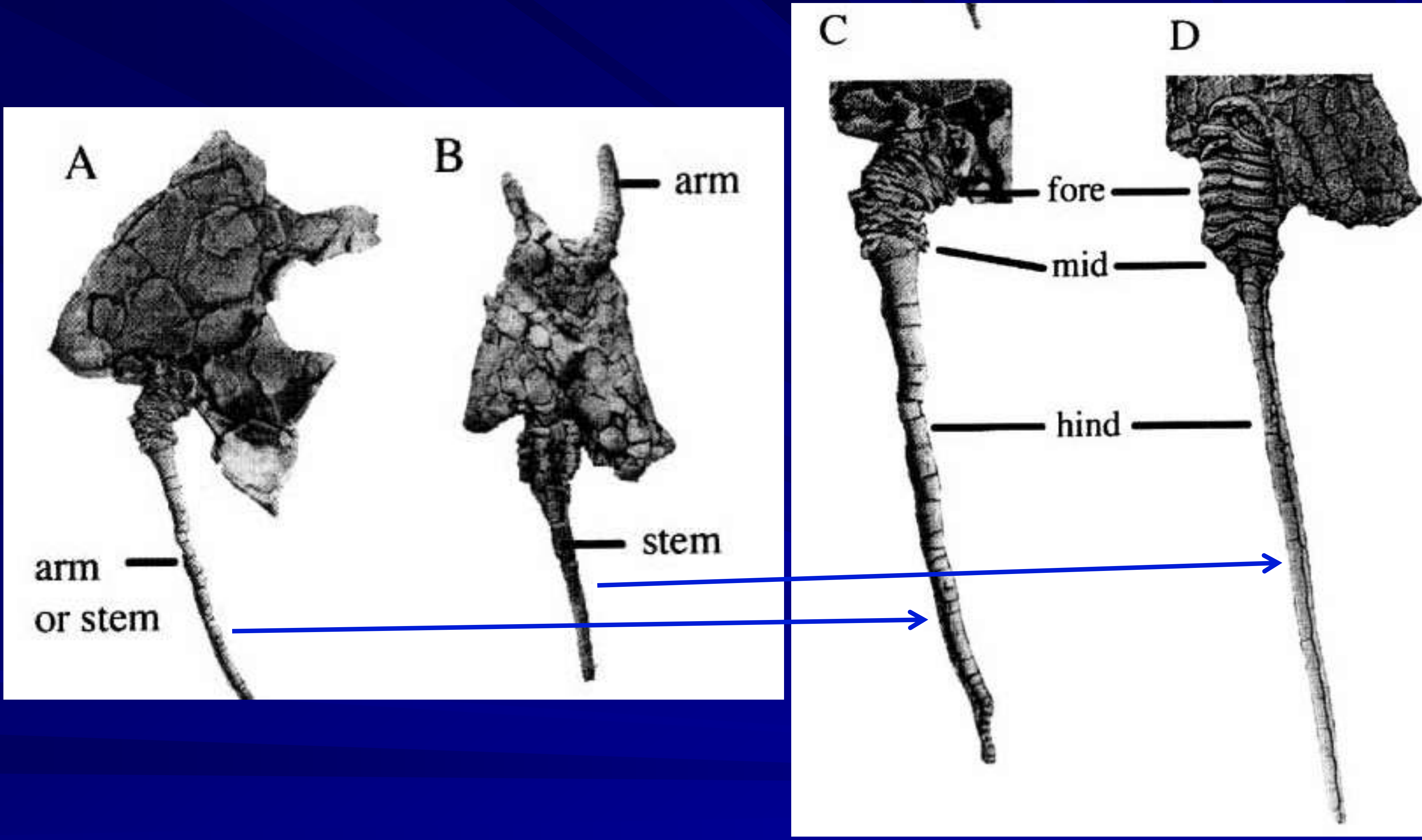
The cornute stylophoran *Cothurnocystis elizae* Bather in dorsal view, based on the Natural History Museum, London, exemplar E23702 (Smith, 2005).



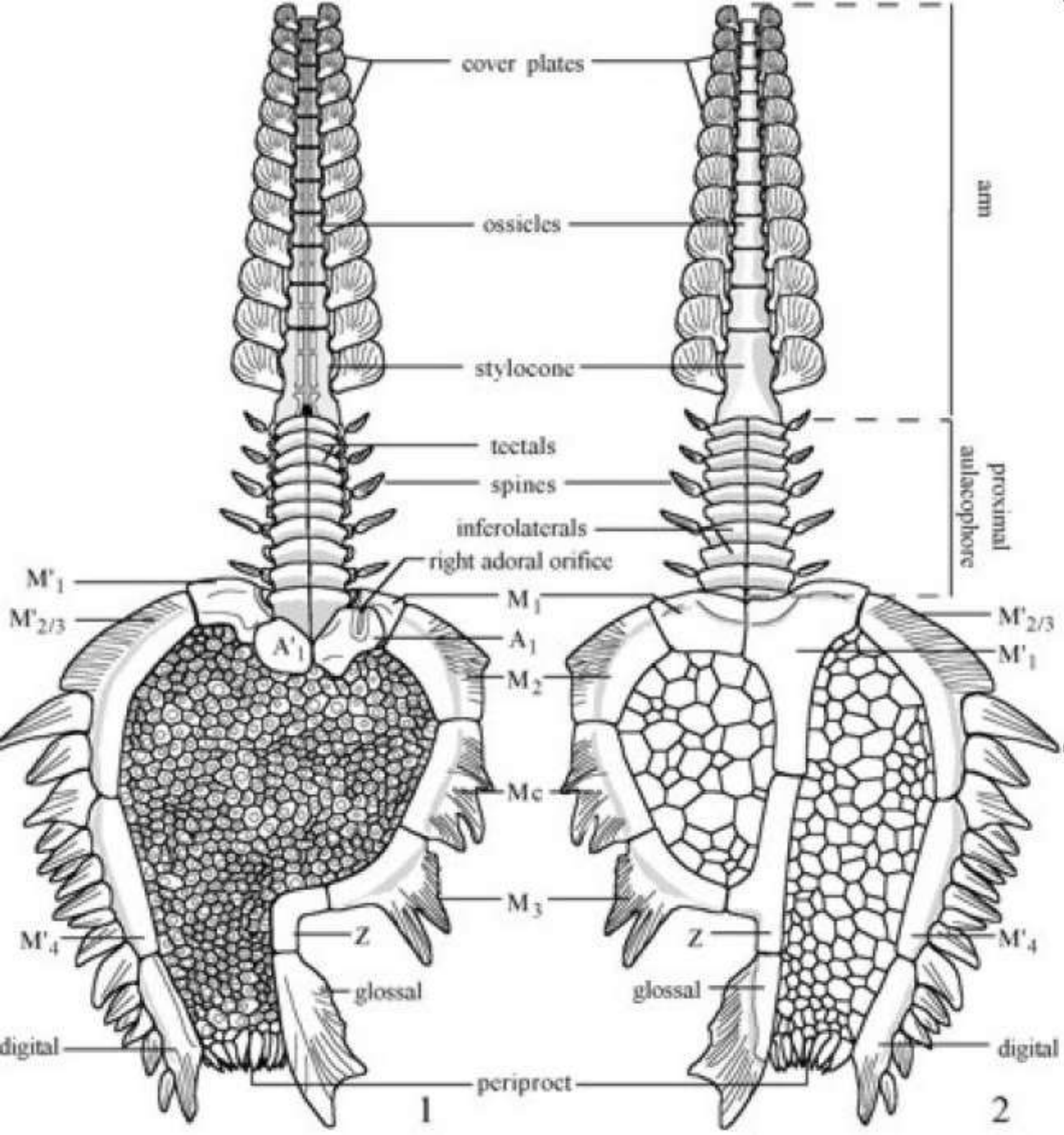
Mitrata

The mitrate stylophoran *Mitrocystites mitra*. (A) Upper aspect; based on the Natural History Museum, London, exemplar E16062; (B) Lower aspect, redrawn from photograph in Ubaghs, 1968 (Smith, 2005).

Stylophora = Cornuta + Mitrata
=Класс Stylophora Gill et Caster, 1960.



Comparison of the single appendage in the primitive stylophoran *Ceratocystis* (A, C) with the two appendages in the solute *Dendrocystoides* (B, D). (A, B) Entire animals; (C, D) appendage architecture and its component parts. (A) and (C) modified from Ubaghs, 1967 (Smith, 2005).

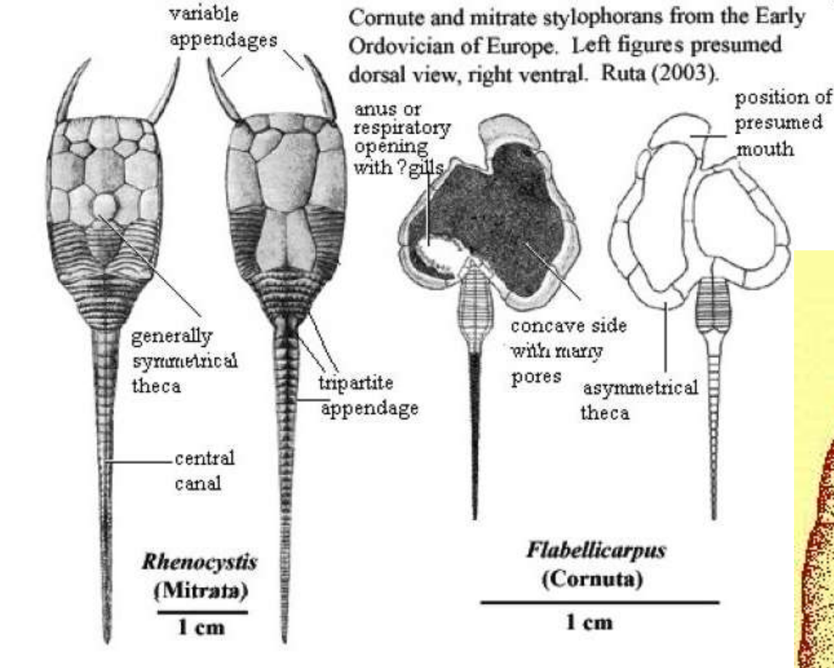


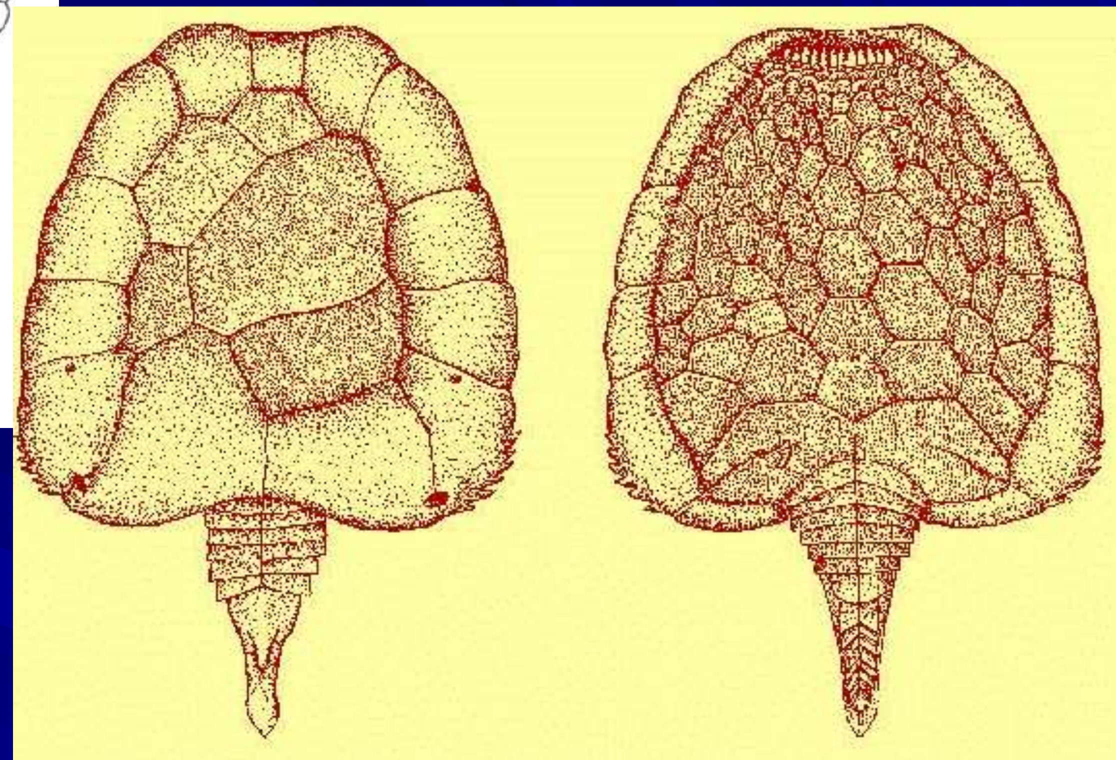
Класс Stylophora Gill et Caster, 1960.

Тело состоит из теки и одного рукоподобного придатка – аулакофора, без стелы; рот, вероятно, интратекальный, на проксимальном конце аулакофора или вблизи него; анус на противоположном конце теки; аулакофор подразделен на три хорошо выраженных отдела. Средний кембрий – средний девон.
Два отряда: Cornuta Jaekel, 1901 и Mitrata Jaekel, 1918.

Morphology of Stylophorans (after Ruta 2003)

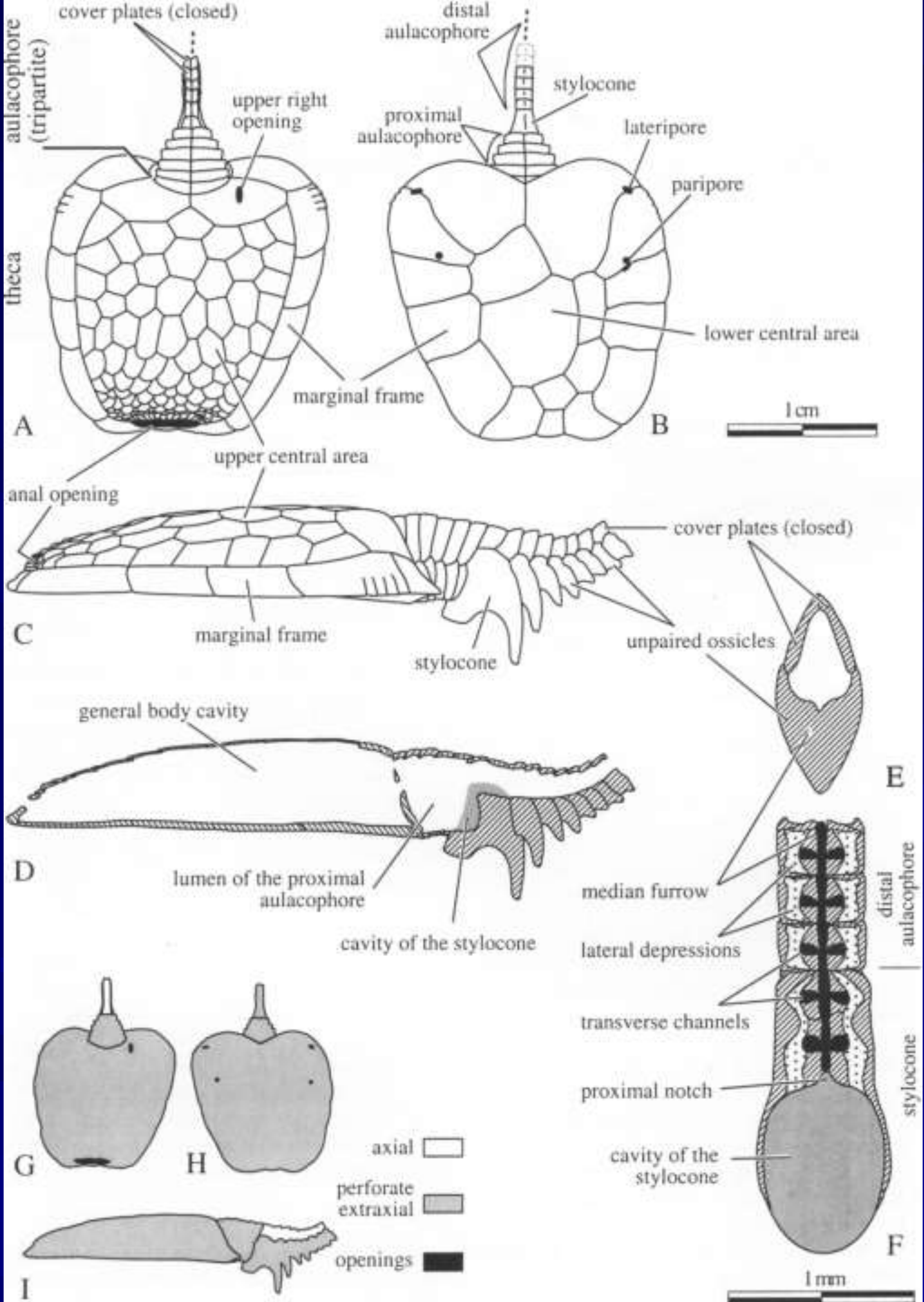
Класс Stylophora Gill et Caster, 1960.





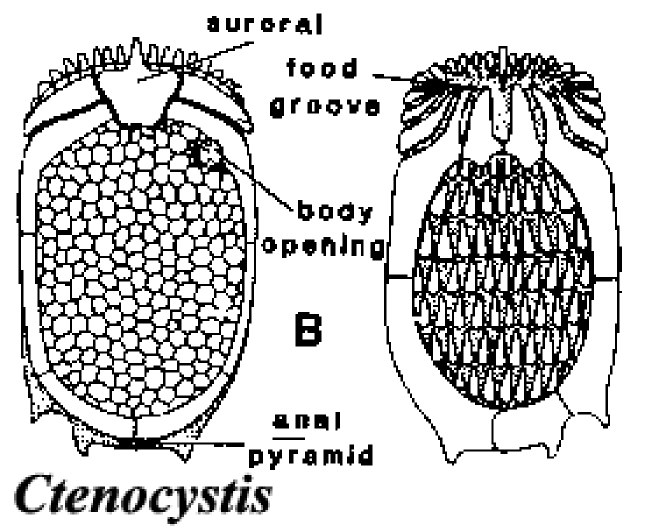
Mitrocystites
(drawn by V. Petr)

This beautiful "carpoid" from the Bohemian Ordovician (esp. abundant in the Sarka Formation) is drawn in a position as a "calcichordate" but interpreted as being an echinoderm with typical echinoderm skeleton and having even an aulacophore (bottom), not a "tail". The "Aulacophore Hypothesis" of Georges Ubaghs and Ronald Parsley is accepted rather than the "Calcichordate Hypothesis" of R. P. S. Jefferies because it seems that practically all "carpoid" characteristics are clearly echinodermal, not chordate. The superficial similarity may result simply from a peculiar convergent evolution of both groups. An article published recently by Shu et al. (1999) on the discovery of two distinct types of agnathans in the Lower Cambrian of China (Chengjiang) is possibly one of the best arguments for the "Aulacophore Hypothesis".



Morphology of a stylophoran (mitrate), *Mitrocystites mitra*,

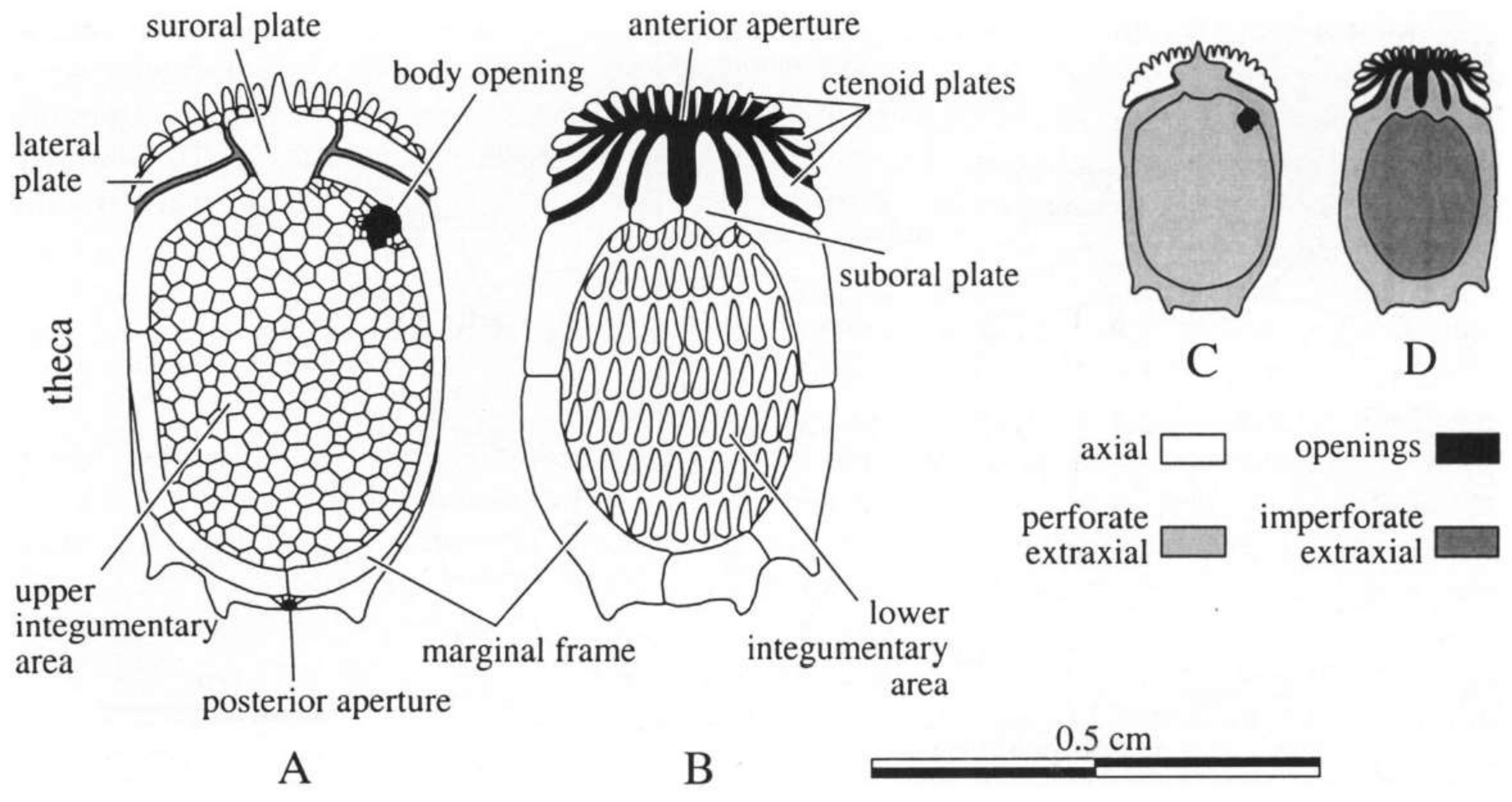
Middle Ordovician, Bohemia, modified from Jefferies 1968 and Ubaghs 1981. A-C, Body-wall anatomy and nomenclature with views toward the upper (A), lower (B), and lateral (C) surfaces. D-F, Structure of the aulacophore and related body-wall regions in longitudinal section (D), cross-section (E), and in a view from the top (F). Body cavities in white, cavity of the stylocone shaded, body wall variously cross-hatched. G-I, Reinterpretation using the EAT with views from the upper (G), lower (H), and lateral (I) surfaces (David et al., 2005).



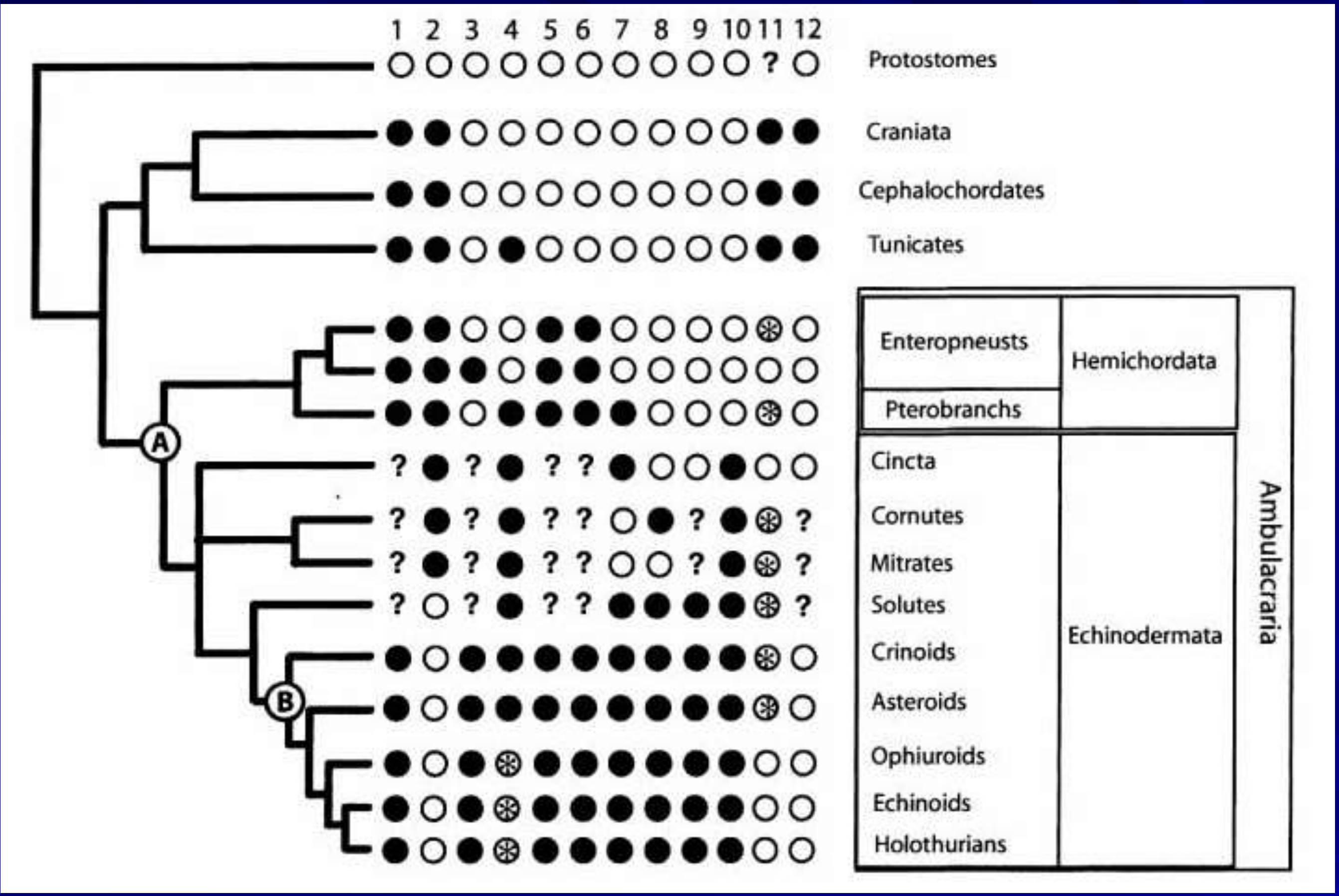
Класс Ctenocystoidea Robison et Sprinkle, 1969.

Тело состоит из теки без придатков; ее очертания почти симметричные; маргинальные и центральные пластинки обычно дифференцированы; маргинальный скелет двурядный; рот (?) вблизи переднего конца середины нижней поверхности, с хорошо развитым ктеноидным аппаратом; анус вблизи середины заднего конца. Средний кембрий. Одно семейство и один род.

Класс Ctenocystoidea Robison et Sprinkle, 1969.



Morphology of a ctenocystoid, *Ctenocystis utahensis*, Middle Cambrian, Utah, modified from Robison and Sprinkle 1969. A, B, Body-wall anatomy and nomenclature with views toward the upper (A) and lower (B) surfaces. C, D, Reinterpretation using the Extraxial-Axial Theory with views from the upper (C), and lower (D) surfaces (David et al., 2000).



Cladogram of deuterostome relationships based on molecular data, as in the previous slide, but with carpoids added on the basis of observable shared derived morphological traits.

(Smith, 2005)

Morphological characters have been optimized on this topology and are as follows. 1, Larval blastopore develops into the mouth (WD-white dot); larval blastopore continues as anus, mouth forms secondarily (BD-black dot). 2. Pharyngeal gill slits absent (WD); present (BD). 3, Larva develops indirectly forming neothroch: no (WD), yes (BD). 4, Larval to adult transition: does not involve attachment and torsion (WD); involves attachment and torsion (BD); involves torsion without attachment (*). 5, Body plan tricoelomate: no (WD); yes (BD). 6, Axial complex: absent (WD); present (BD). 7, Mesocoel (=hydrocoel) developed as a tentacular hydrovasuclar system: no (WD); yes (BD). 8, Body plan bilateral, with paired organs and bilaterally organized nervous system (WD); adult body plan radiate (BD). 9, Torsion results in vertical stacking of body coeloms and complete suppression of right hydrocoel development (i.e. water vascular system derived from single hydrocoel and with single hydropore): no (WD); yes (BD). 10, Calcitic mesoskeleton constructed of stereom: no (WD); yes (BD). 11, No post-anal appendage during development (WD); present, as muscular tail (BD); present as muscular stalk with attachment sucker (*). 12, Notochord present; no (WD); yes (BD). Between node A and node B in this figure we should expect to see the following four characters: appearance of a skeleton constructed of stereom; loss of pharyngeal openings; loss of bilateral symmetry and its replacement with asymmetry followed by radial symmetry; acquisition of an echinoderm-style water vascular system built entirely from the left hydocoel-axocoel.

Тип Echinodermata

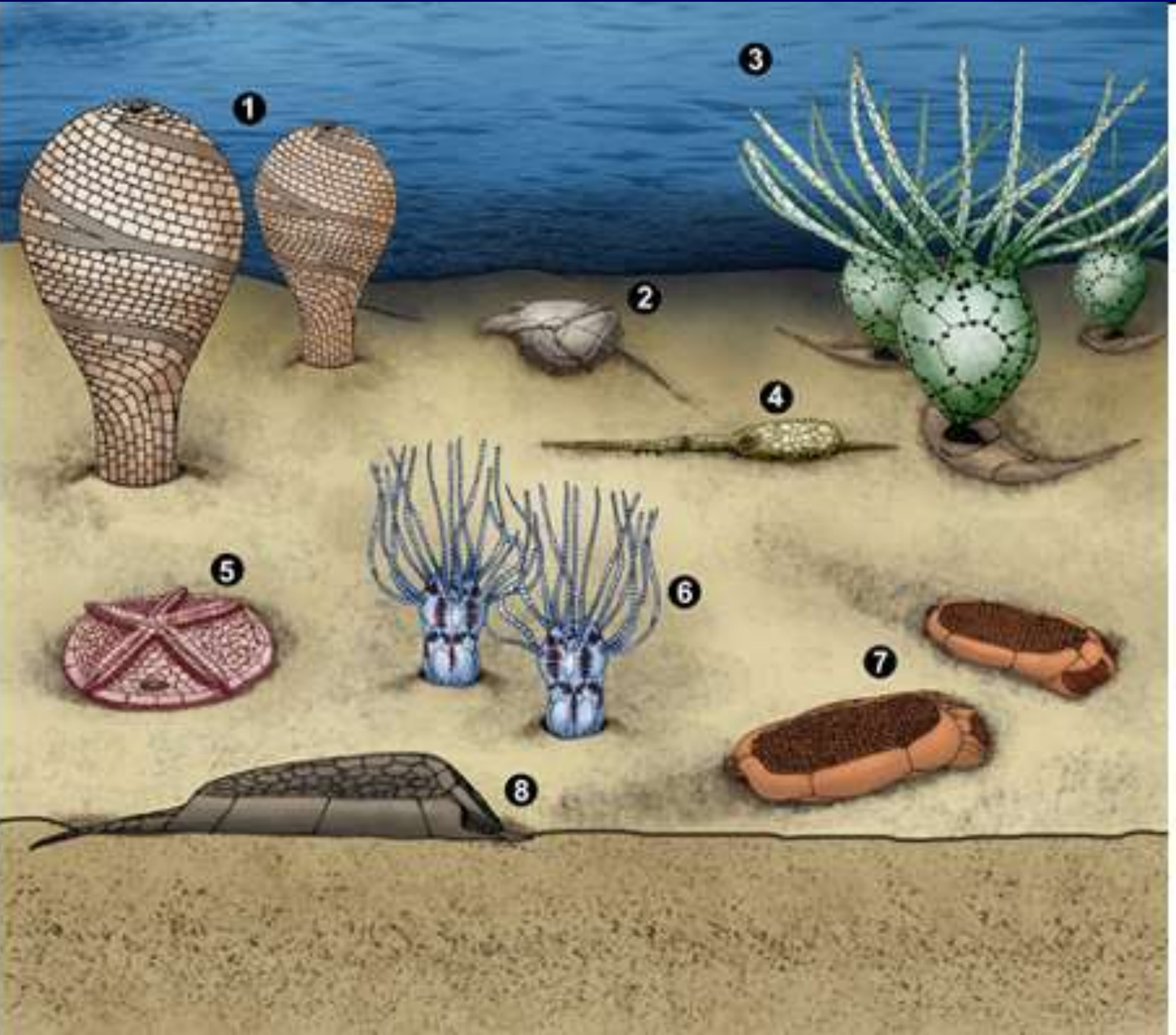
- П/т Homalozoa
  - Ctenocystoidea
  - Homostelea
  - Stylophora
  - Homoiostelea

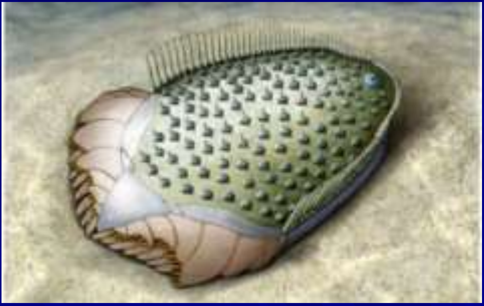
- П/т Pelmatozoa
  - Eocrinoidea
  - Rombifera
  - Diploporita
  - Blastoidea
  - Parablastoidea
  - Paracrinoidea
  - Crinoidea

- П/т Echinozoa
  - Camptostromatoidea
  - Helicoplacoidea
  - Edrioasteroidea
  - Edrioblastoidea
  - Cyclocystoidea
  - Ophiocystoidea
  - Echinoidea
  - Holothuroidea

- П/т Asterozoa
  - Somasteroidea
  - Asteroidea
  - Ophiuroidea

Reconstruction of a Cambrian echinoderm hypothetic community which contains taxa from different geographic areas and different ages.
After S.Zamora et al, 2010.





1. Helicoplacoidea (*Helicoplacus*)
2. Stylophora (*Ceratocystis*)
3. Eocrinoidea (*Gogia*)
4. Soluta (*Castericystis*)
5. Edrioasteroidea (*Cambraster*)
6. Eocrinoidea (*Lichenoides*)
7. Ctenocystoidea (*Ctenocystis*)
8. Cincta (*Gyrocystis*).

Soluta	Solute gen.sp.	Derstrler, 1975, 1981	
	Dendrocystites sp. et al		
Helicoplacus Durham & Caster		Durham & Caster, 1963	
	H.gilberti Durham & Caster	Durham & Caster, 1963	
	H.curtisi Durham & Caster	Durham & Caster, 1963	
	H.everndeni Durham	Durham, 1967	нет
	H.firbyi Durham	Durham, 1967	пентарадиальной
Waucobella Durham (?=Helicoplacus)		Durham, 1967	симметрии
	W.nelsoni Durham	Durham, 1967	
Polyplacus Durham		Durham, 1967	
	P.kilmiri Durham	Durham, 1967	

J. Wyatt Durham

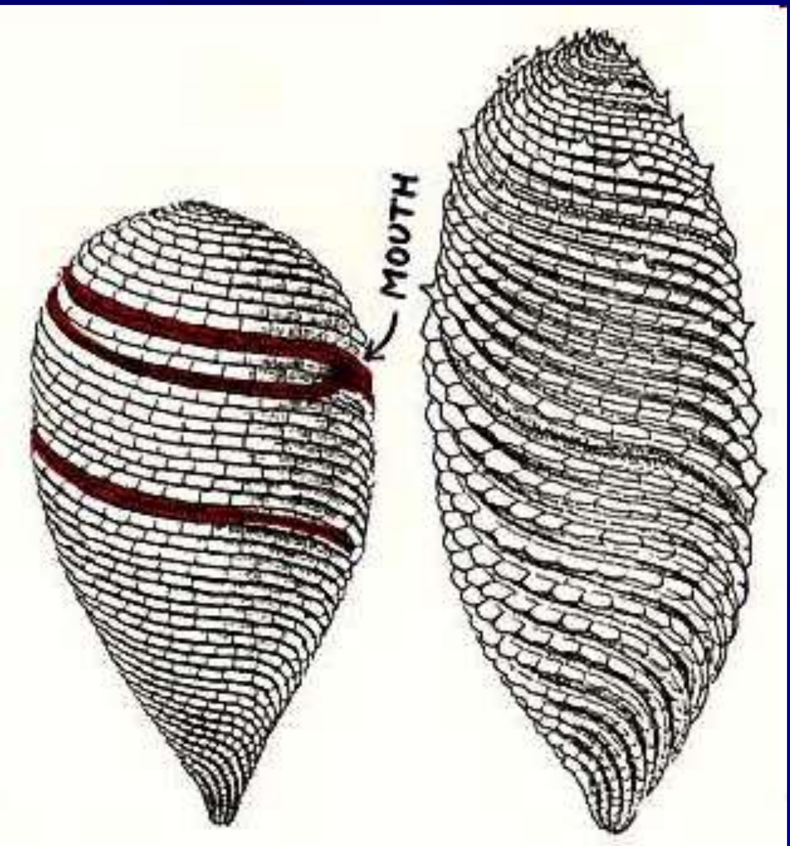
Camptostroma Ruedemann		Ruedemann, 1933	
	C.roddyi Ruedemann	Ruedemann, 1933	
Kinzercystis Sprinkle		Sprinkle, 1973	
	K.durhami Sprinkle	Sprinkle, 1973	
Lepidocystis Foerste		Foerste, 1938	
	L.wanneri Foerste	Foerste, 1938	есть
	L.cf.wanneri Foerste	Sprinkle, 1973	пентарадиальная
Stromatocystites Pompeckj		Pompeckj, 1896	симметрия
	S.walcotti Schuchert	Schuchert, 1919	
	S.pentangularis Pompeckj	(BMNH collections)	
Gogia Walcott		Walcott, 1917	
	G.ojenai Durham	Durham, 1978	

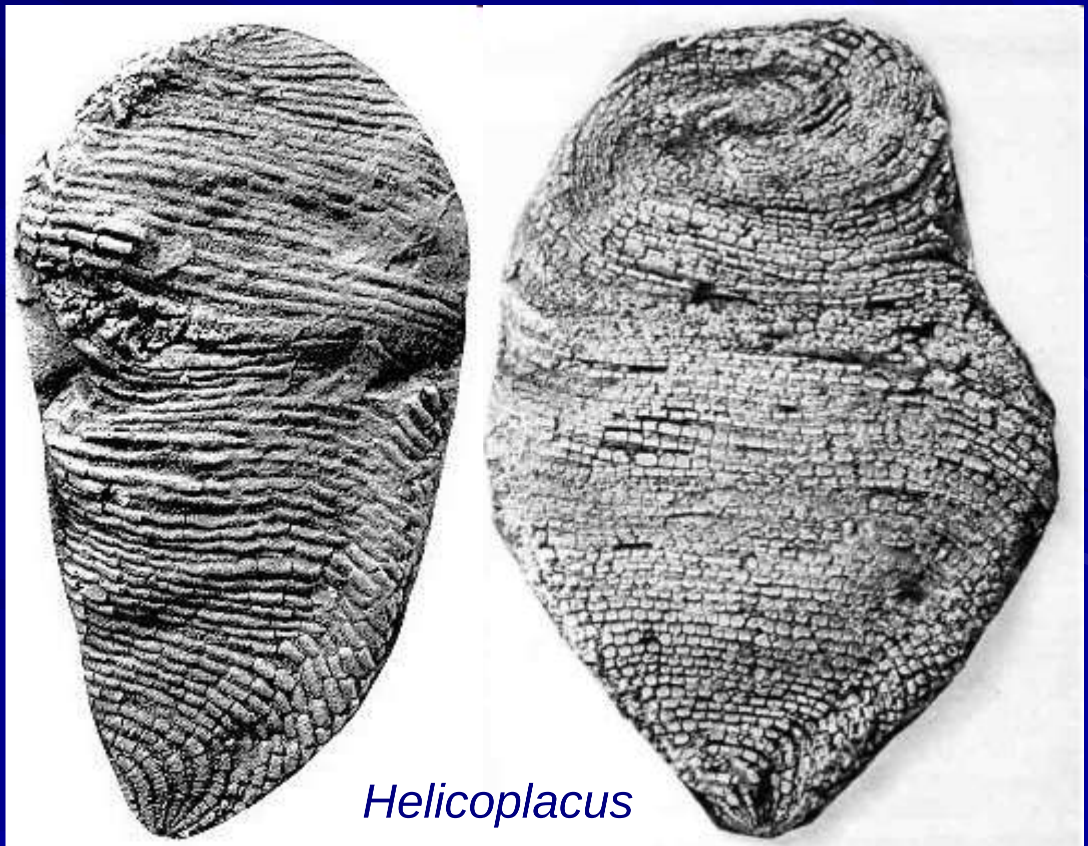
Кембрий

(Paul, Smith, 1984)

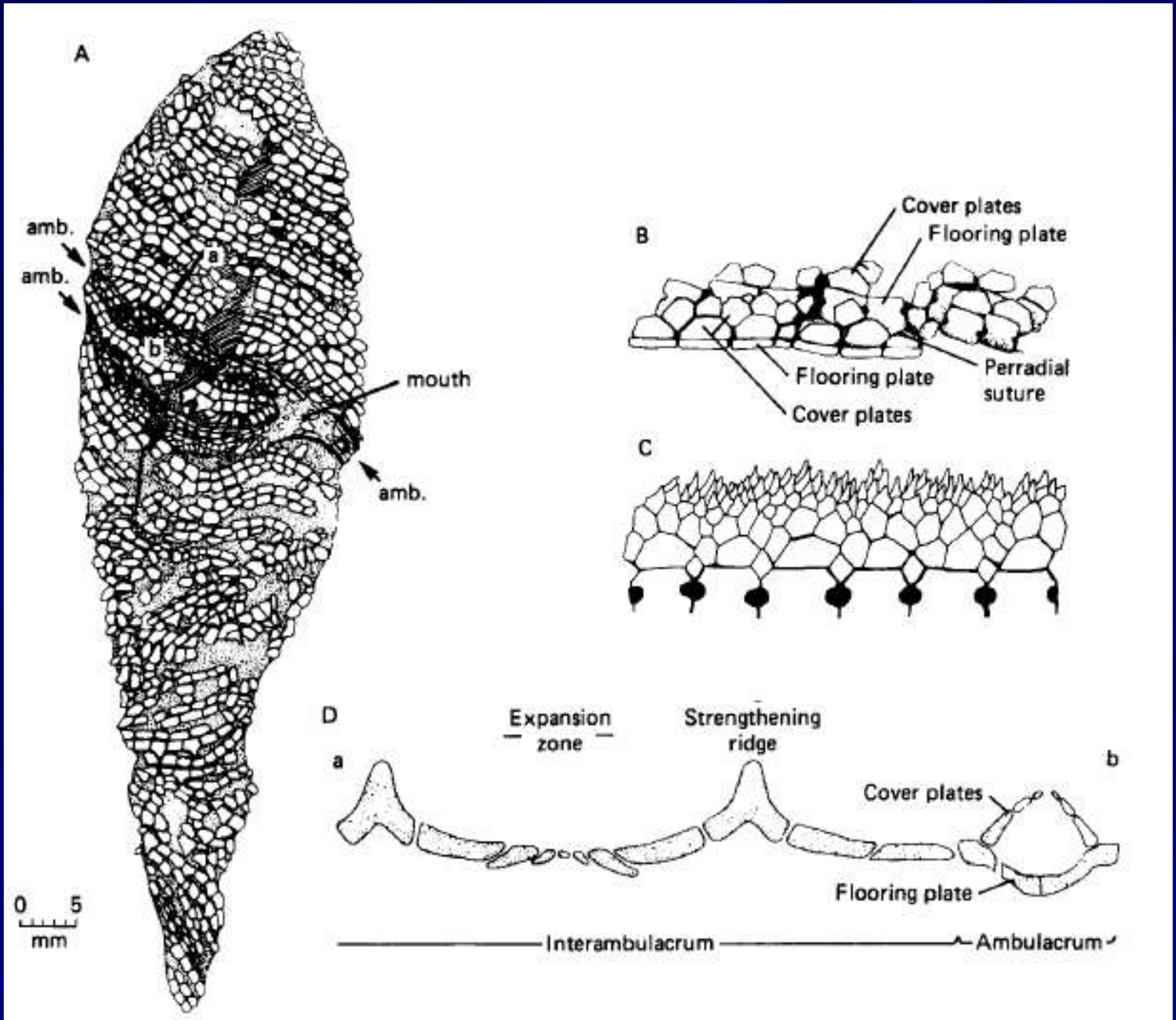
Helicoplacoidea

Helicoplacus Durham & Caster	Durham & Caster, 1963
H.gilberti Durham & Caster	Durham & Caster, 1963
H.curtisi Durham & Caster	Durham & Caster, 1963
H.everndeni Durham	Durham, 1967
H.firbyi Durham	Durham, 1967
Waucobella Durham (?=Helicoplacus)	Durham, 1967
W.nelsoni Durham	Durham, 1967
Polyplacus Durham	Durham, 1967
P.kilmiri Durham	Durham, 1967





Helicoplacus



Radiation and phylogeny of echinoderms

Basic morphology of helicoplacoids. A, B, D, *Helicoplacus*; C, *Waucobella*, Poleta Formation, California, USA. A, camera lucida drawing of *H.curtis*i Durham & Caster. B, detail of ambulacral structure. C, arrangement of cover plates in the ambulacra of *Waucobella nelsoni* Durham. D, reconstruction of the plating across an ambulacrum and two interambulacral ridges in *Helicoplacus*, as indicated in A (Paul, Smith, 1984).

Helicoplacoidea

The Cambrian Substrate Revolution

The physical environment of the world was VERY different from what it is today. For example, the substrate (i.e., the dirt, sediment, mud, etc.) that these animals lived in was not very dynamic. Very still. Non-actualistic.

Up until then, there were no little creatures burrowing up and down through the sediment. Nothing creating burrows. Nothing contributing to the dynamic fabric that is the substratum we know today.

PLUS, it was covered in sort of a yogurt or cheese-like film or covering of MICROBES (what kind of microbes is another question).

Helicoplacoids sat with the spindle-end down, essentially suspended in these bacterial mats like living, suspension-feeding potatoes!

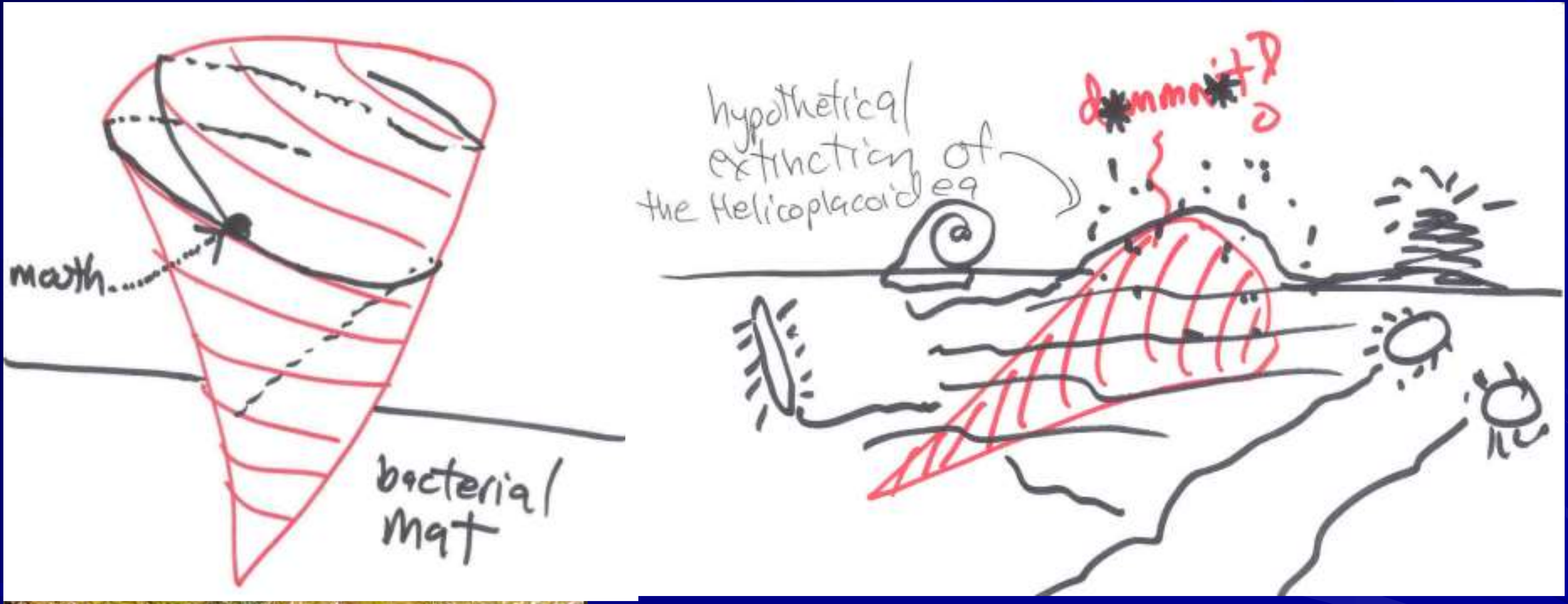
It's thought that when all of this changed i.e., The Cambrian Substrate Revolution, began with the advent of bioturbation and the mixing of sediment by little critters, mixing up different layers of sediment creating little waves of sediment and water, etc.

This began a major ecological shift that ultimately did no favors to the weird things that had become adapted to living there. Did this shift cause or at least greatly affect the Helicoplacoidea? Some believe so.

Thanks to Dr Christopher Mah, Washington, D.C., USA

Helicoplacoidea

The Cambrian Substrate Revolution

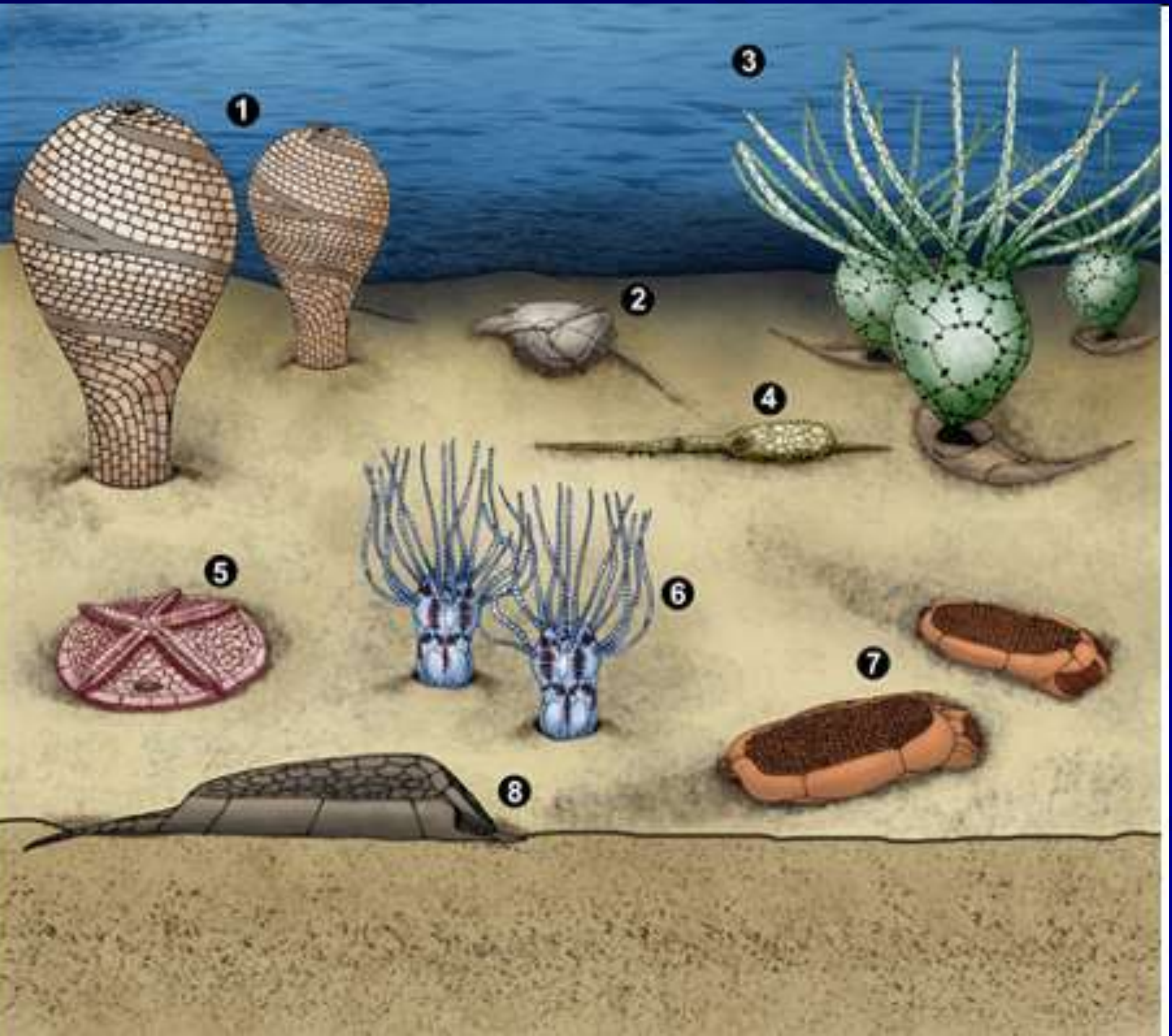


Here is a highly detailed graphic reconstructing how helicoplacoids may have lived, with mouth labeled.

The black lines indicate feeding grooves, which were open to the water around them and were apparently absent on the surfaces of the body which were directed below the outward surface.

Thanks to Dr Christopher Mah

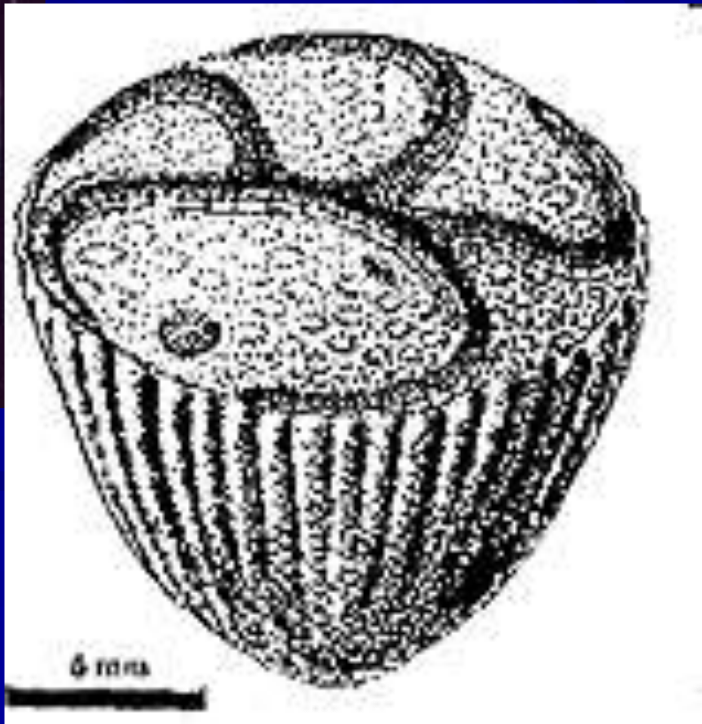
Reconstruction of a Cambrian echinoderm hypothetic community which contains taxa from different geographic areas and different ages.
After S.Zamora et al, 2010.



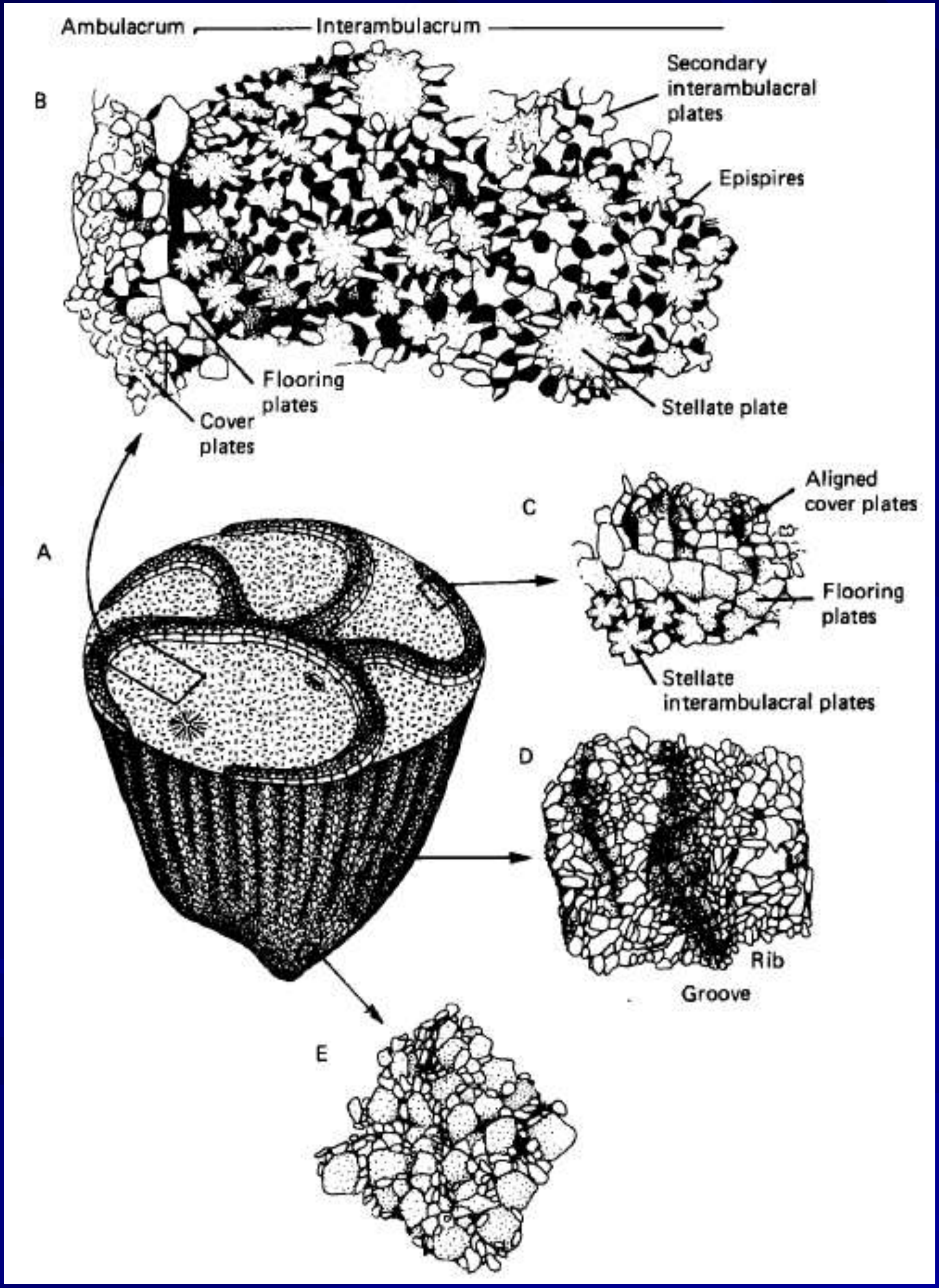
1. Helicoplacoidea (*Helicoplacus*)
2. Stylophora (*Ceratocystis*)
3. Eocrinoidea (*Gogia*)
4. Soluta (*Castericystis*)
5. Edrioasteroidea (*Cambraster*)
6. Eocrinoidea (*Lichenoides*)
7. Ctenocystoidea (*Ctenocystis*)
8. Cincta (*Gyrocystis*).

“Edrioasteroidea”

Camptostroma roddyi



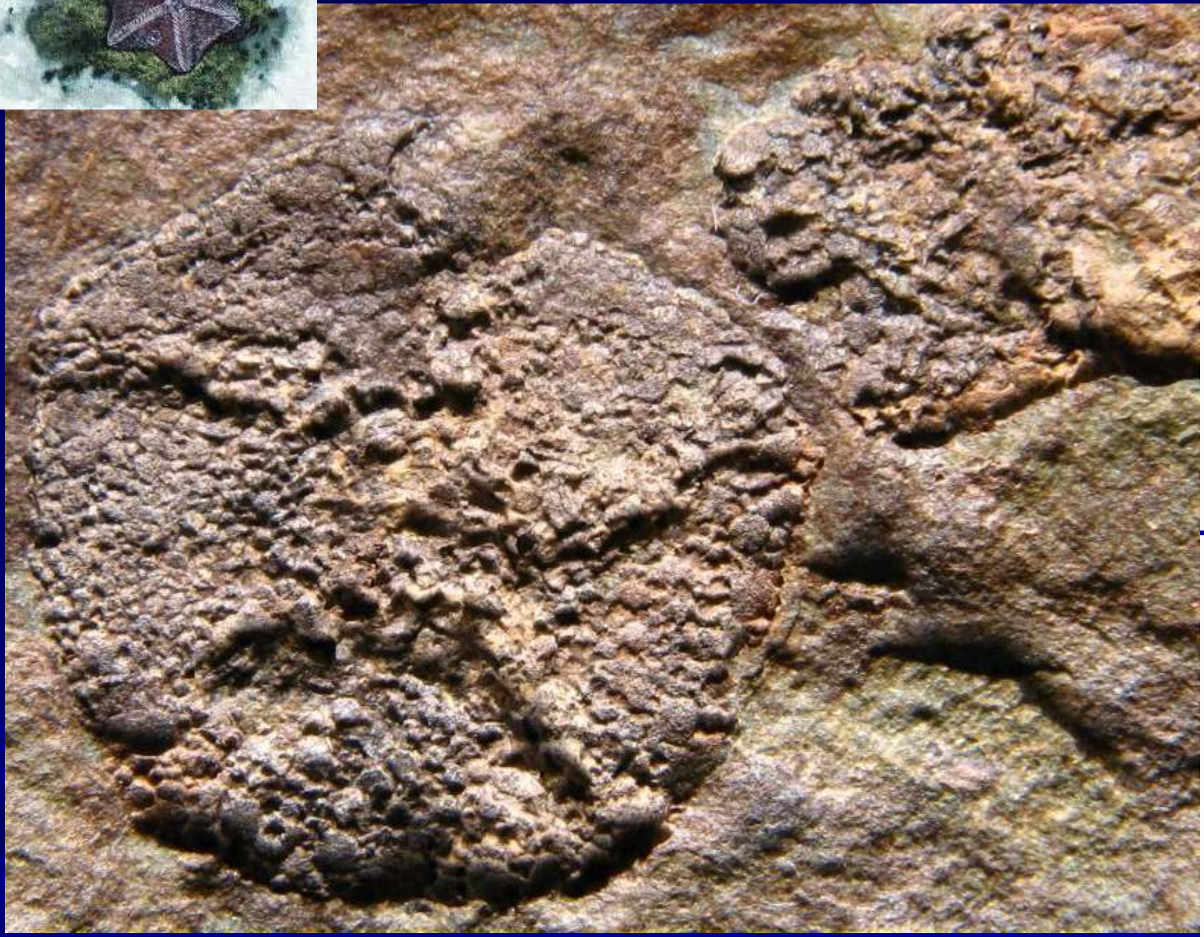
Radiation and phylogeny of echinoderms

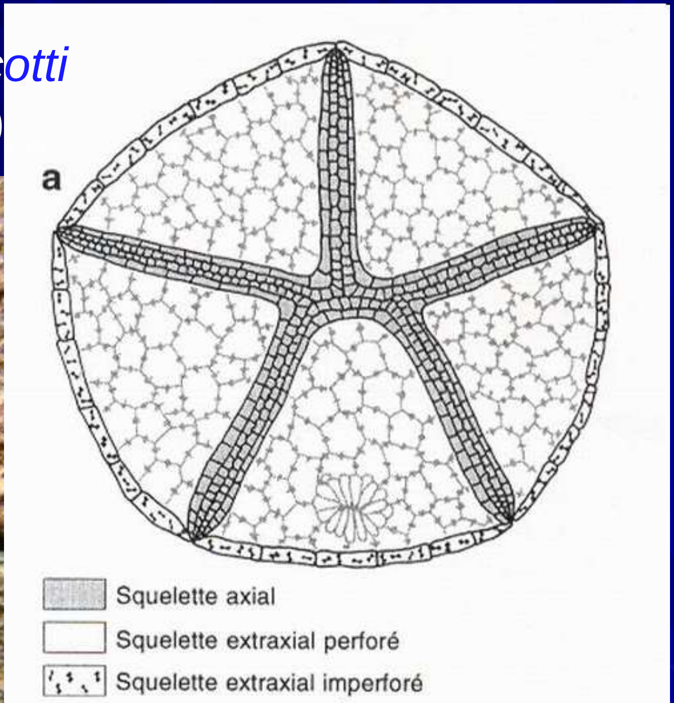


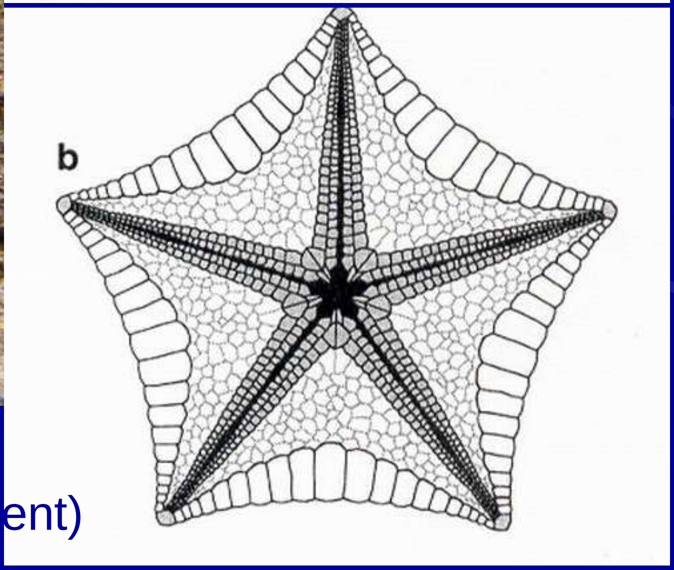
Basic morphology of *Camptostroma roddyi* Ruedermann, Kinzers Formation, Pennsylvania, USA, reconstruction of the whole animal, B, details of an ambulacrum and part of an interambulacrum on the oral (ventral) surface. C, details of aligned cover plates towards the tip of one ambulacrum. D, detail of the plating on the ridged lateral wall. E, details of imbricate plating on the aboral (dorsal) surface. B-E, camera lucida drawings taken from latexes in the US National Museum of Natural History, Washington (Paul, Smith, 1984).

“Edrioasteroidea” Stromatocystitoida

Stromatocystites walcotti
(Early Cambrian)

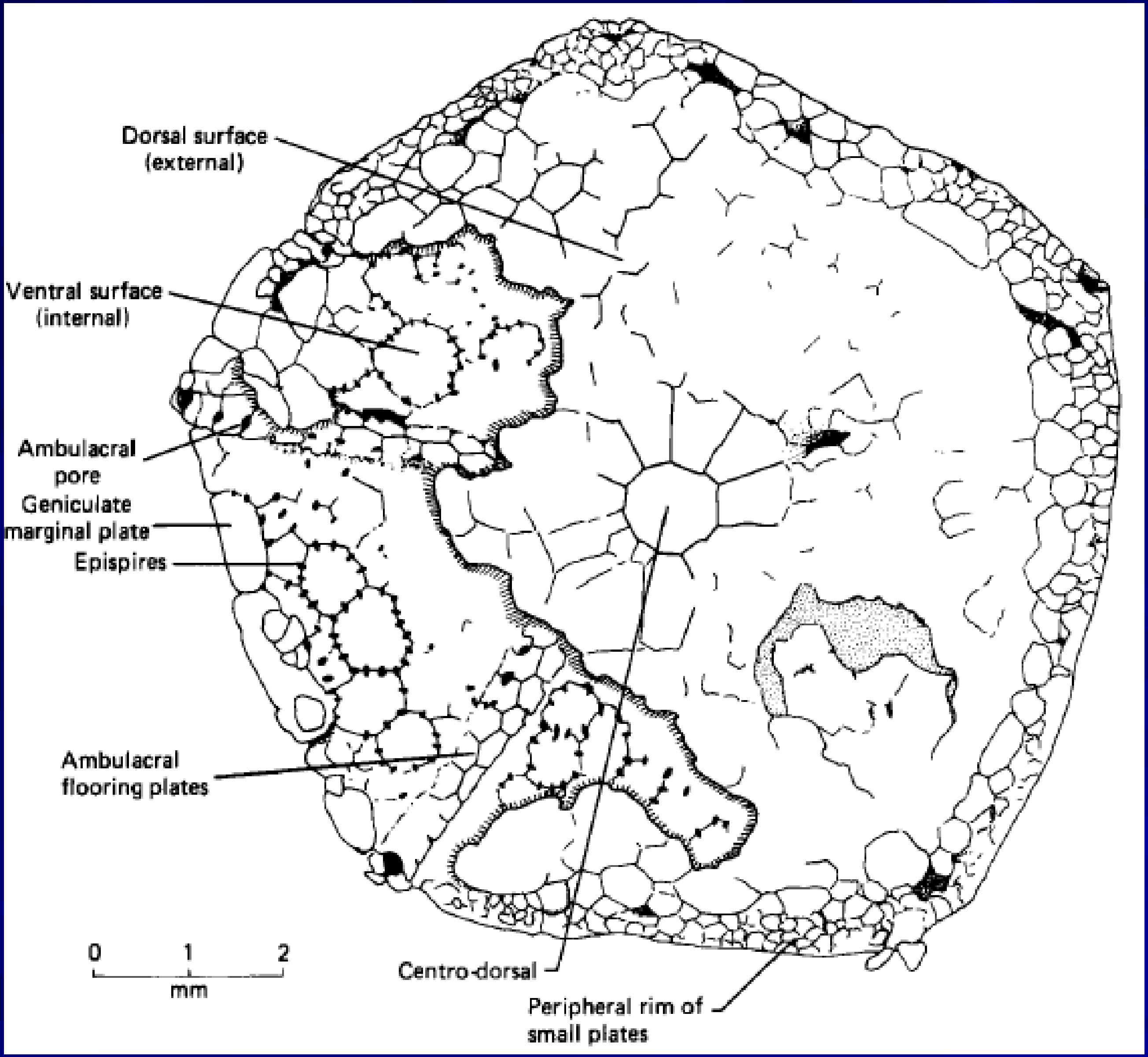






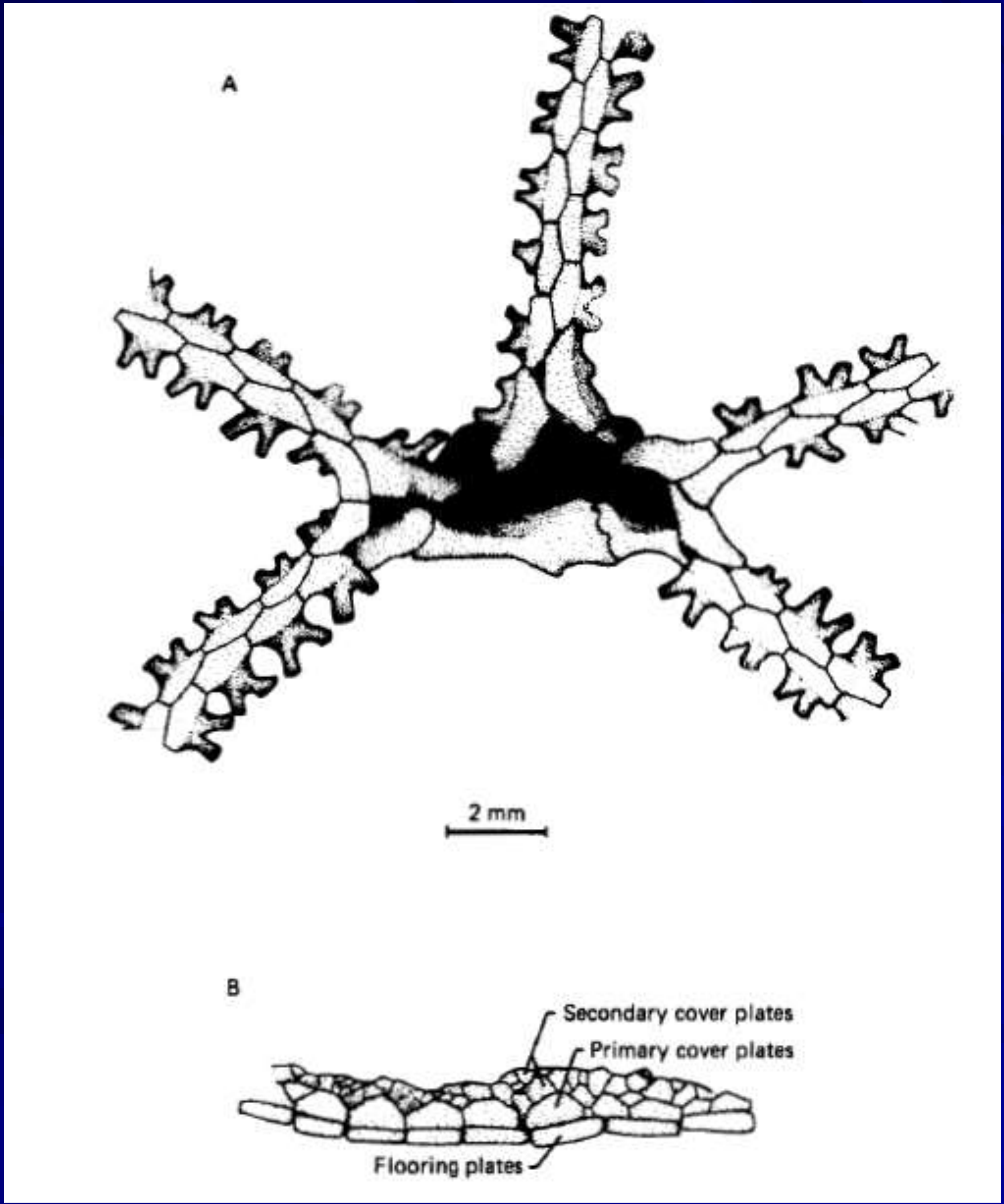
Asteroidea (recent)

Radiation and phylogeny of echinoderms



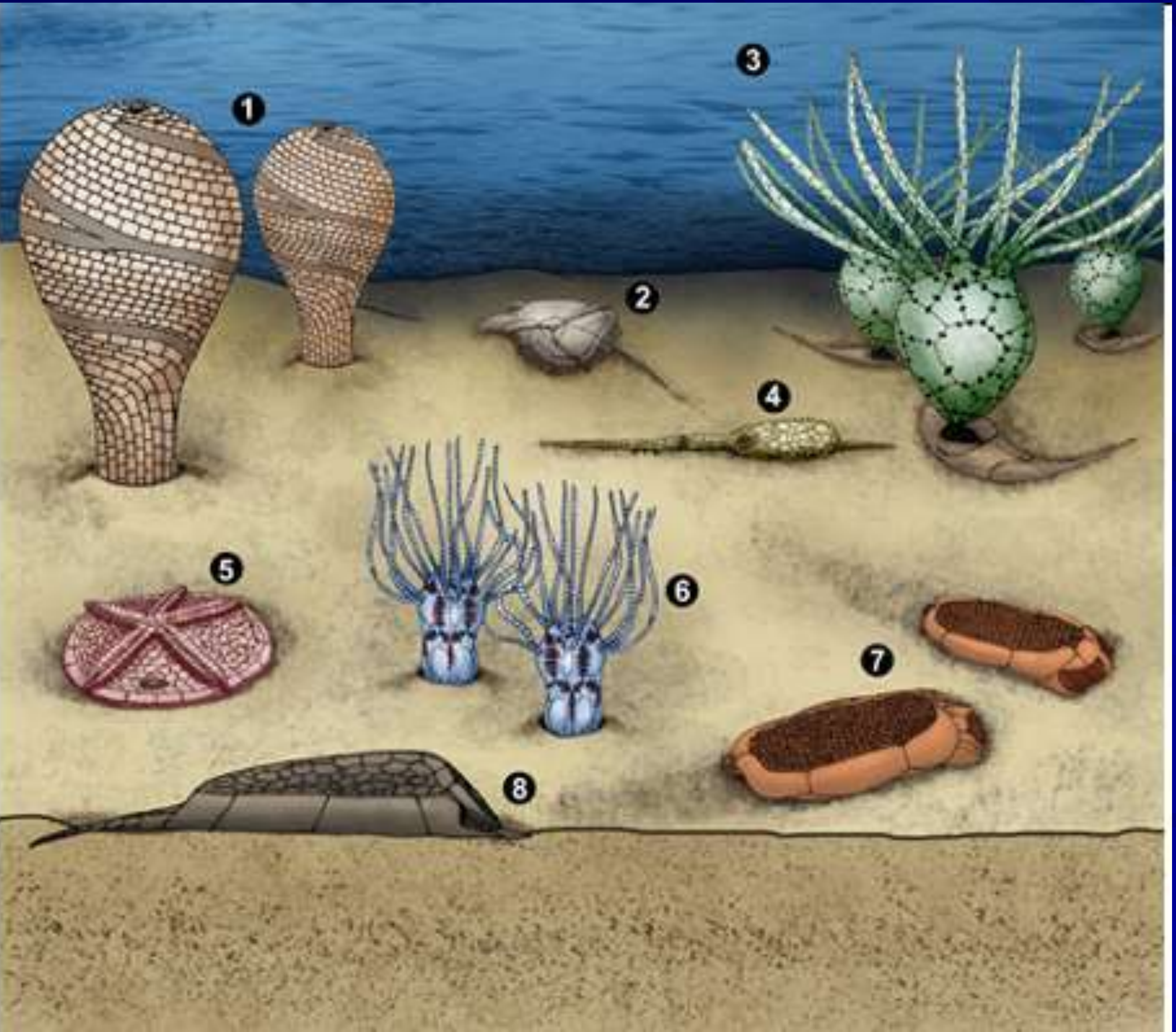
Camera lucida drawing of a latex of *Stomatocystites walcotti* Schuchert, Olenellus Beds, Newfoundland, Canada (Paul, Smith, 1984).

Radiation and phylogeny of echinoderms



Ambulacral structure *in Stromatocystites*. A, detail of arrangement of ambulacral flooring plates and mouth frame in *S.walcotti*. B, detail of ambulacral cover plates in *S.pentangularis* (Paul, Smith, 1984).

Reconstruction of a Cambrian echinoderm hypothetic community which contains taxa from different geographic areas and different ages.
After S.Zamora et al., 2010.



1. Helicoplacoidea (*Helicoplacus*)
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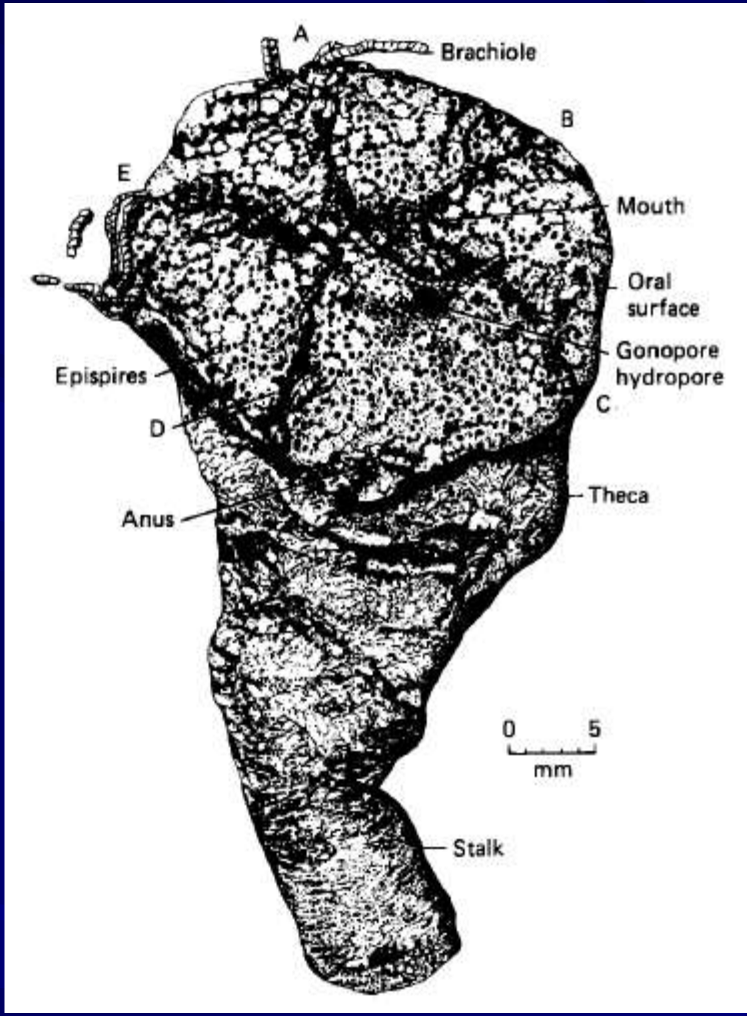
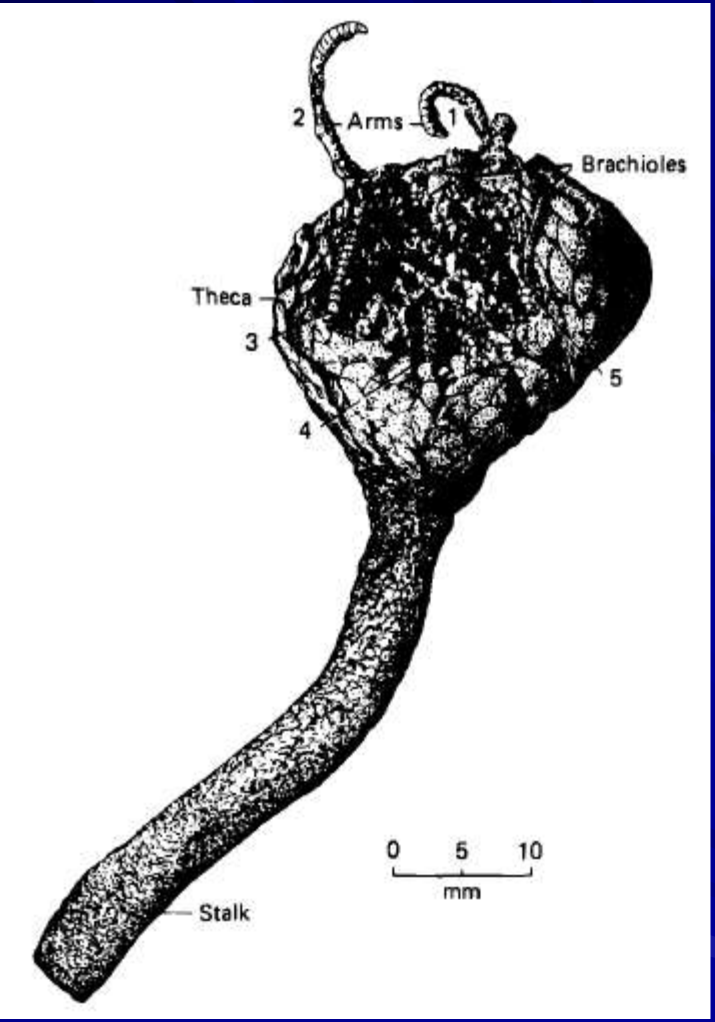
4. Soluta (*Castericystis*)
5. Edrioasteroidea (*Cambraster*)
6. Eocrinoidea (*Lichenoides*)
7. Ctenocystoidea (*Ctenocystis*)
8. Cincta (*Gyrocystis*).

Radiation and phylogeny of echinoderms



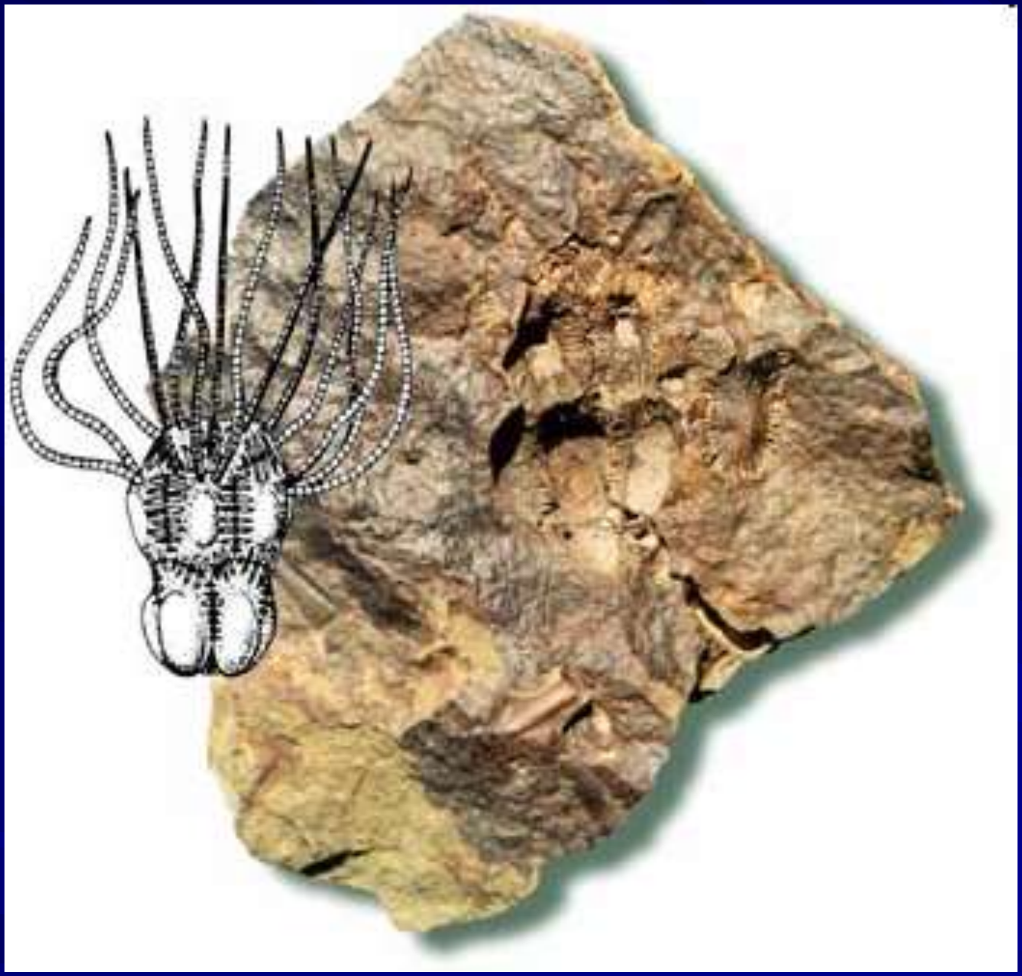
General morphology of *Kinzercystis durhami*.



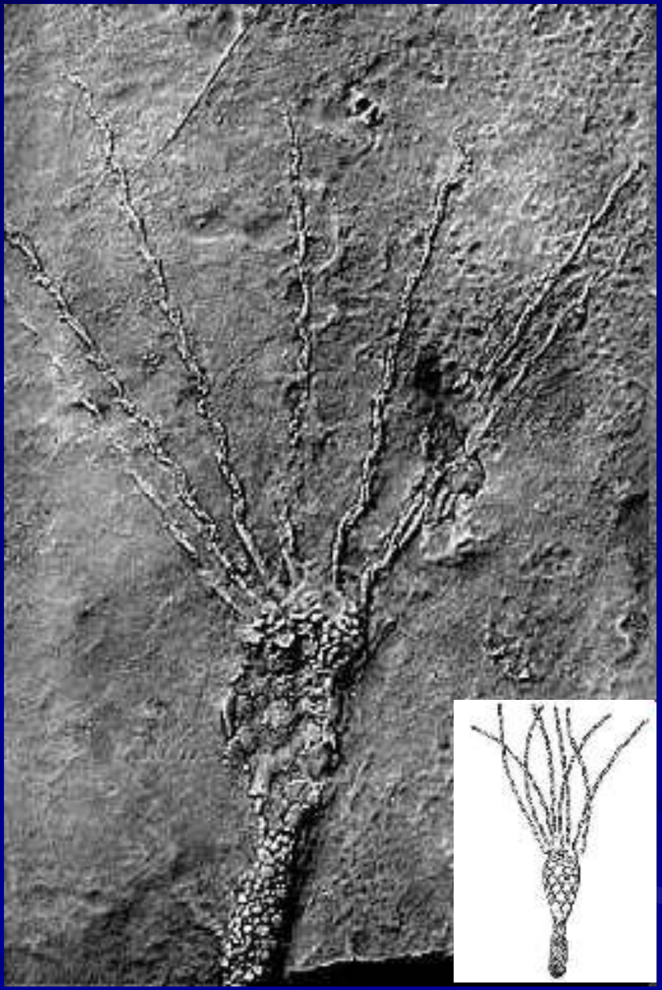
General morphology of *Lepidocystis*.

(Paul, Smith, 1984)

Eocrinoidea

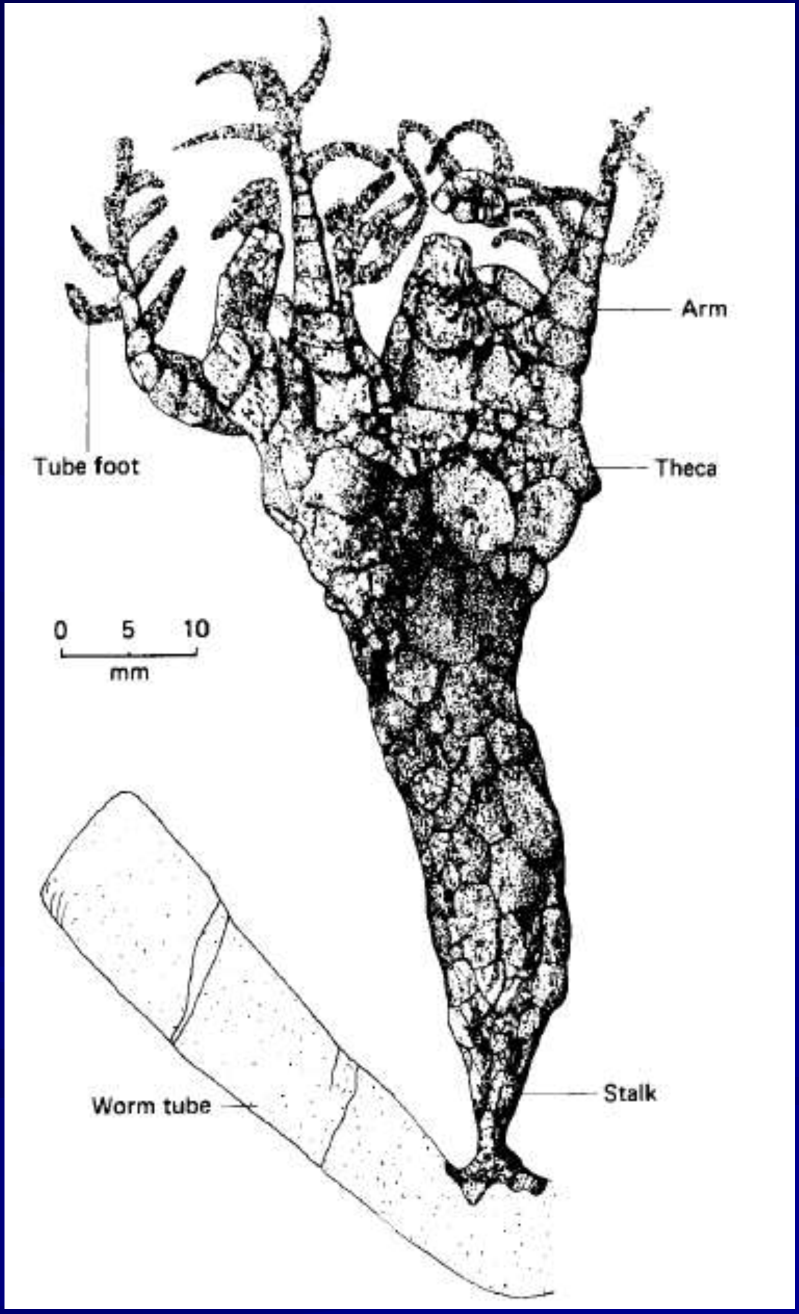


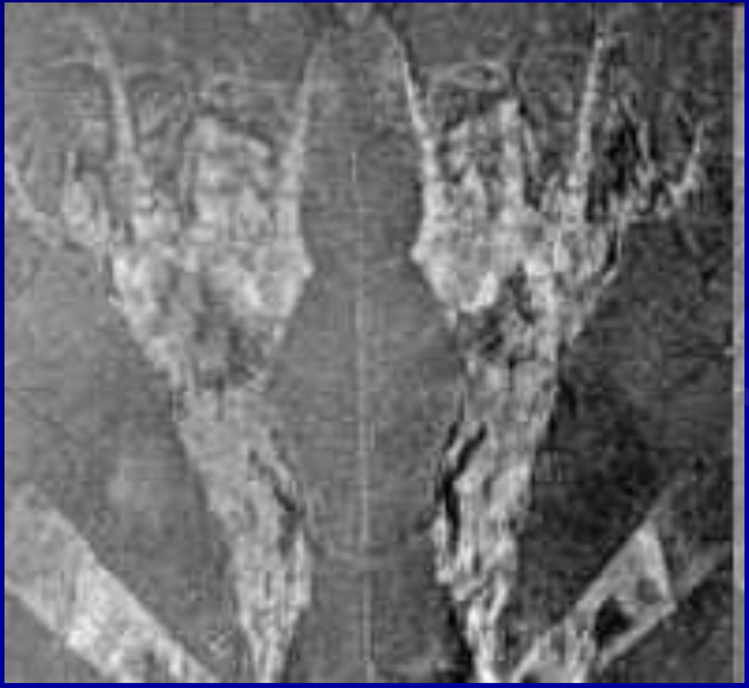
Lichenoides priscus



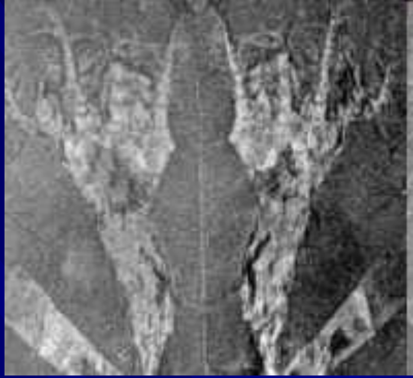
Gogia sp.

Echmatocrinus brachiatus Sprinkle 1973 – древнее иглокожие?





Echmatocrinus brachiatus Sprinkle 1973 – древнее иглокожие?



Age: Middle Cambrian.

Location: Burgess Shale, western Canada.

Hypodigm: Five partially complete specimens and a single plate (Sprinkle & Moore, 1978).

Description: Stalked, sessile animal with tapering, cylindrical holdfast broadening to a "cup" bearing eight to ten short tentacles. Holdfast, cup and tentacles all covered with small to medium-sized irregular plates. Tentacles with numerous small, unarmoured appendages. Specimens show a considerable variation in the size and length of the holdfast, but it is unclear whether this represents growth differences or whether the holdfast was capable of telescoping or extension.

Comments: Echmatocrinus was originally described as the earliest known crinoid, and its irregular plating and holdfast was believed to represent an ancestral stage to the regular plating and stem of later crinoids. As such, it was compared to a similar pattern of descent between eocrinoids and cystoids, but with crinoids arising independently from these other echinoderm classes.

However, reinterpretation of Echmatocrinus excluded it from the crinoids and echinoderms in general because of the absence of pentamery, a clear column/calyx distinction, sutured plates organised in offset circlets, evidence for a water vascular system or stereomic microstructure (Ausich 1998a,b, 1999). Instead, Ausich (1998a) suggested the Lower Ordovician Aethocrinida with four circlets of plates in the cup as representing the primitive morphology for crinoids, with crinoids probably descended from rhombiferans.

As for Echmatocrinus, the presence of eight arms (reinterpreted as tentacles with the side branches interpreted as pinnae) and the microstructure of the plates lead to the suggestion that it was an octocoral.

Echmatocrinus brachiatus Sprinkle 1973 – древнее иглокожие?

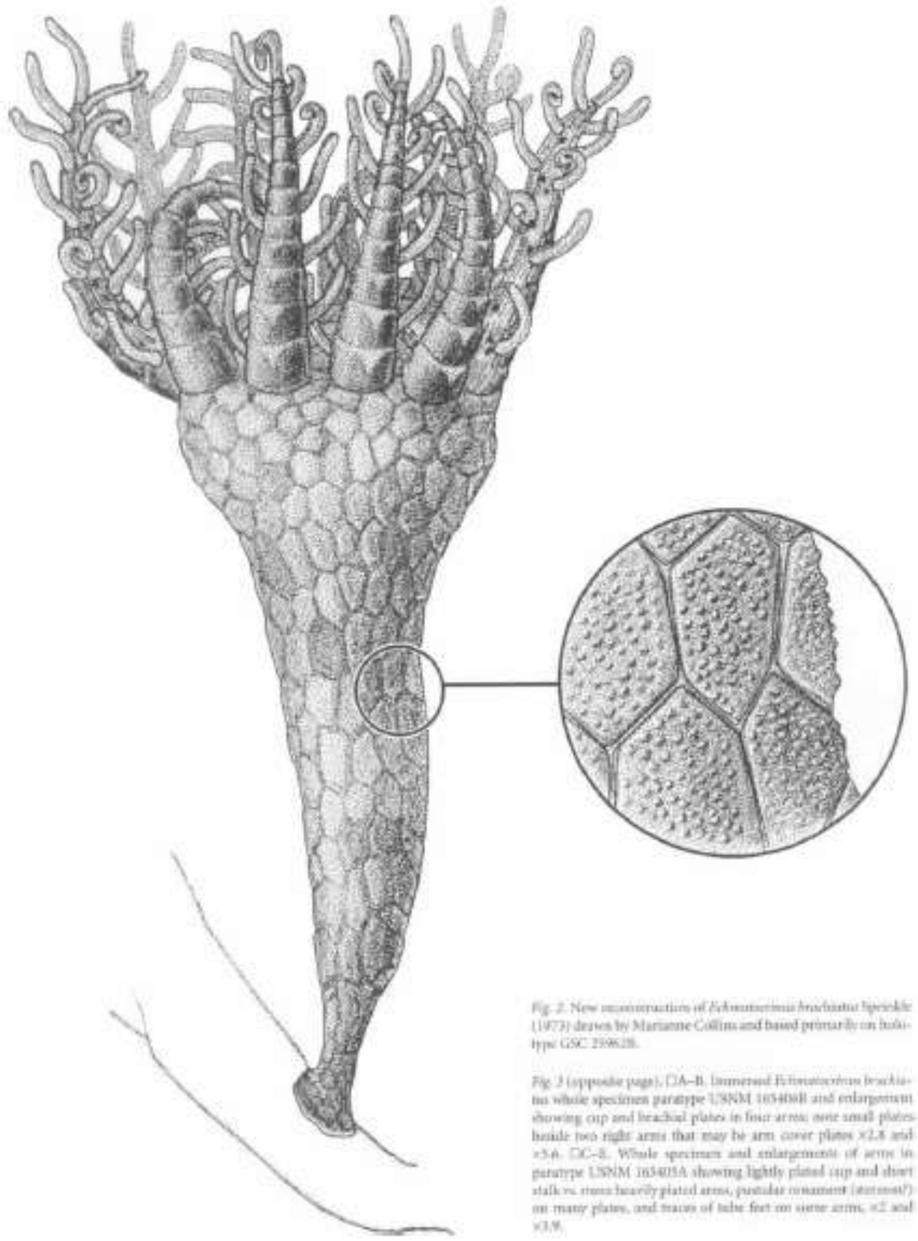


Fig. 2. New reconstruction of *Echmatocrinus brachiatus* Sprinkle (1973) drawn by Marianne Collins and based primarily on holotype GSC 25962B.

Fig. 3 (opposite page). □A–B. Immersed *Echmatocrinus brachiatus* whole specimen paratype USNM 165406B and enlargement showing cup and brachial plates in four arms; note small plates beside two right arms that may be arm cover plates ×2.8 and ×5.6. □C–E. Whole specimen and enlargements of arms in paratype USNM 165405A showing lightly plated cup and short stalk vs. more heavily plated arms, pustular ornament (stereom?) on many plates, and traces of tube feet on some arms, ×2 and ×3.9.

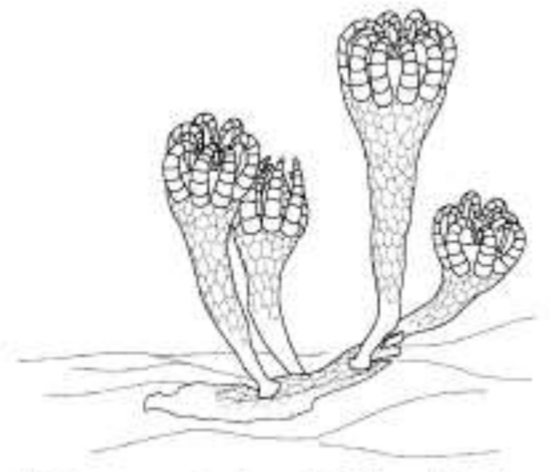
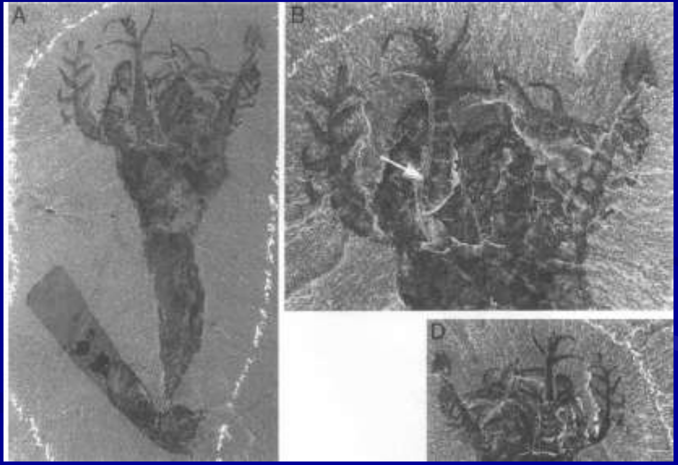


Fig. 5. New reconstruction of cluster of four *Echmatocrinus brachiatus* specimens, attached to recumbent stalk on sea-floor; drawn by Marianne Collins and based on ROM 52721.



(Sprinkle, Collins, 1998)

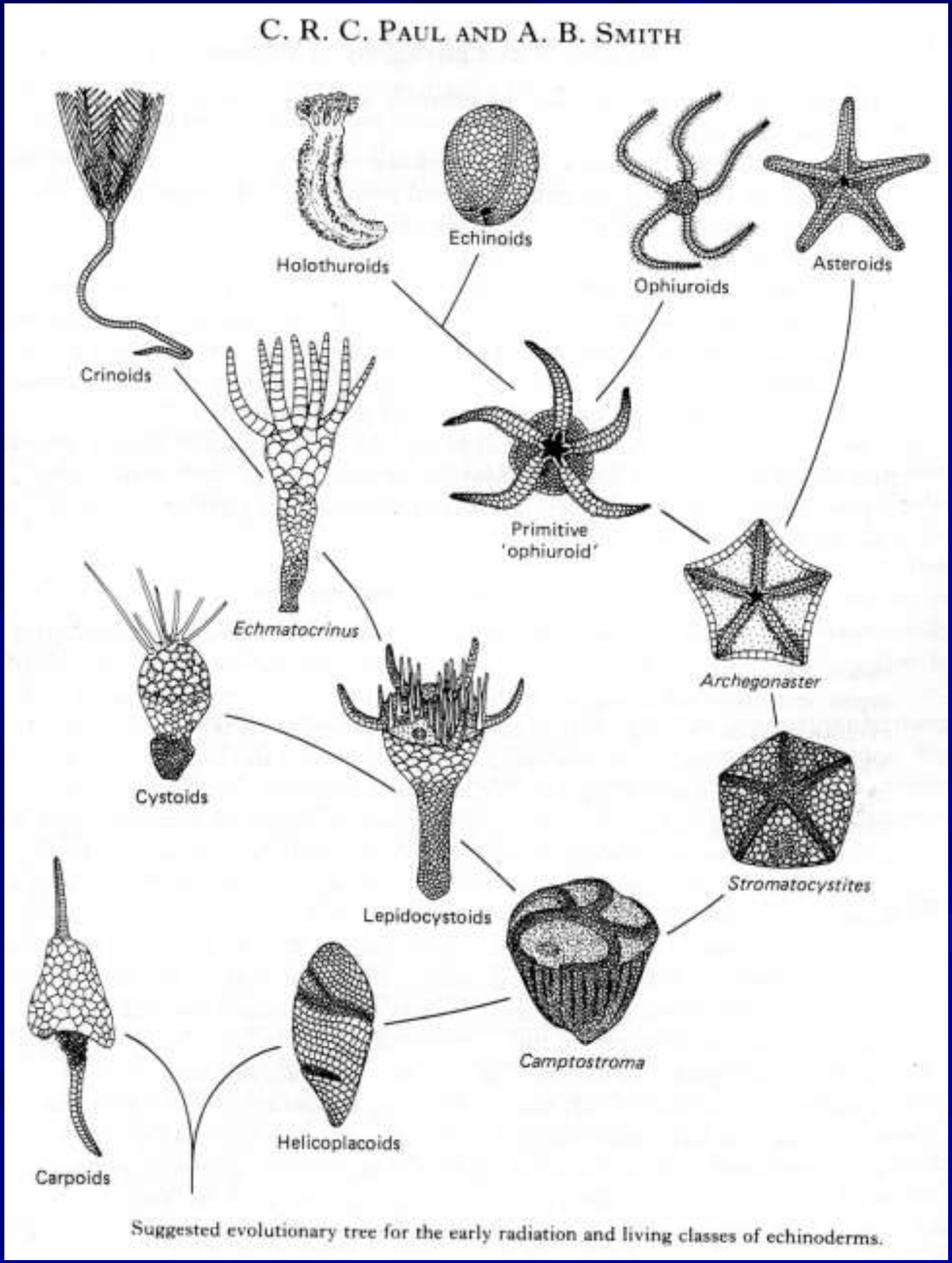
Distribution of characters in Lower Cambrian echinoderm genera

<table>
<tr><th></th><th>Solute</th><th>Helicoplacus</th><th>Waucobella</th><th>Polyplacus</th><th>Stromatocystites</th><th>Camptostroma</th><th>Gogia</th><th>Kinzercystis</th><th>Lepidocystis</th><th>Echmatocrinus</th></tr>
<tr><td>Stereom</td><td colspan="10">1 Present</td></tr>
<tr><td>Ambulacra part of thecal wall</td><td>No</td><td colspan="2"></td><td>(?)</td><td colspan="5">2 yes</td><td>(?)</td></tr>
<tr><td>Polyserial cover plates</td><td>(?)</td><td colspan="2"></td><td>(?)</td><td colspan="5">3 yes</td><td>(?)</td></tr>
<tr><td>Three primary ambulacra</td><td>No</td><td colspan="2"></td><td>(?)</td><td colspan="5">4 yes</td><td>(?)</td></tr>
<tr><td>Spiral plating</td><td>Absent</td><td colspan="3">5 present</td><td colspan="6">Absent</td></tr>
<tr><td>Anus</td><td>? present</td><td colspan="3">6 absent</td><td colspan="5">Pyramid in CD interambulacrum</td><td>(?)</td></tr>
<tr><td>Interambulacra with alternating ridges and contraction zones</td><td>No</td><td colspan="2">7 yes</td><td colspan="7">No</td></tr>
<tr><td>Polyplated lateral area</td><td colspan="3">No</td><td>8 yes</td><td colspan="6">No</td></tr>
<tr><td>Dorso-ventral differentiation of skeleton</td><td colspan="4">No</td><td colspan="6">9 yes</td></tr>
<tr><td>Bifurcate lateral ambulacra in 2-1-2 arrangement</td><td colspan="4">No</td><td colspan="5">10 yes</td><td>(?)</td></tr>
<tr><td>Ventral epispires</td><td colspan="4">No</td><td colspan="5">11 yes</td><td>(?)</td></tr>
<tr><td>Dorsal surface flat, tesselate, as extensive as ventral surface</td><td colspan="4">No</td><td>12 yes</td><td colspan="5">No</td></tr>
<tr><td>Marginal ring</td><td colspan="4">No</td><td>13 yes</td><td colspan="5">No</td></tr>
<tr><td>Two-layered plating; curved ambulacra</td><td colspan="5">No</td><td>14 yes</td><td colspan="4">No</td></tr>
<tr><td>Attached, elongate, aboral stalk</td><td>'Stele'*</td><td colspan="5">No</td><td colspan="4">15 yes</td></tr>
<tr><td>Brachioles</td><td colspan="6">No</td><td colspan="3">16 yes</td><td>19 No</td></tr>
<tr><td>Tesselate cup and stalk</td><td colspan="6">No</td><td>17 yes</td><td colspan="2">No</td><td>(?)</td></tr>
<tr><td>Multiple free arms</td><td colspan="8">No</td><td colspan="2">18 yes</td></tr>
<tr><td>Uniserial arm plates</td><td colspan="9">No</td><td>20 yes</td></tr>
</table>

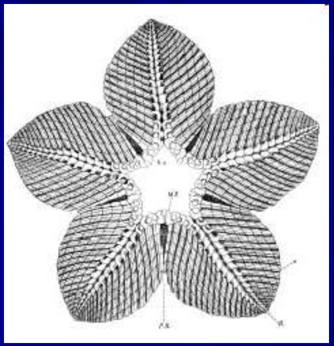
* No stele is known to have been attached and the carpoid stele is certainly not homologous with the pelmatozoan stem.

(?) indicates that the character is not confirmed in these genera.

(Paul, Smith, 1984)

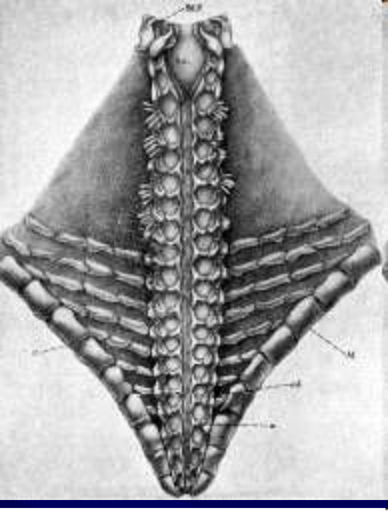


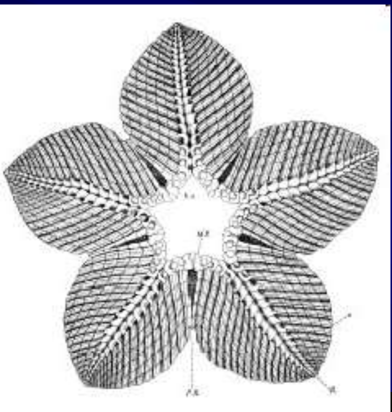
Suggested evolutionary tree for the early radiation and living classes of echinoderms.



(Paul, Smith, 1984)

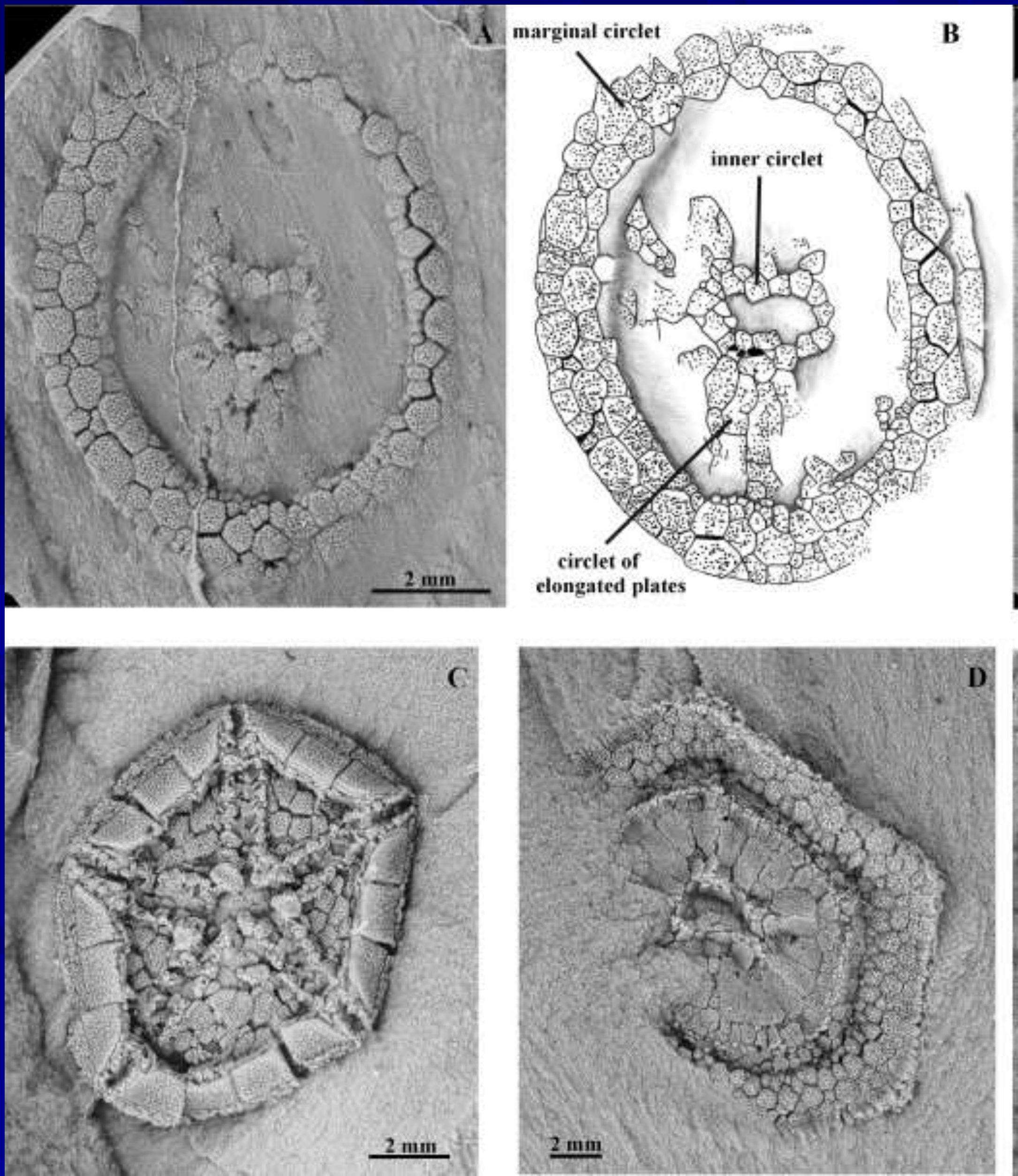
"Edrioasteroidea"



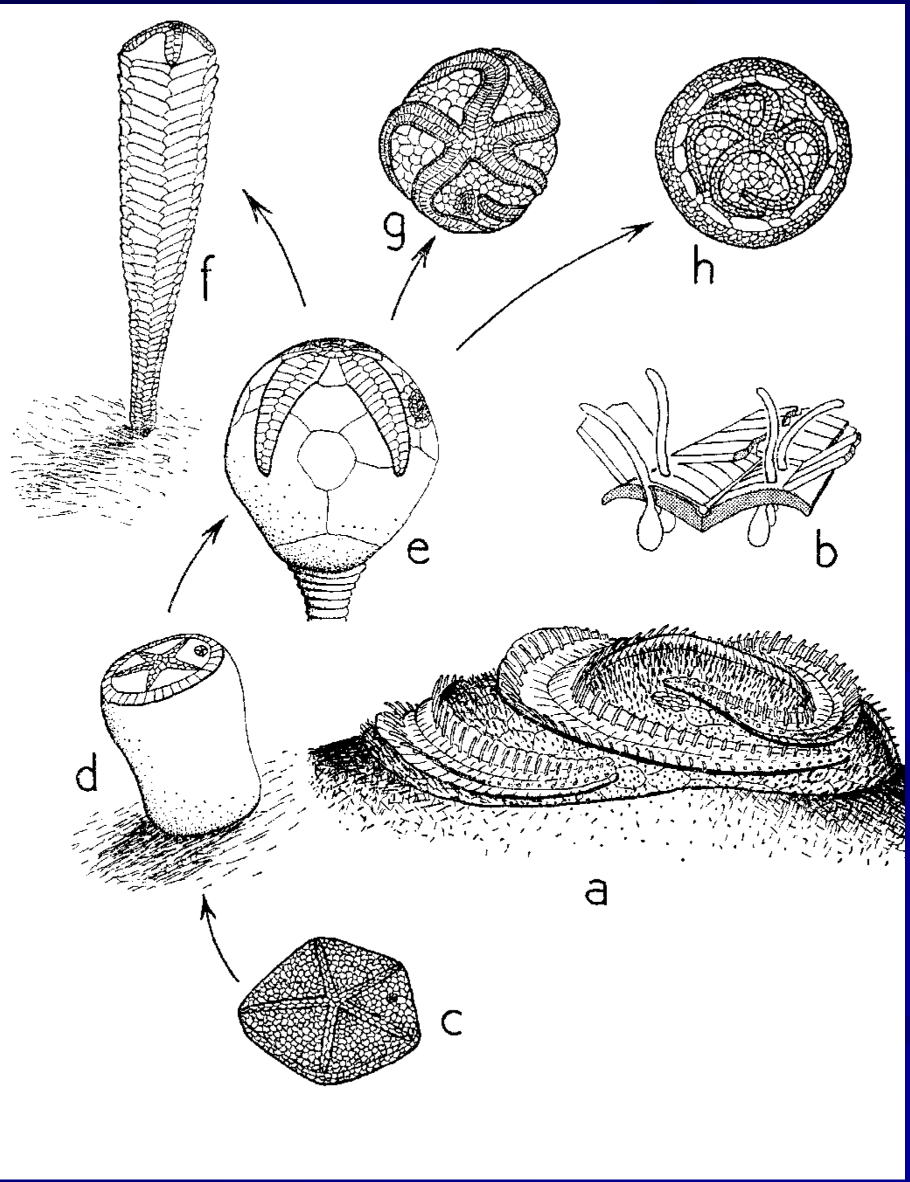


Archegonaster
(Somasteroidea)

Cambraster (Edrioasteroidea)



“Edrioasteroidea”

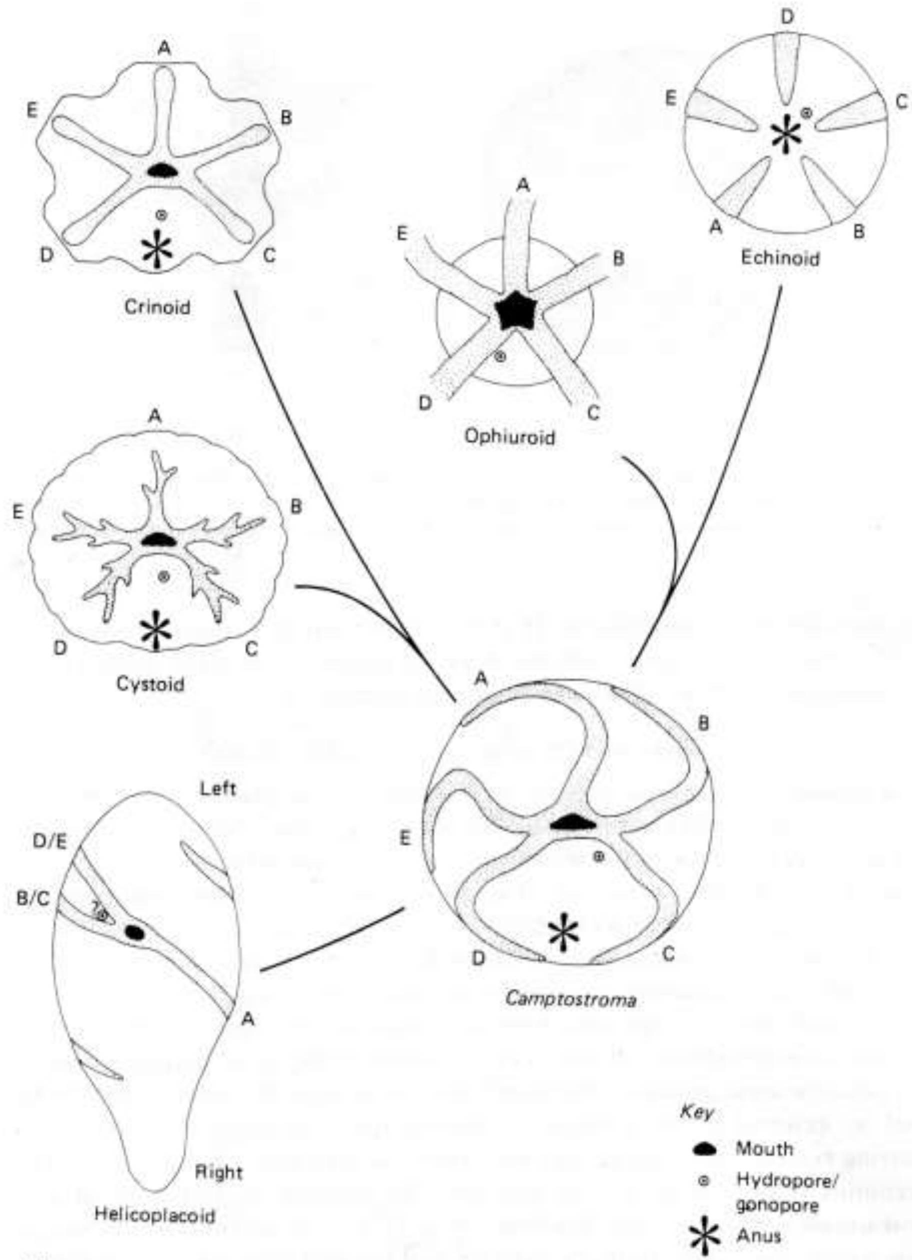


(Nichols, 1969)

Cystaster stellatus

Carneyella pilea

Streptaster vorticellatus, 13 mm, Ordovic



Diagrammatic representation of ray homologies in major echinoderm groups as seen in oral (ventral) view with the exception of the echinoid, which is shown in aboral (dorsal) view.

(Paul, Smith, 1984)

Radiation and phylogeny of echinoderms

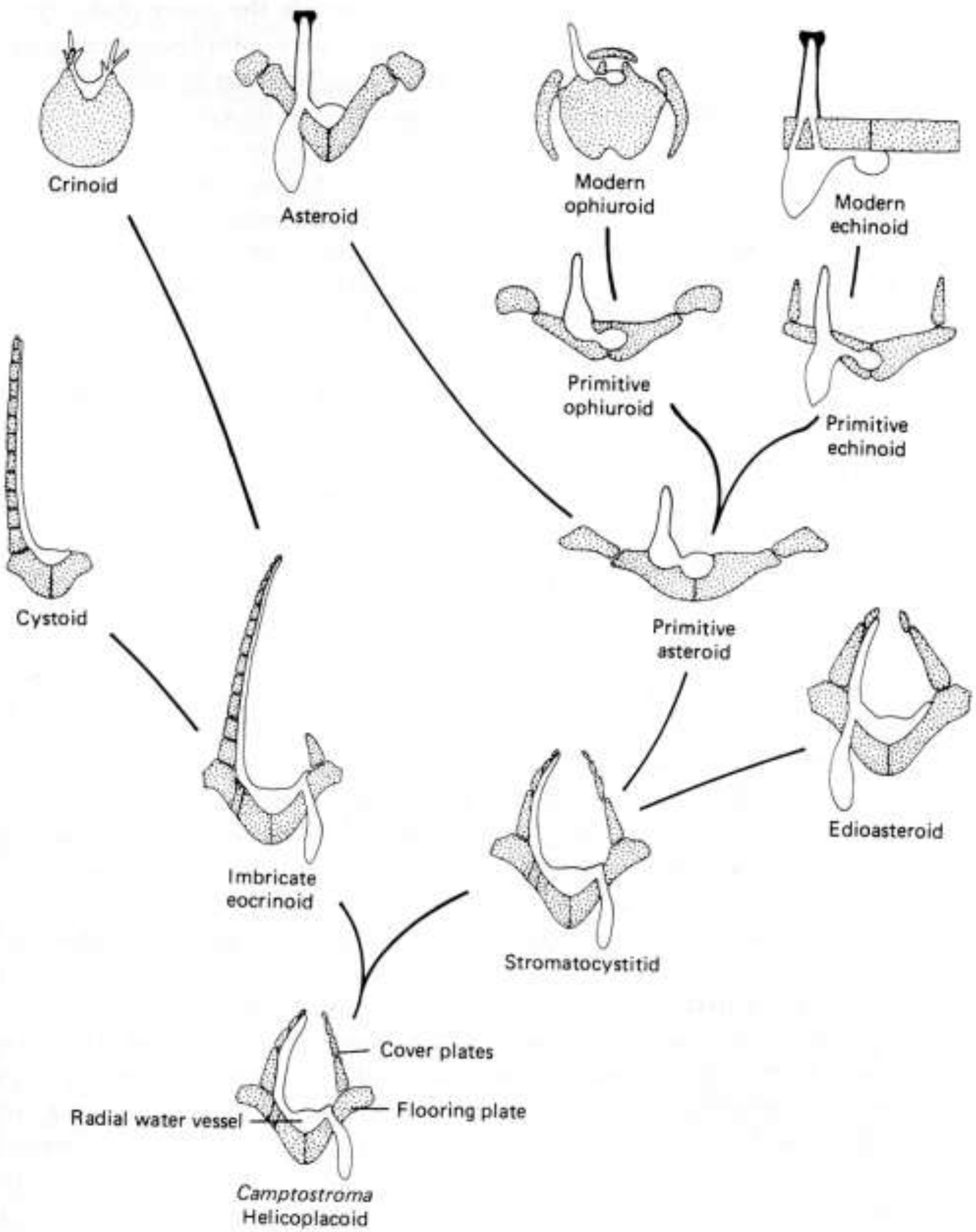
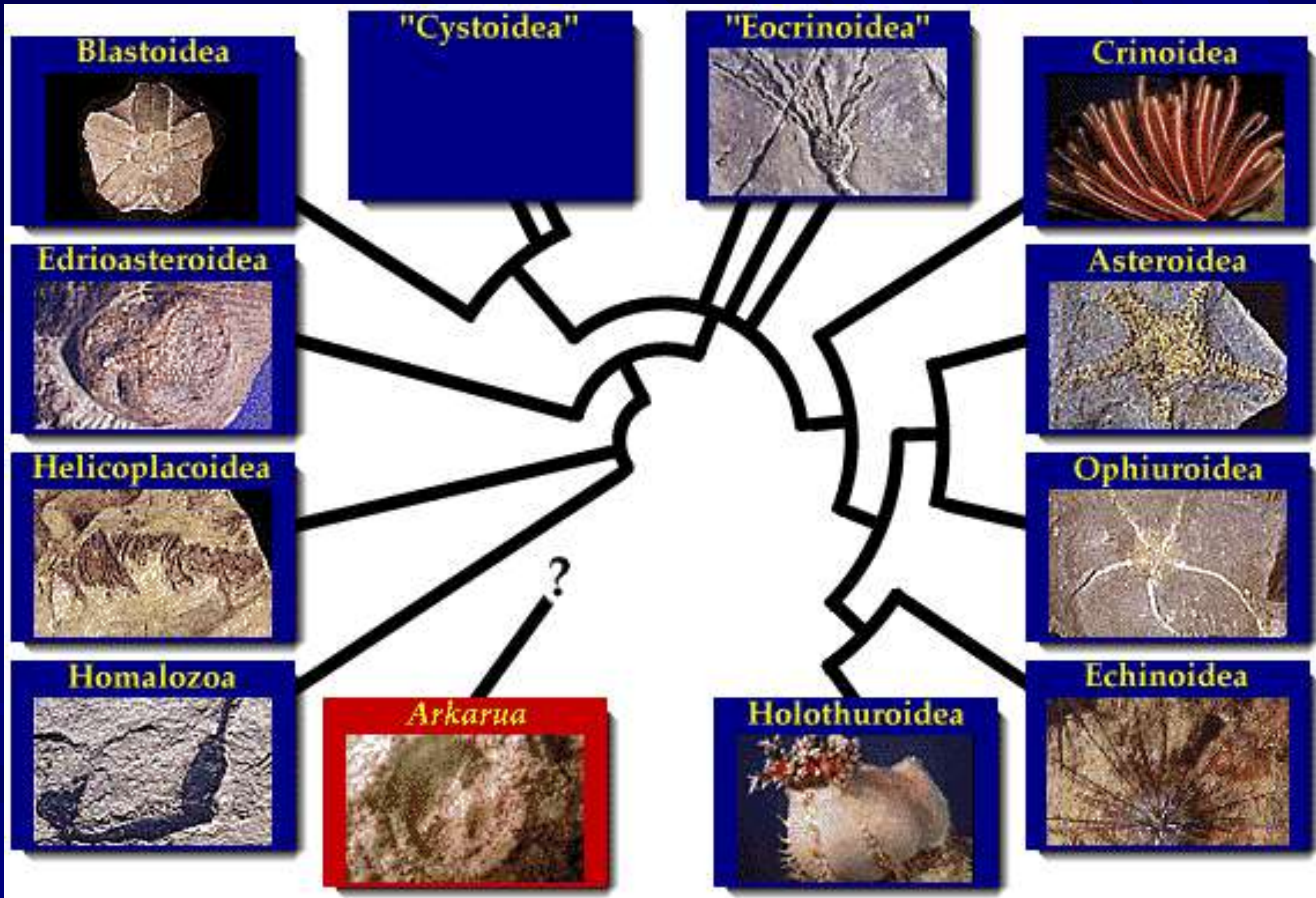


Diagram to show the evolution in the structure of the ambulacra and water vascular system in echinoderms.

(Paul, Smith, 1984)

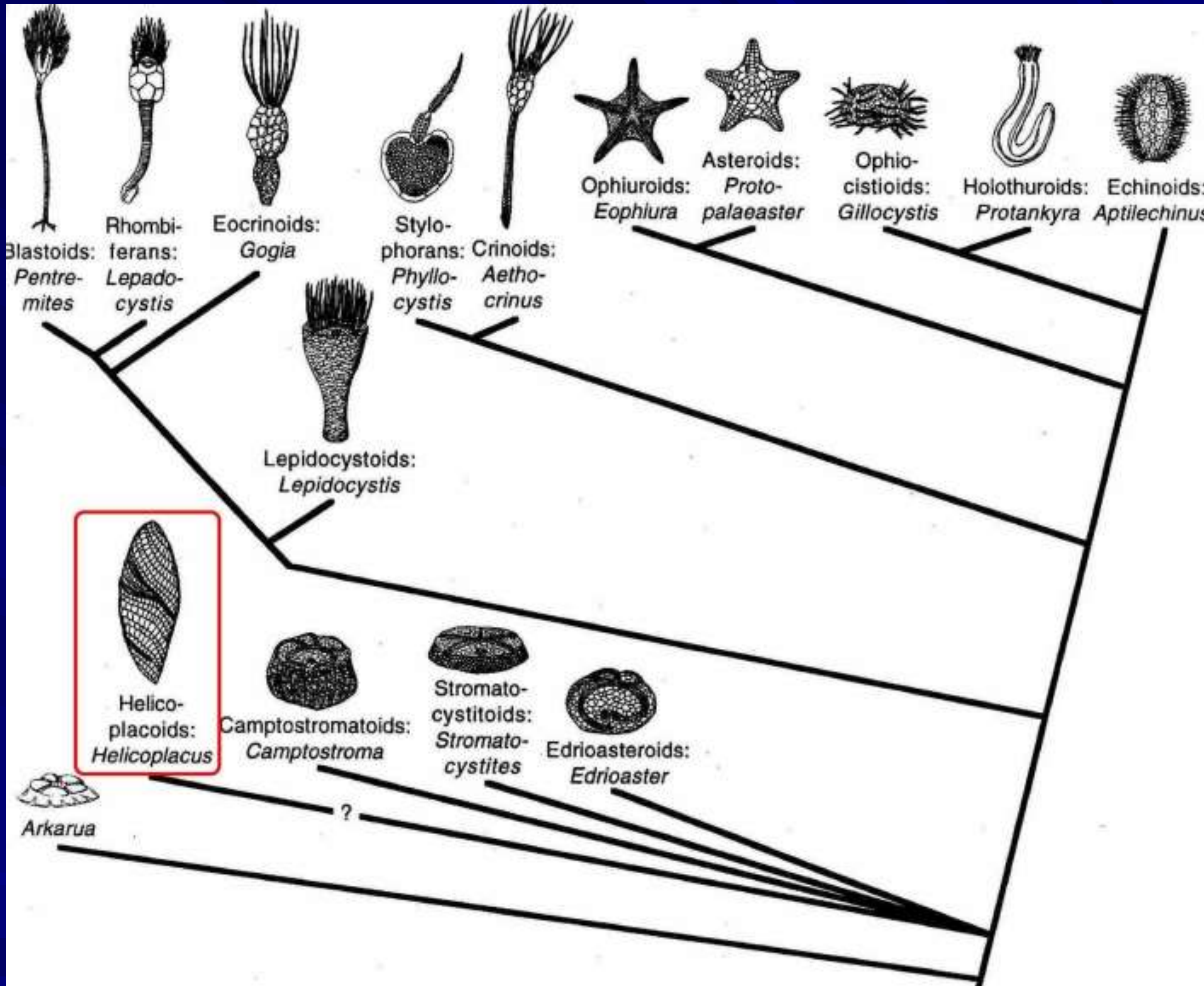


Blastoidea
"Cystoidea"
"Eocrinoidea"
Crinoidea
Edrioasteroidea
Asteroidea
Helicoplacoidea
Ophiuroidea
?
Homalozoa
Arkarua
Holothuroidea
Echinoidea

Прекембрийские находки (Венд)

Arkarua

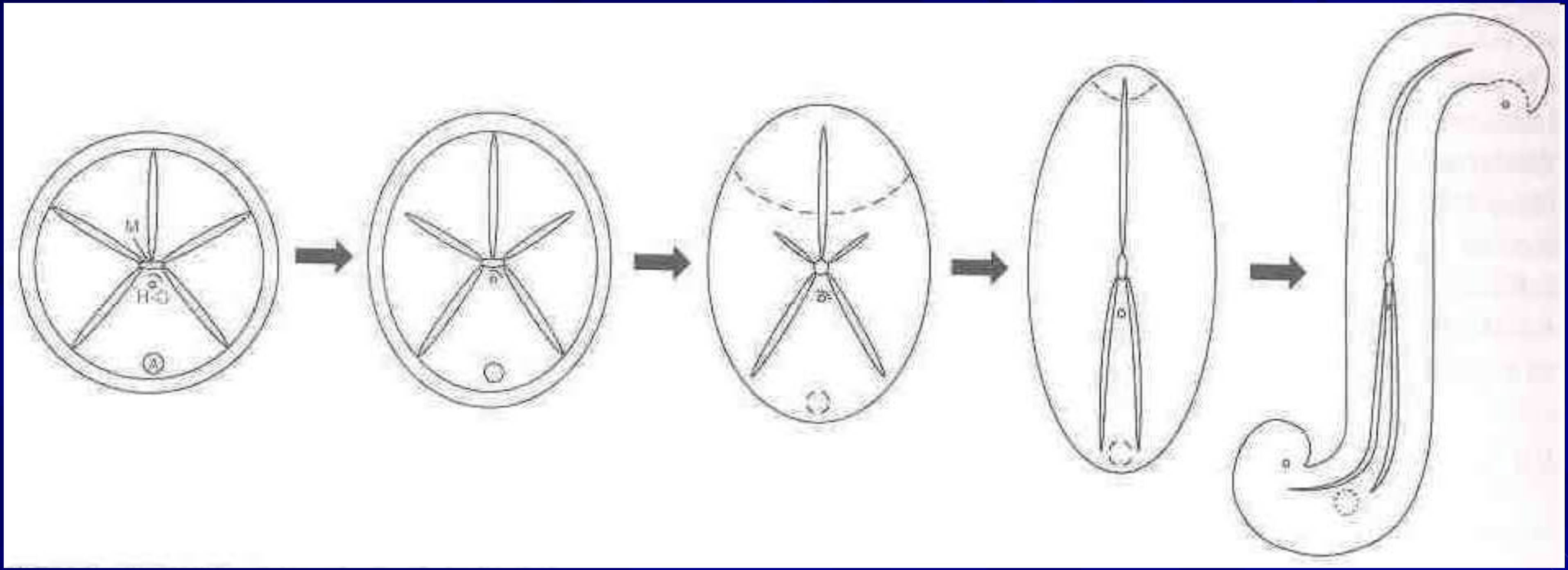

Arkarua is a small, Precambrian disk-like fossil with a raised center, a number of radial ridges on the rim, and a five-pointed central depression marked with radial lines of 5 small dots from the middle of the disk center. The only known species, *Arkarua adami*, is 3 to 10 mm in diameter. *Arkarua* is known only from the Ediacaran beds of the Flinders Ranges in South Australia, and takes its name from a mythical giant snake of the local Aboriginal people (Gehling 1987).



(from Mooi & David, 1998; Helicoplacoids shown in red box)

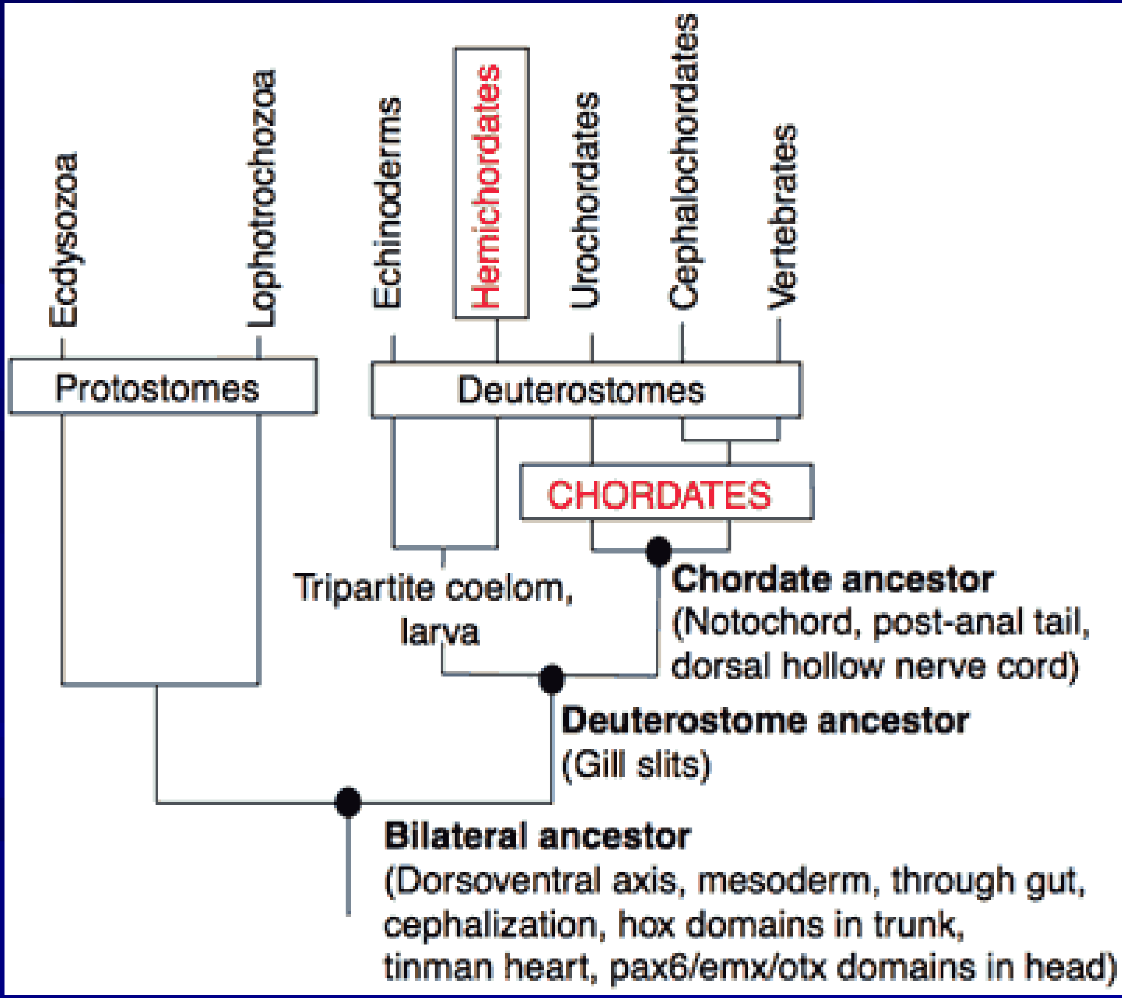
Thanks to Dr Christopher Mah

Helicoplacoida



One idea by James Sprinkle and Bryan Wilbur from the University of Texas hypothesizes that helicoplacoids are derived from edrioasteroids but have undergone a striking change in plate geometry and overall shape. Edrioasteroids were a widespread Paleozoic group of echinoderms with a more conventional five part symmetry but which looked like little biscuits.

Thanks to Dr Christopher Mah, USA


Ecdysozoa
Lophotrochozoa
Echinoderms
Hemichordates
Urochordates
Cephalochordates
Vertebrates
Protostomes
Deuterostomes
CHORDATES
Tripartite coelom, larva
Chordate ancestor
(Notochord, post-anal tail, dorsal hollow nerve cord)
Deuterostome ancestor
(Gill slits)
Bilateral ancestor
(Dorsoventral axis, mesoderm, through gut, cephalization, hox domains in trunk, tinman heart, pax6/emx/otx domains in head)