

Echinodermata



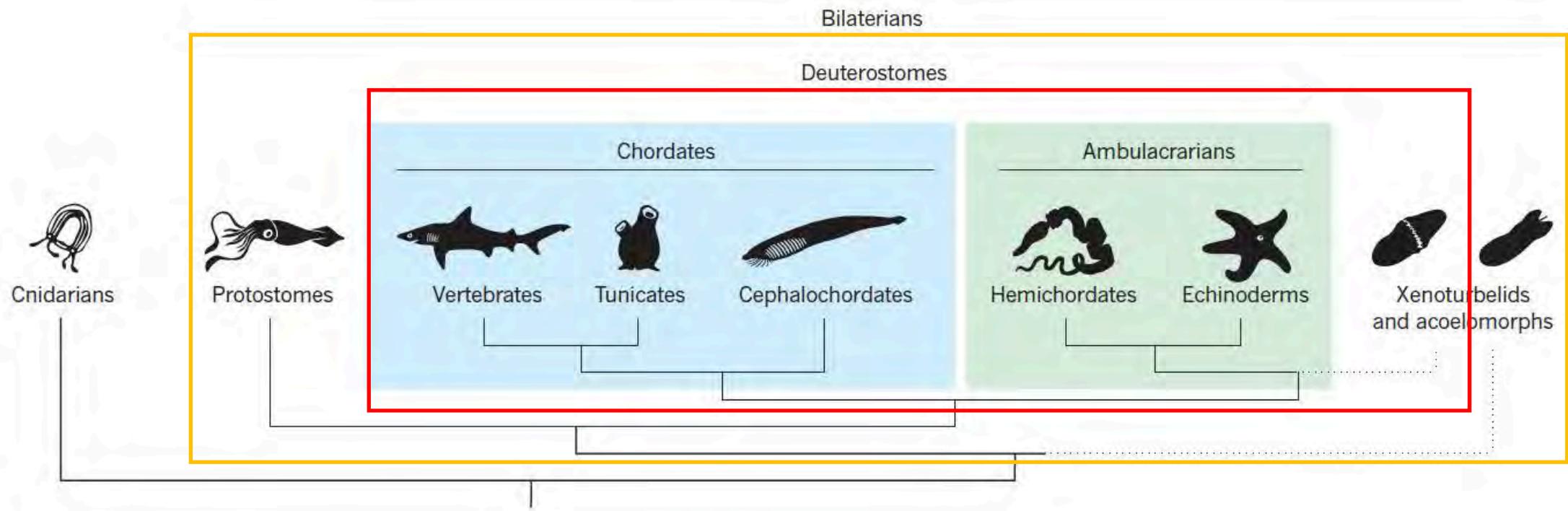
Marine Fau

marine.fau@unifr.ch

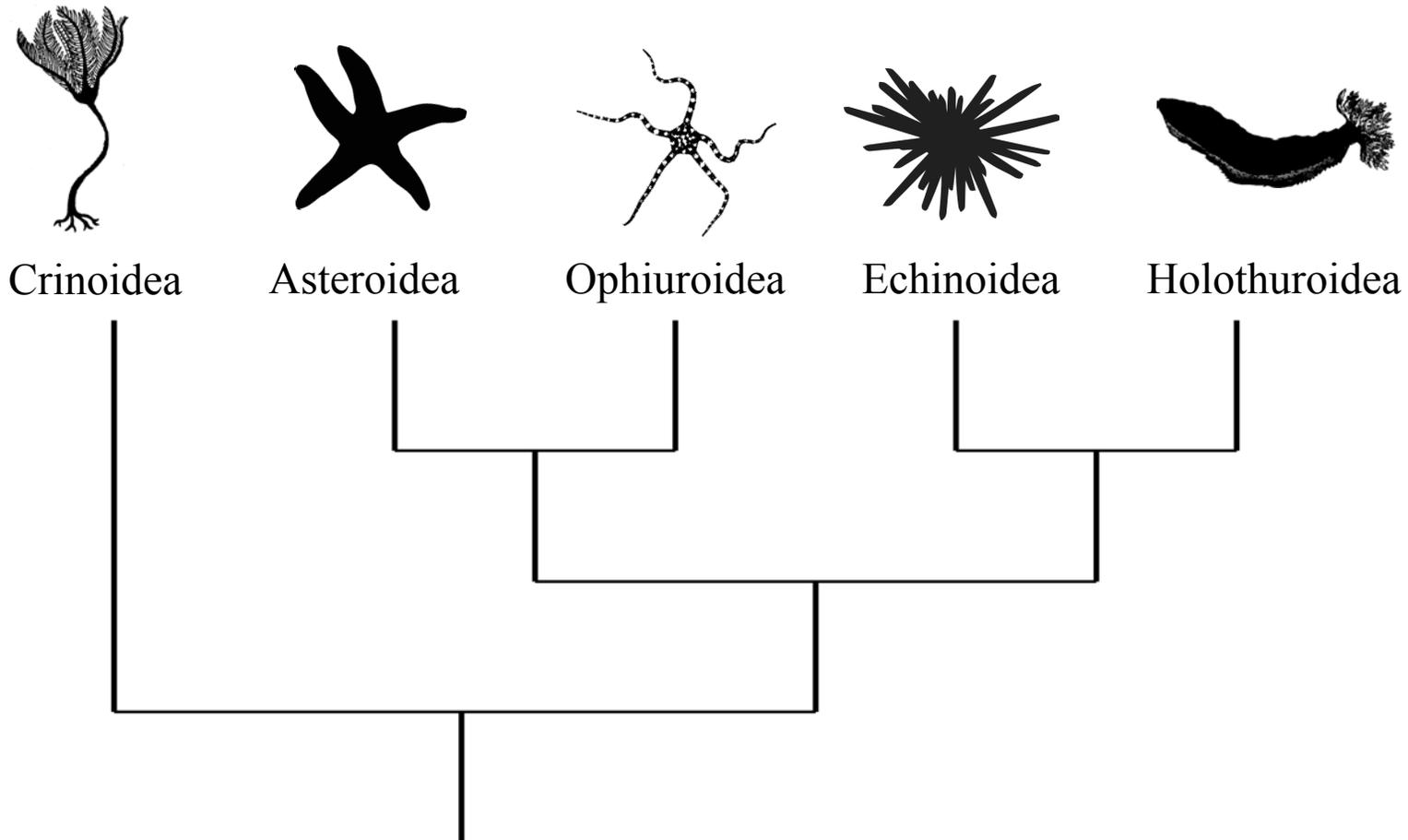
PhD student, University of Fribourg

03/12/2018

Contexte phylogénétique



Contexte phylogénétique



ECHINODERMATA



Crinoidea



Echinoidea



Holothuroidea



Ophiuroidea



Asteroidea

ECHINODERMATA



600 extant species

Crinoidea

1 000 extant species



Echinoidea

1 700 extant species



Holothuroidea

2 000 extant species



Ophiuroidea

2 000 extant species



Asteroidea

Symétrie pentaradiée (5)



Ophiure
(ophiuroidea)

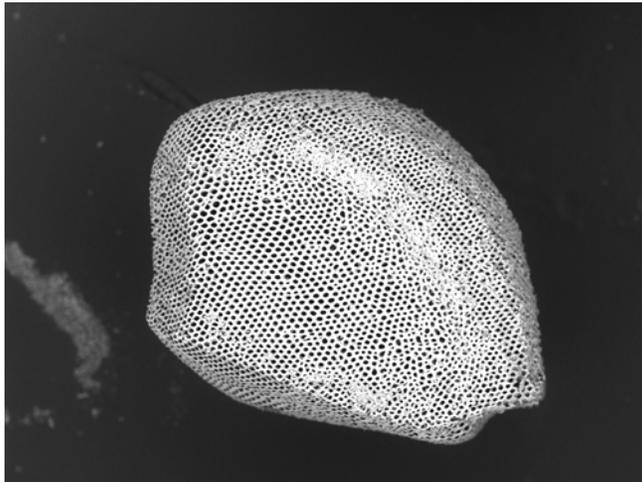
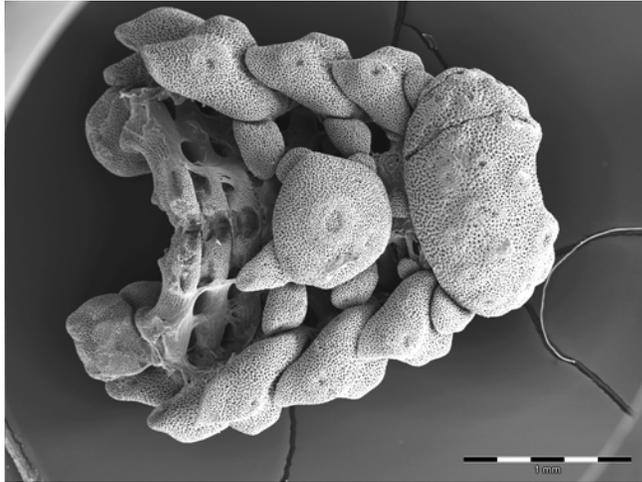


Oursins irréguliers (echinoidea)



M. Fau
Maldives 2018

Étoile de mer
(asteroidea)



pluto_0035 2015/06/19 FL x100 1 mm

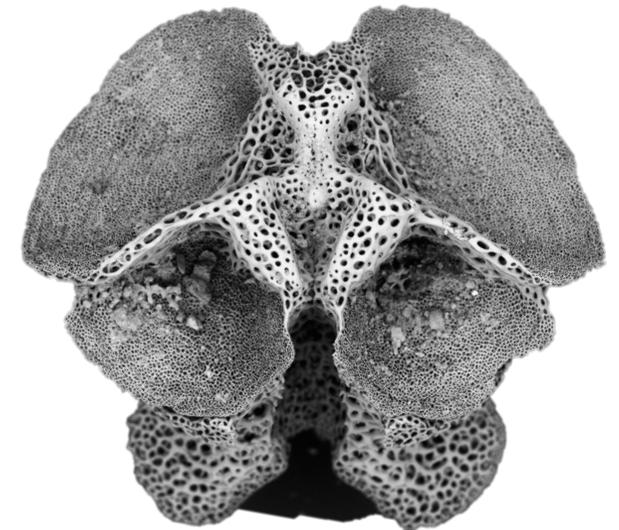
ossicules d'étoile de mer (SEM)

Le stéréome

- Squelette mésodermique
- Centaines à milliers d'ossicules
 - 100% calcite (CaCO_3)

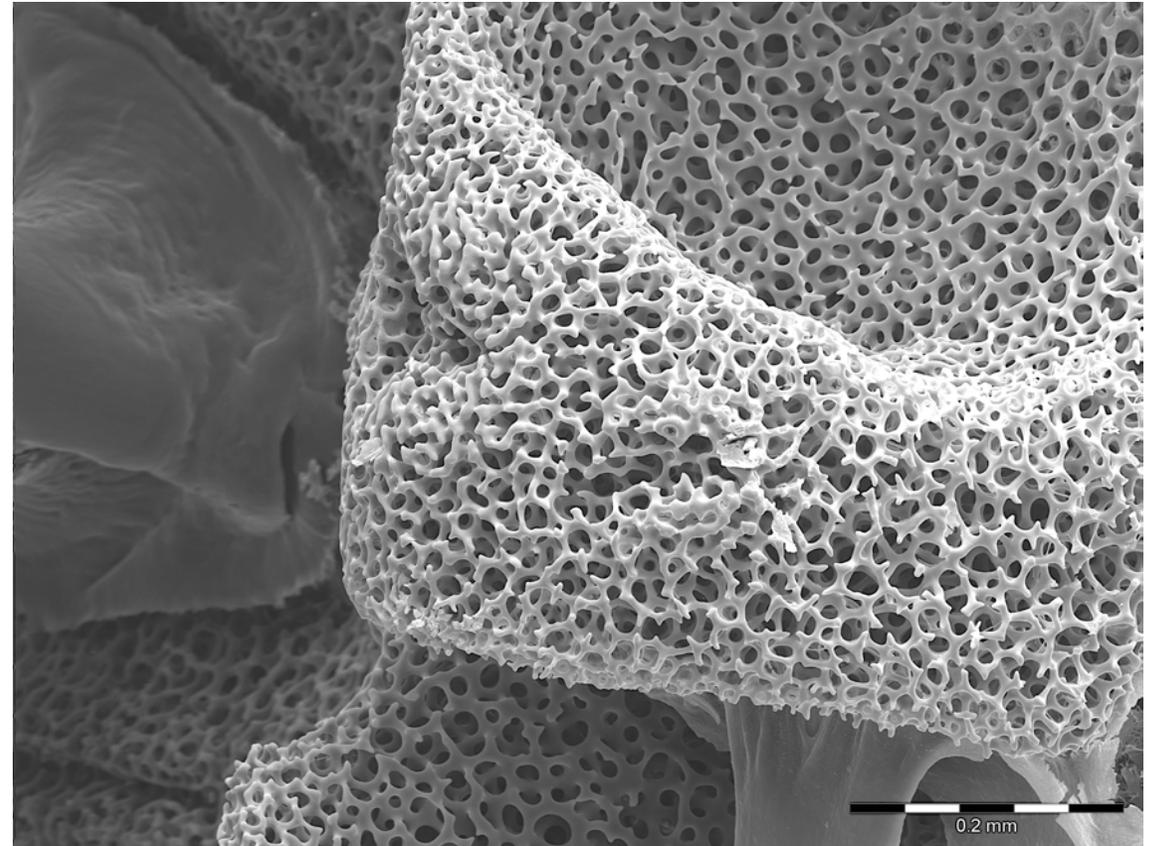
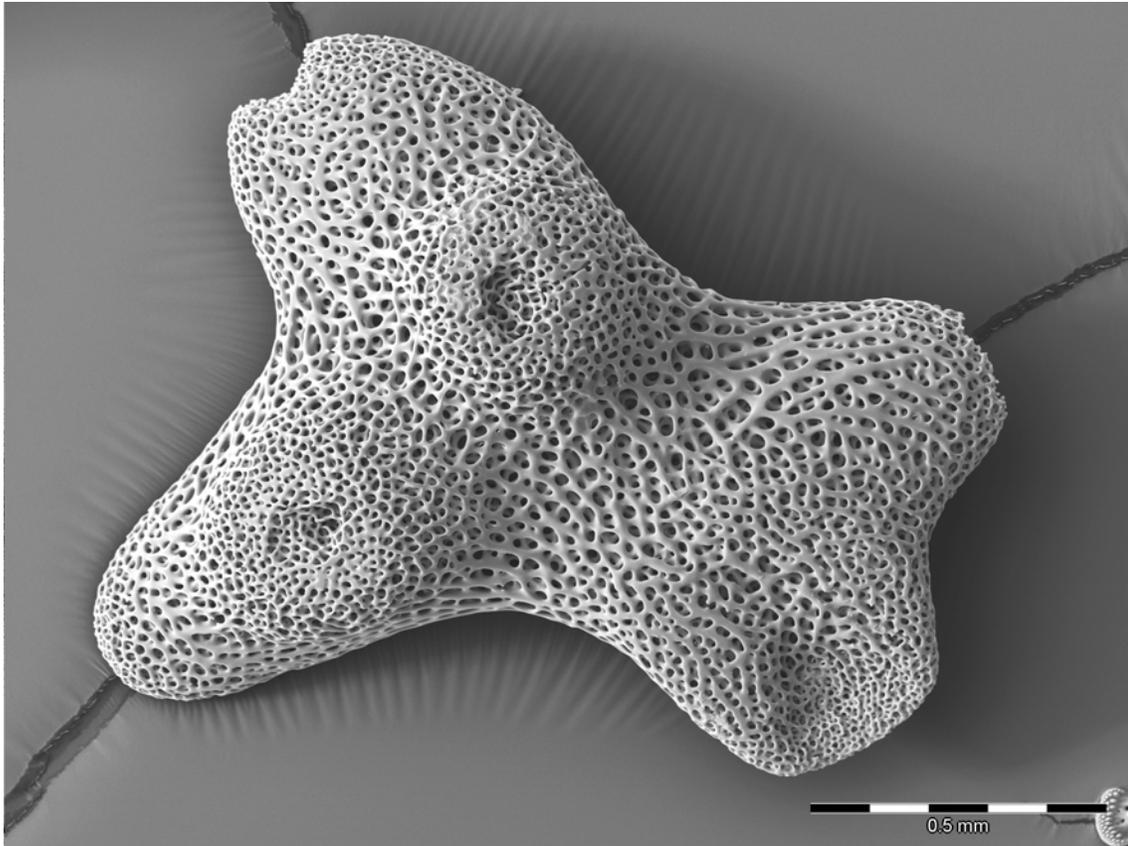


Test d'oursin

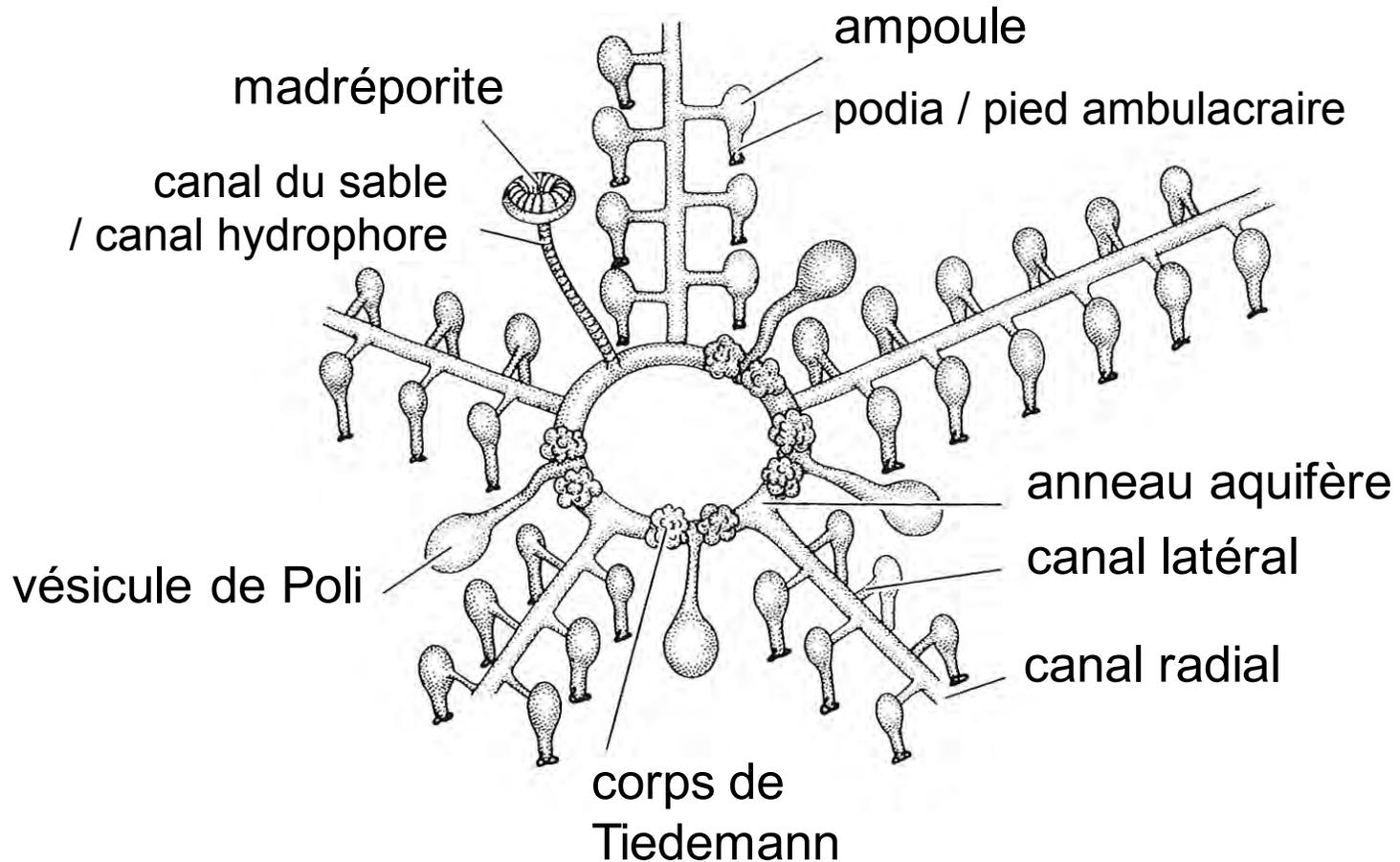


Vertèbre d'ophiure (SEM)

Le stéréome

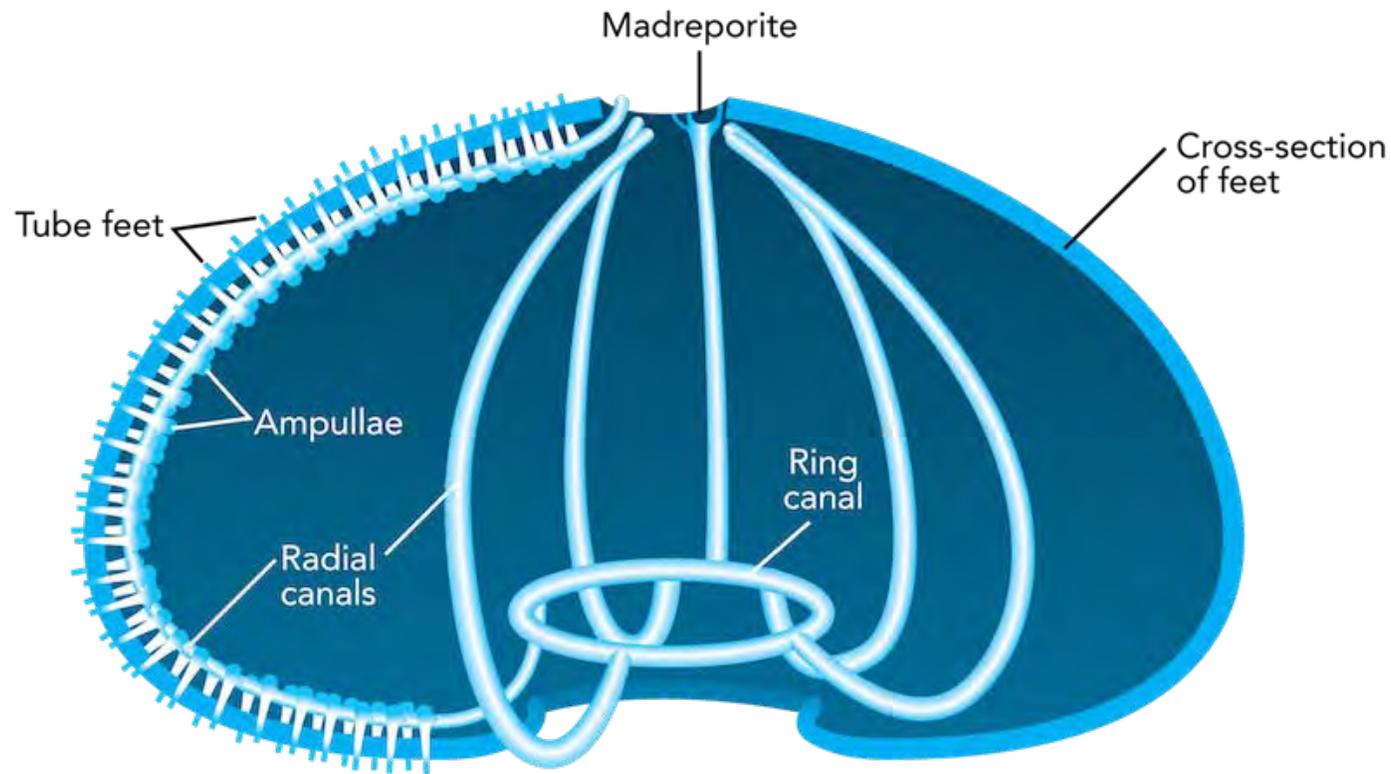


Le système ambulacraire ou aquifère



Oursin & étoile de mer

Le système ambulacraire ou aquifère

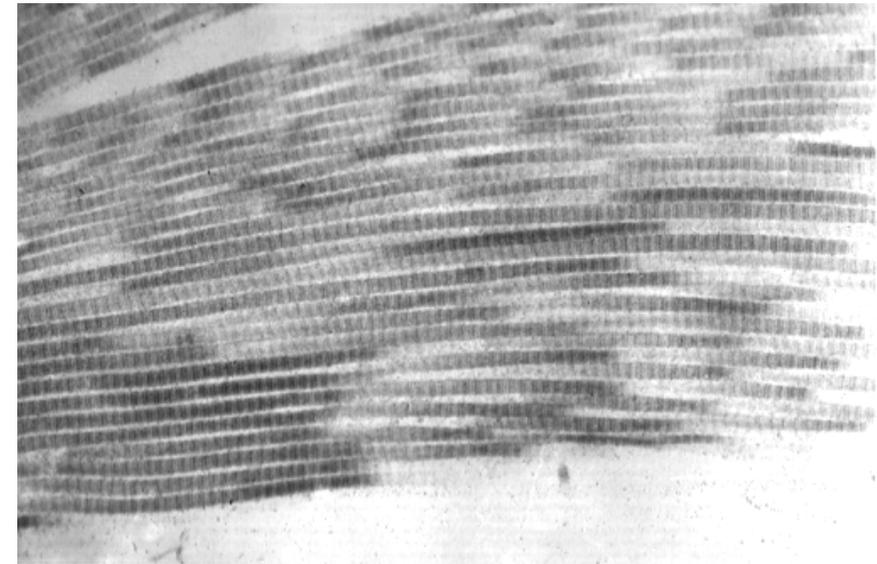
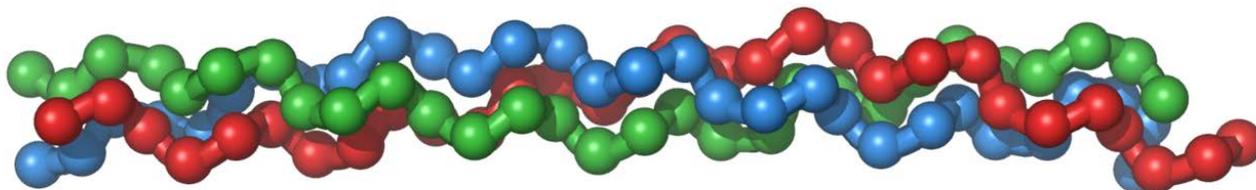


Oursin régulier & étoile de mer

Mutable Collagenous Tissues (MTC)

Collagène:

- protéine structural extracellulaire
- triple hélice
- 28 type de collagène différents
- Protéine la plus abondante dans le règne animal

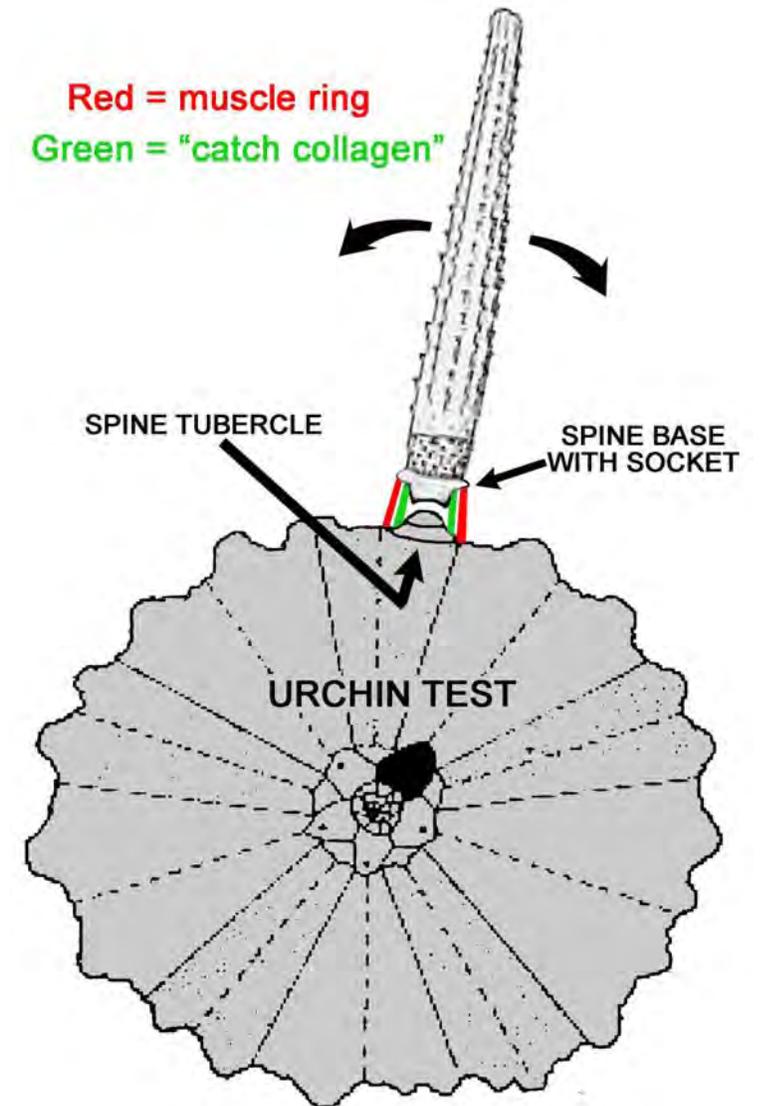


Collagen Fibrils, TEM, 40,000x

Mutable Collagenous Tissues (MTC)

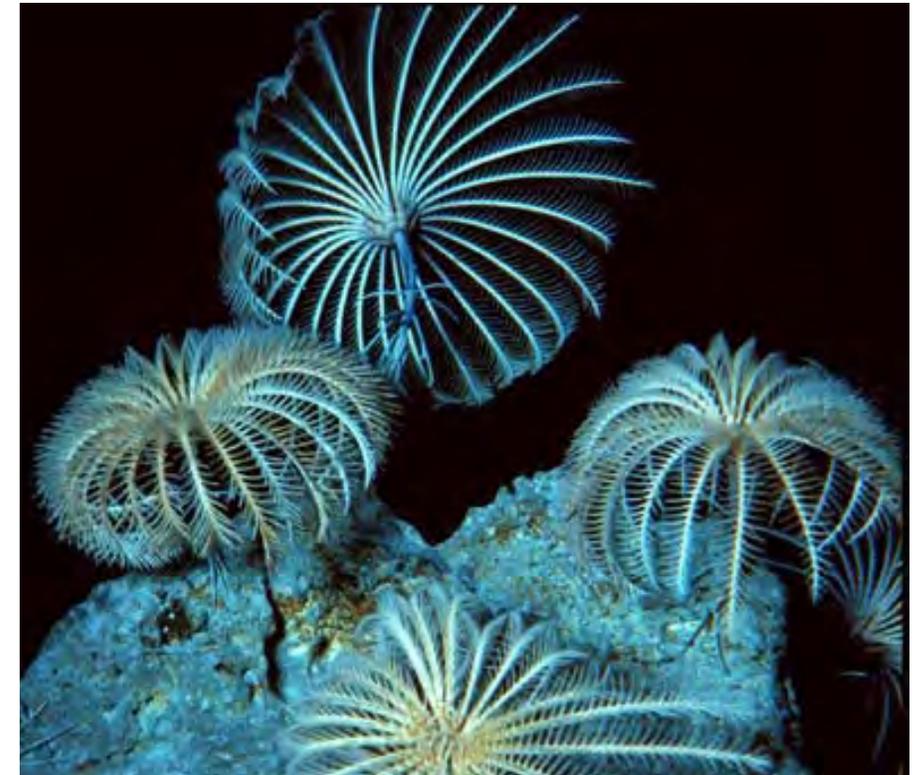
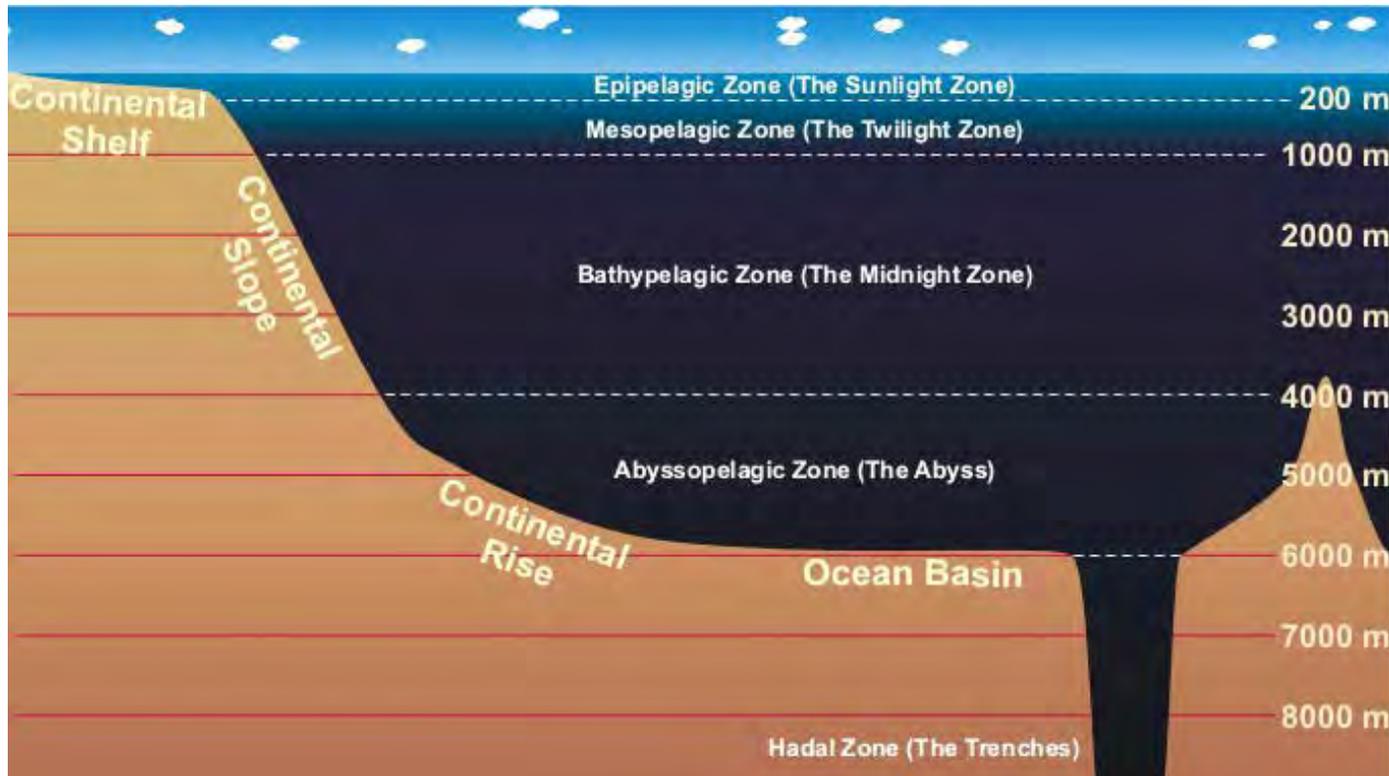


Heterocentrotus ssp. (oursin crayon / red pencil sea urchin)



Millieu de vie:

- exclusivement marin (de 0 à -10 000 m)
 - de l'équateur aux pôles



Macrobenthos

- Épibenthique (endobenthique)
- sessile, vagile (nectonique)



Alimentation :

suspensivores
carnivores
herbivores
détritivores



Alimentation :

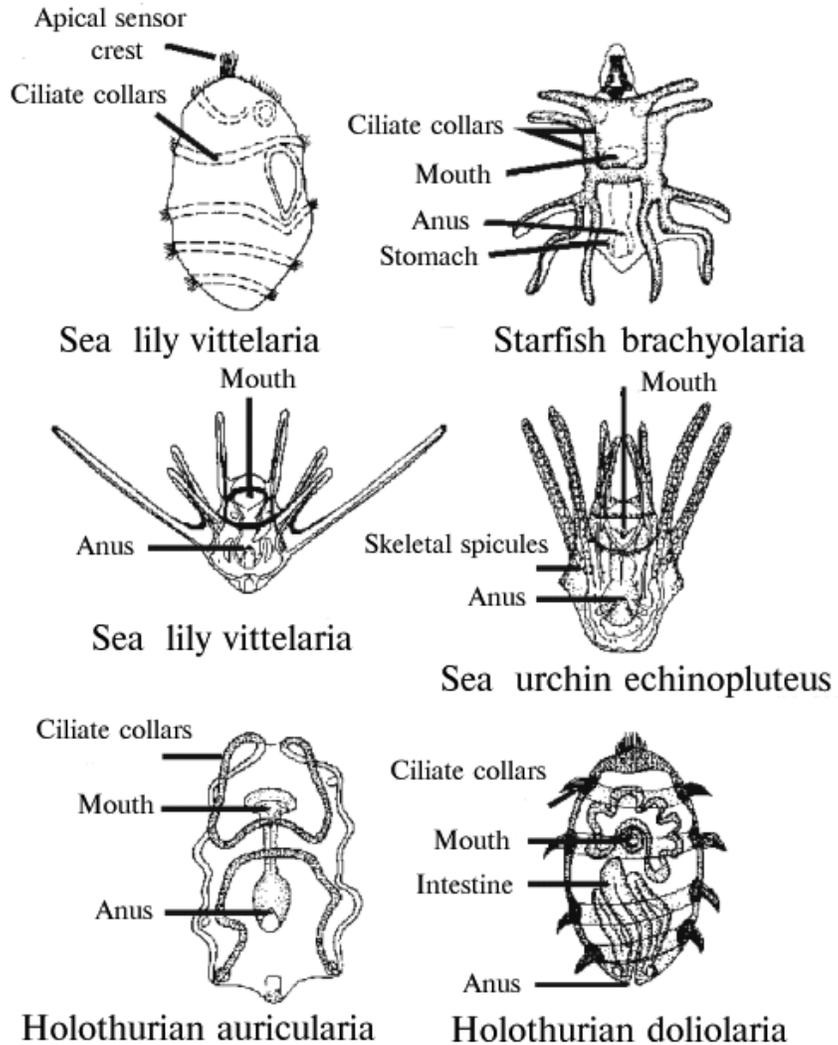


Reproduction

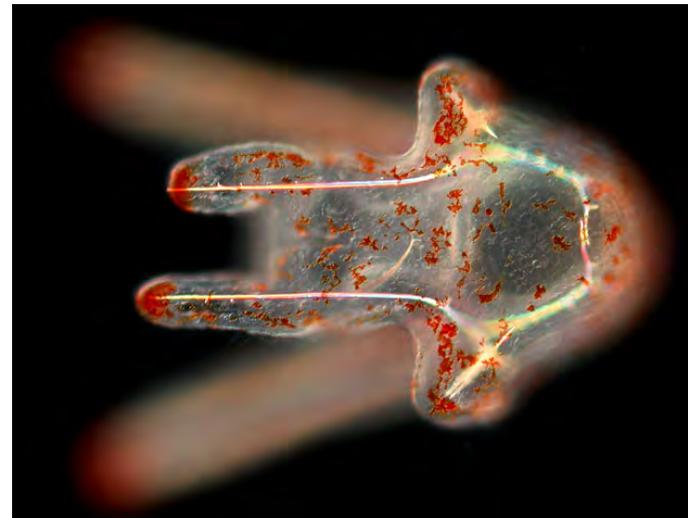
- Gonochorique
- Pas de dimorphisme sexuel
- Fécondation externe (le plus souvent)



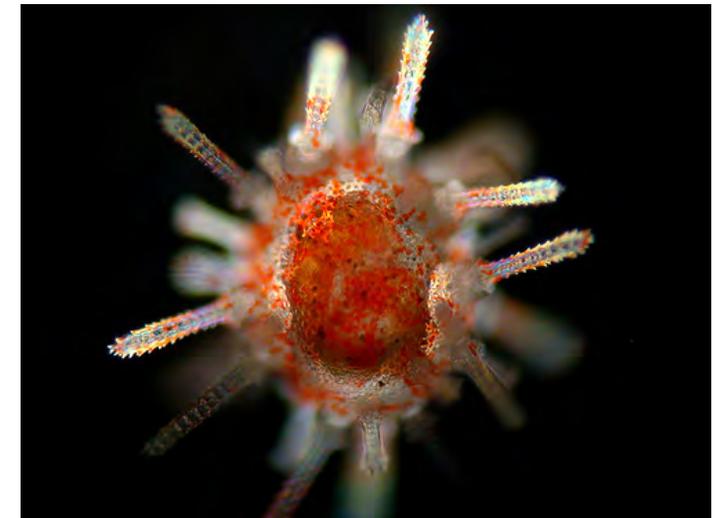
Echinodermata larvae (according to Barnes, 1980)

**Larves :**

- Symétrie bilatérale
- Planctonique (quelques jours à plusieurs semaines)
- Planktotrophic VS Lecithotrophic



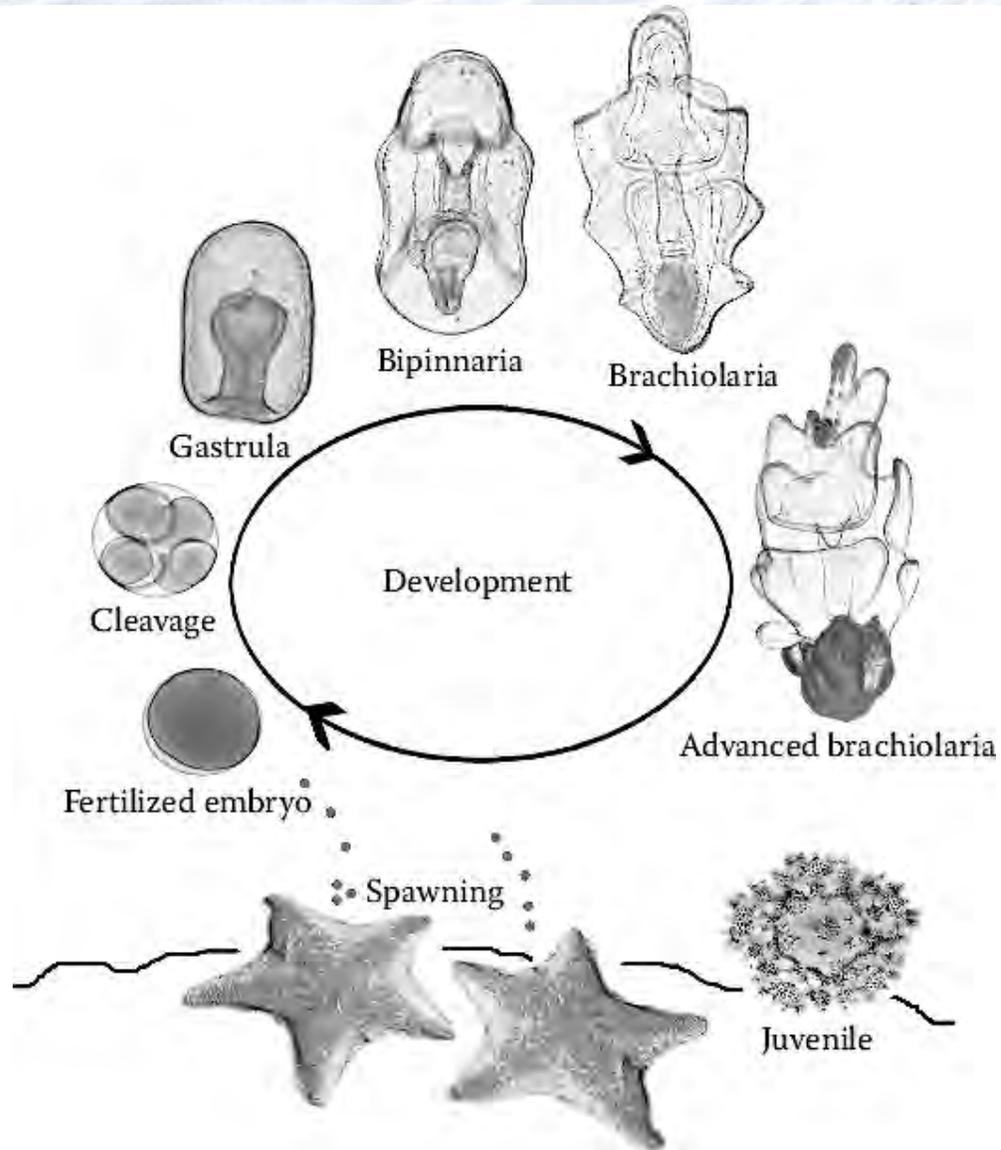
Sea urchins larvae



Cycle de vie:

Larve planctonique → «settlement» →
métamorphose → juvénile

Avec parfois quelques petites exceptions...



III. Systématique des classes actuelles

1. Crinoidea

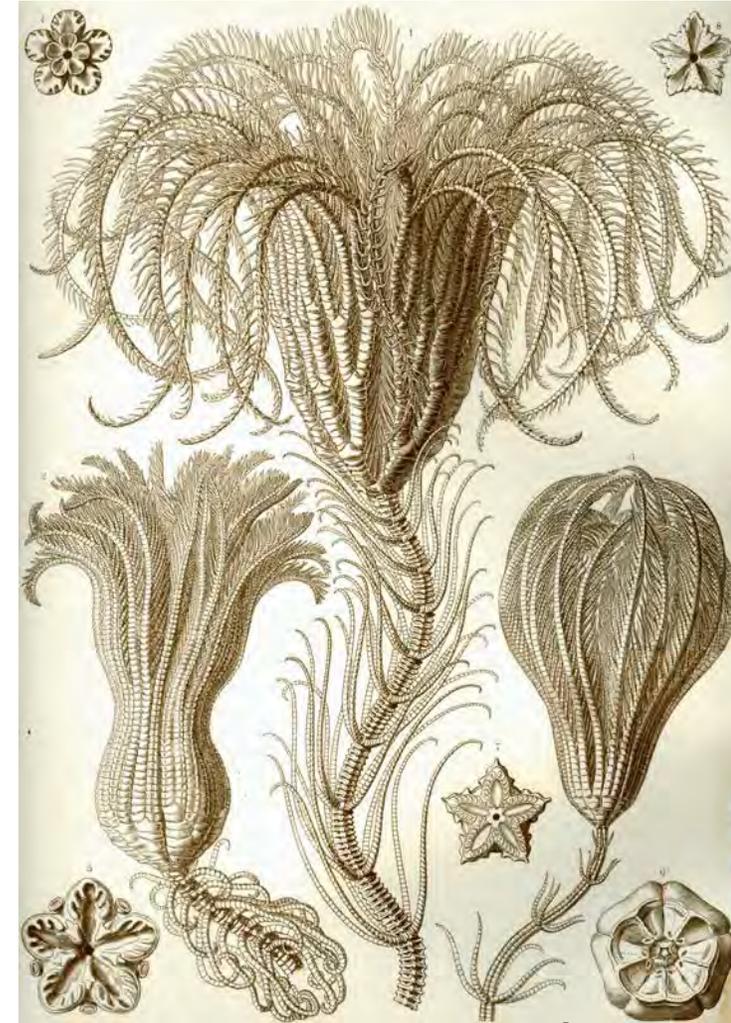
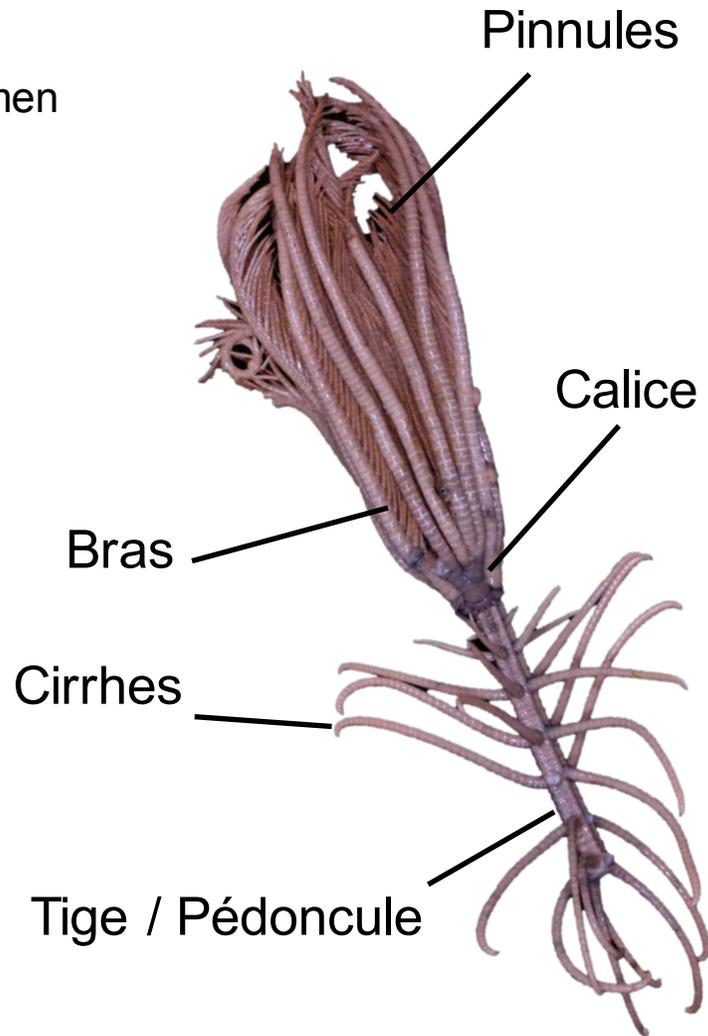
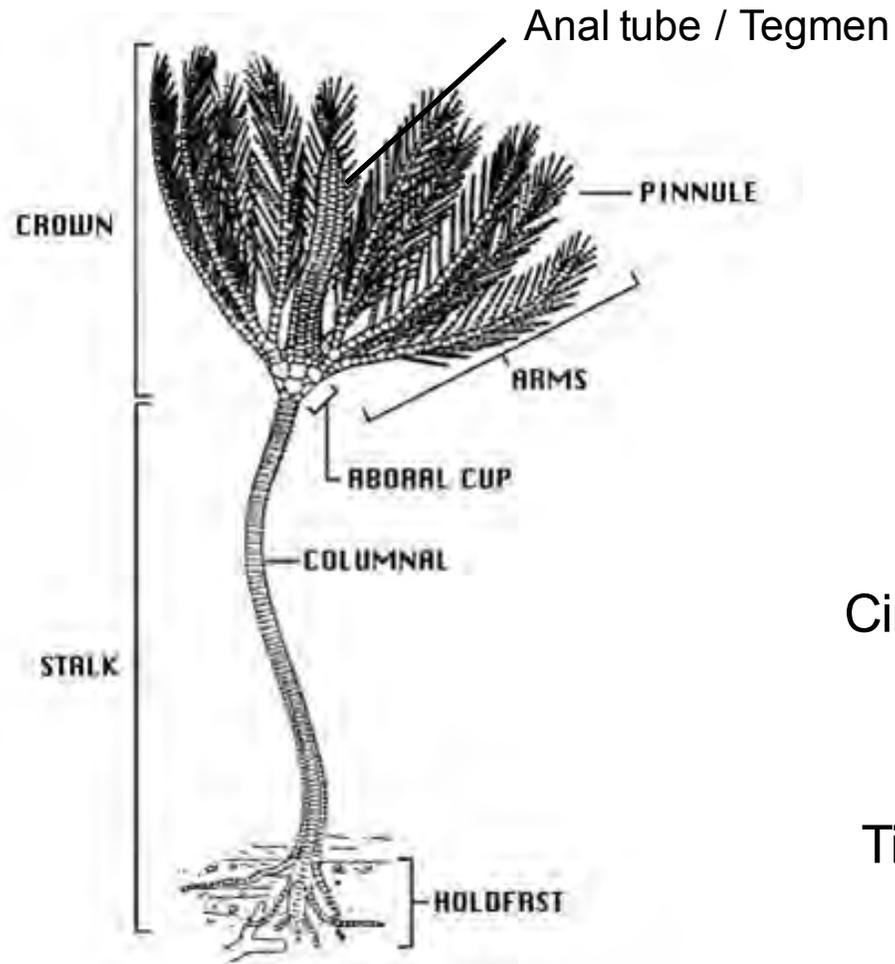
~ 550 espèces actuelles
> 5 000 espèces fossiles

- Ordovicien à l'actuel
- Très diversifié au Paléozoïque

<https://www.youtube.com/watch?v=AmTvSuPsrnE>

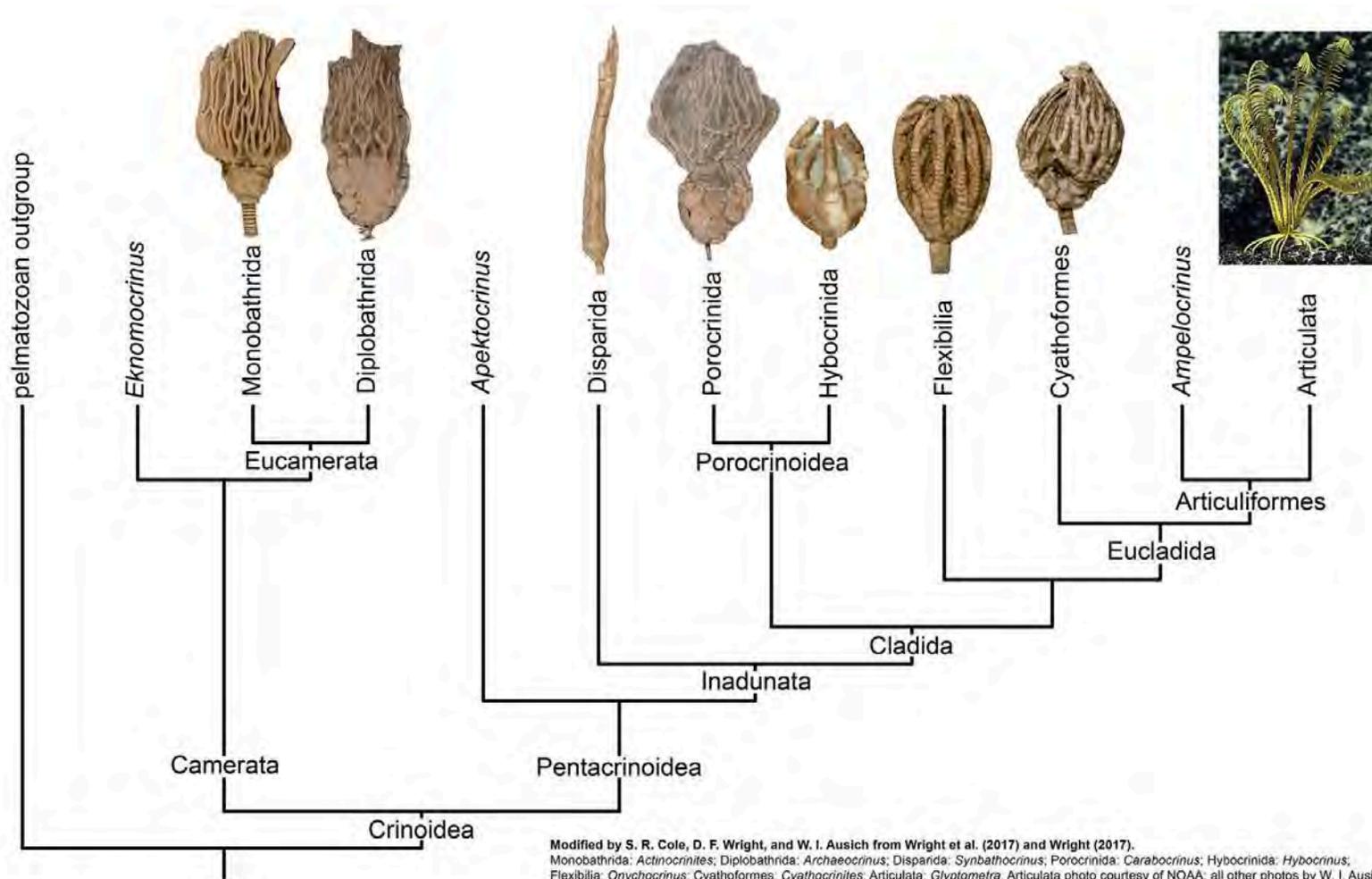


III. 1. Crinoidea



Metacrinus sp?
Ernst Haeckel

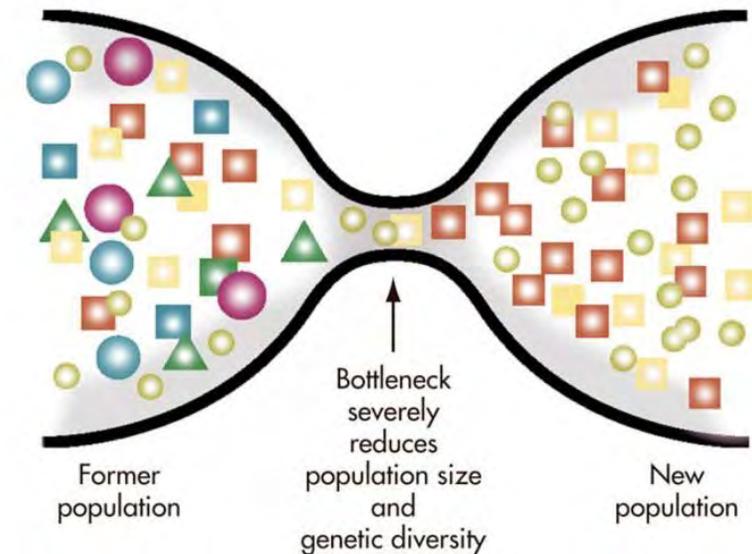
III. 1. Crinoidea



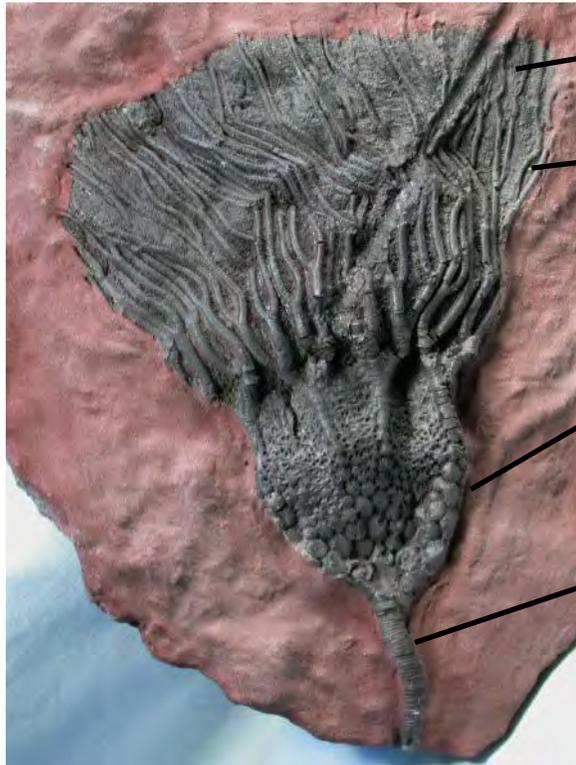
Crise Permo-Trias :

Extinction de masse

98 % des genres de crinoïdes disparaissent

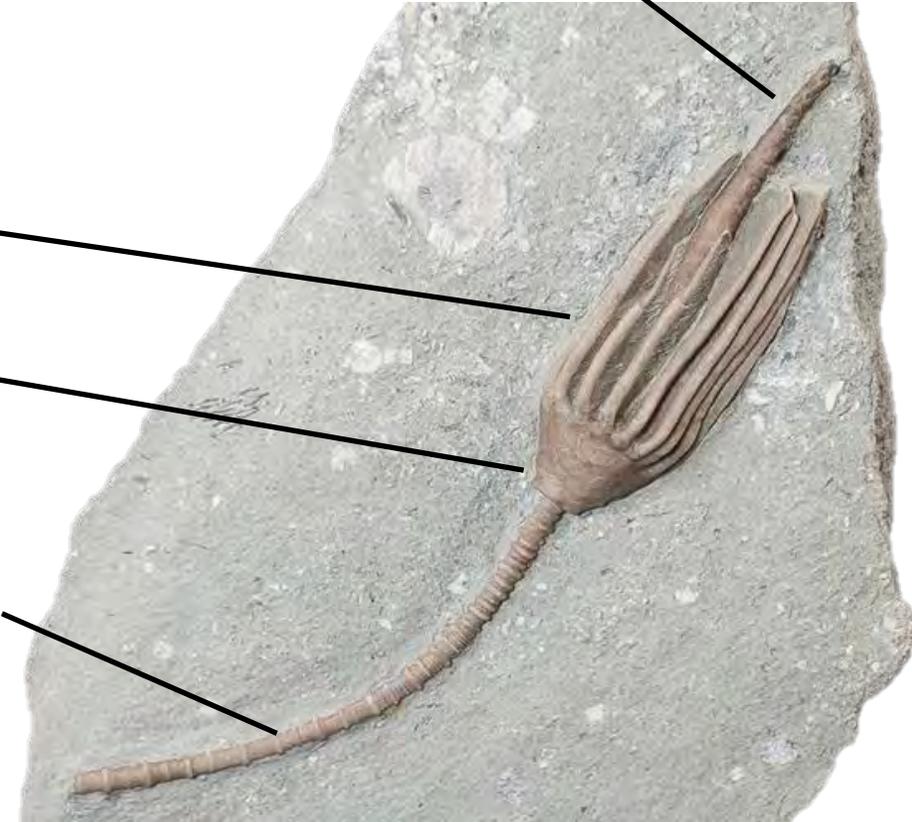


III. 1. Crinoidea



Scyphocrinites sp.
Upper Silurian, Maroco

Pinnules
Bras
Calice
Tige / Pédoncule



Macrocrinus mundulus
Mississippian (Lower Carboniferous)
Indiana, USA

Anal tube / Tegmen

III. 1. Crinoidea



Crinoïdes sur bois flotté
Staatliches Museum für
Naturkunde Stuttgart, Germany



Échantillon : collection ENS Lyon

Calcaire à entroques
Kimméridgien, Cérin, France

Calcaire à entroques
Jurassique moyen, Ardèche, France

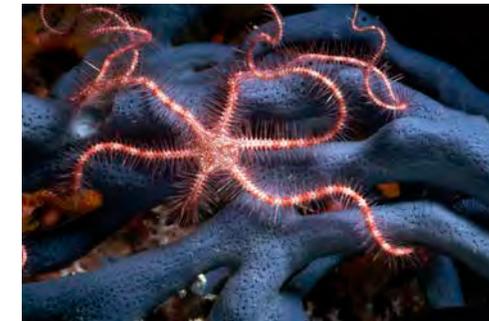
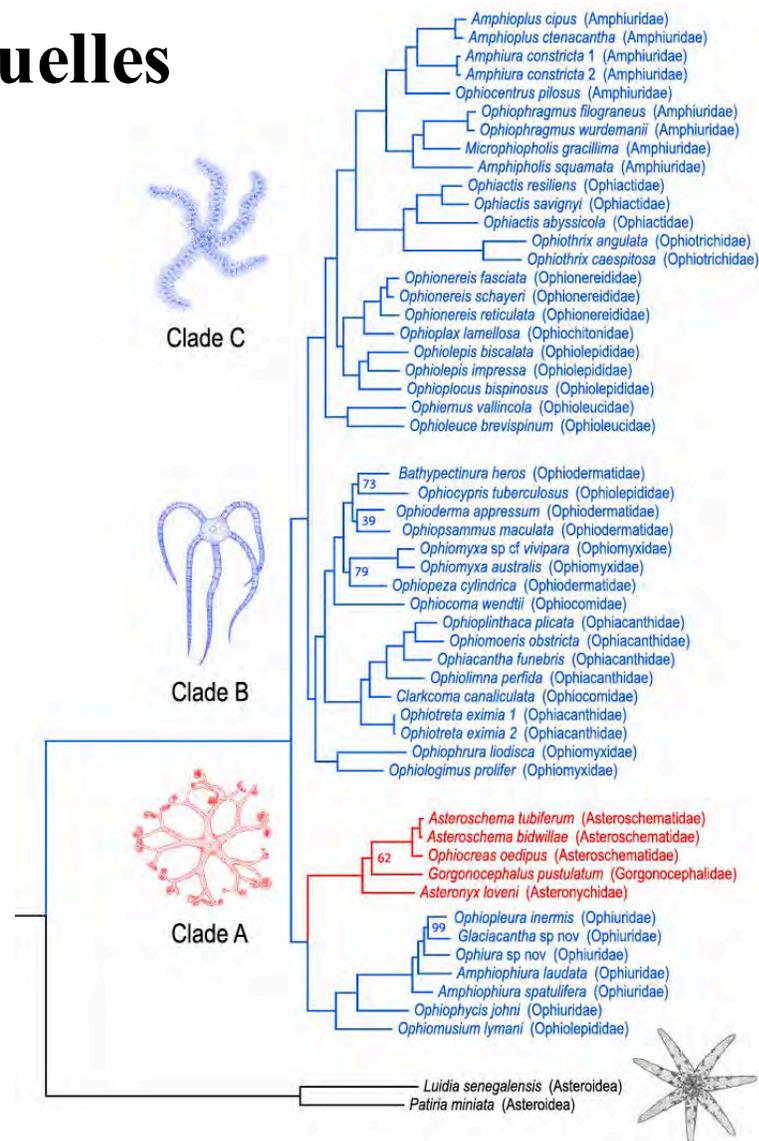
III. Systématique des classes actuelles

2. Ophiuroidea

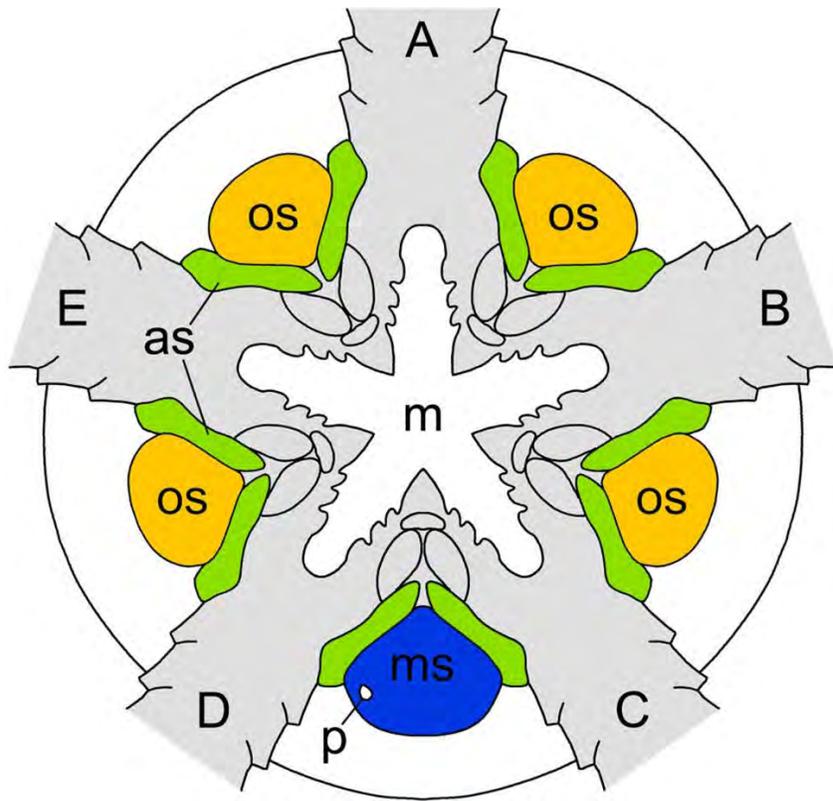
~ 2 000 espèces actuelles

- Ordovicien à l'actuel
- Registre fossile (très) pauvre

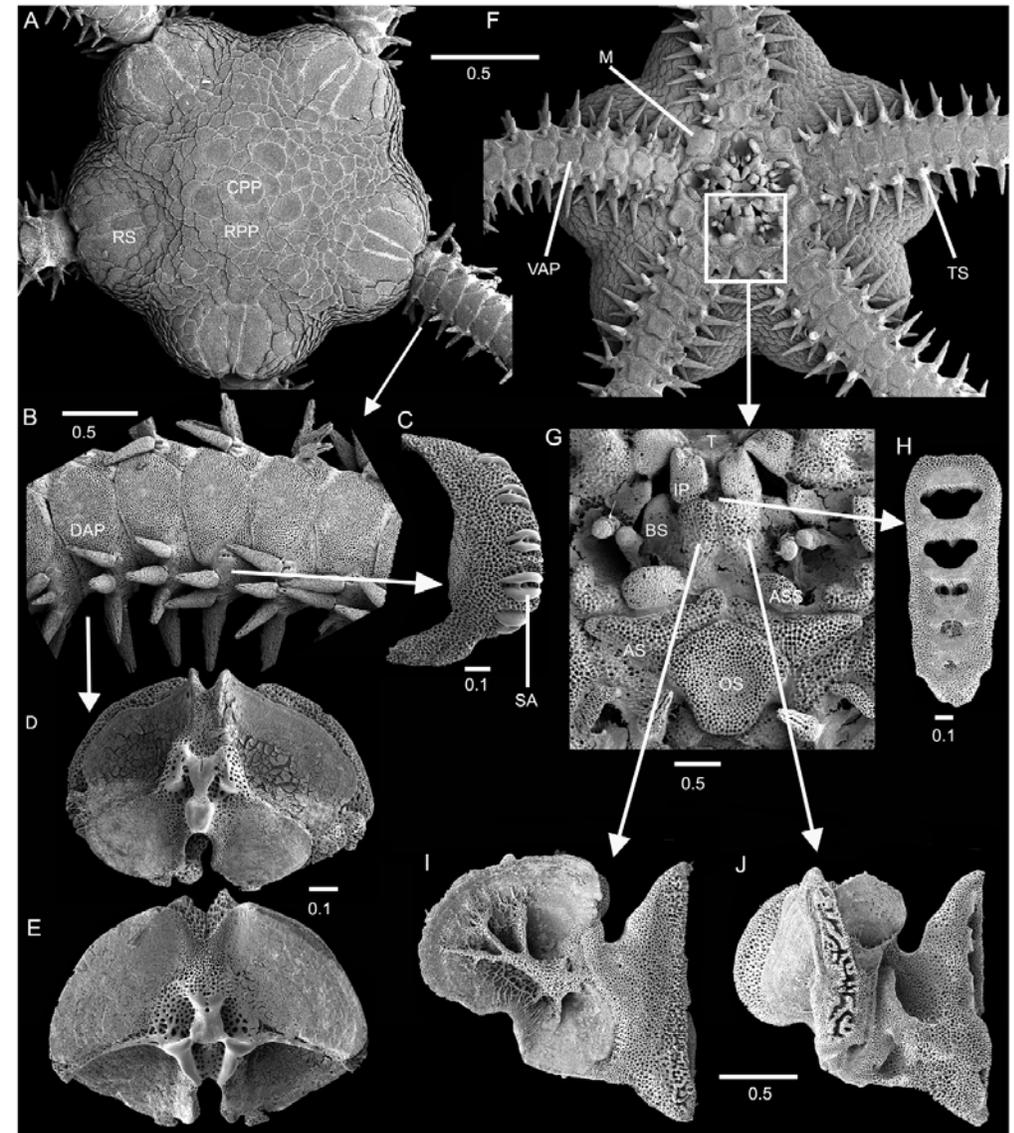
https://www.youtube.com/watch?time_continue=107&v=Myhp8ifW6ig



III. 2. Ophiuroidea

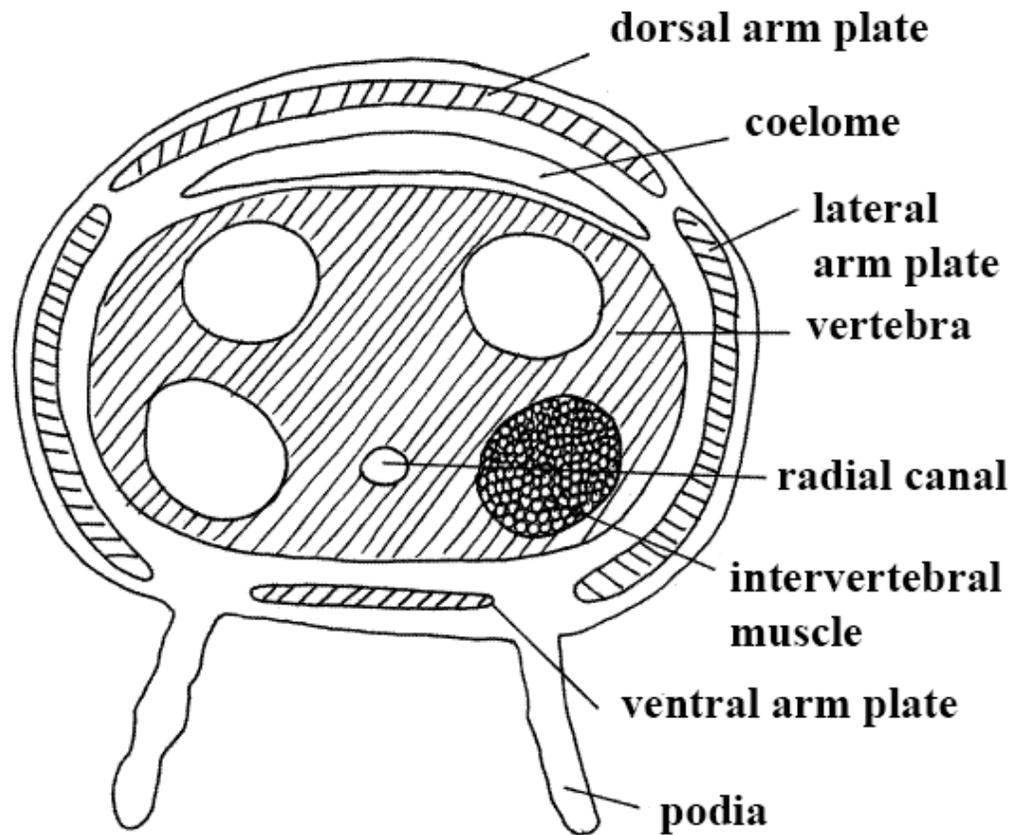


Ezhova et al. 2016



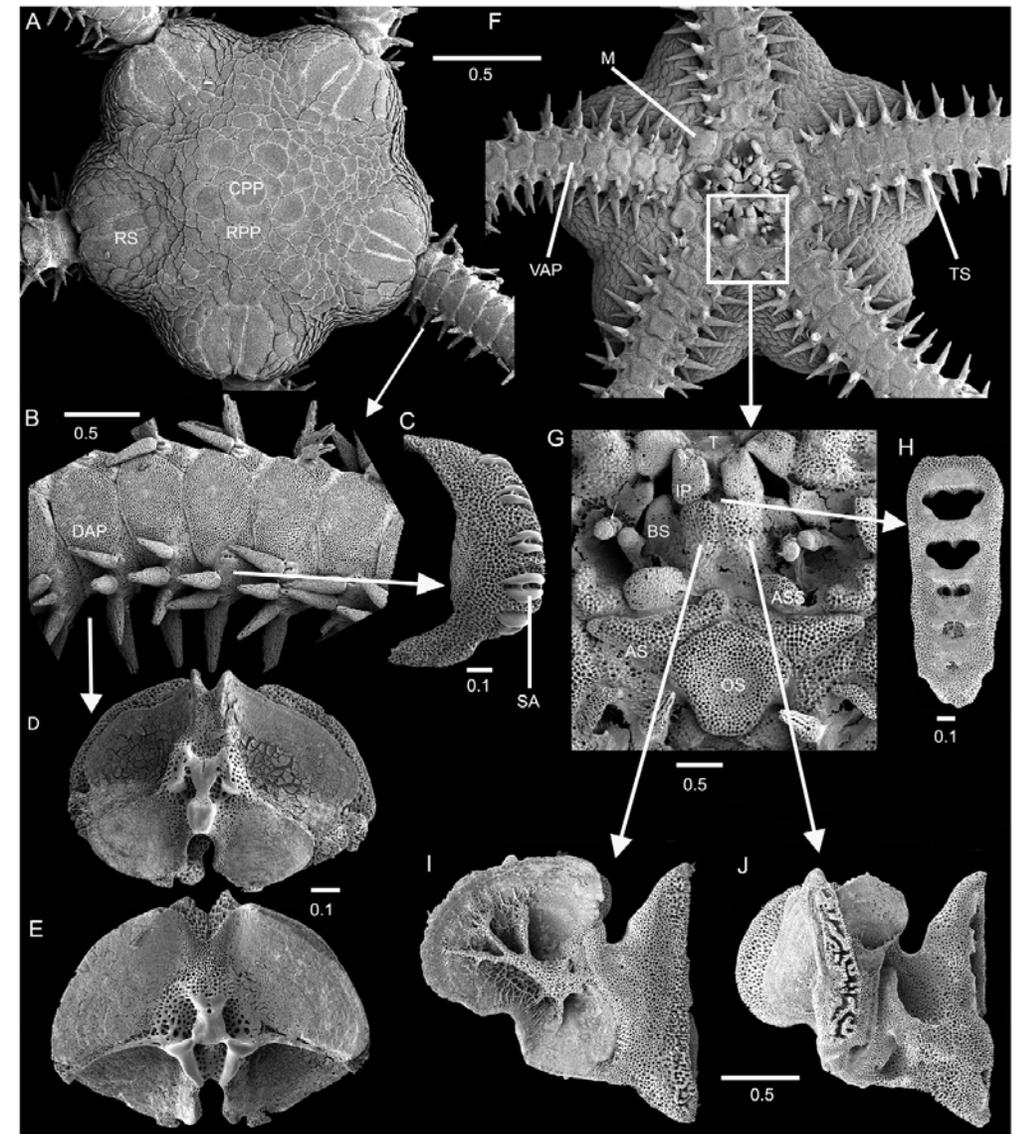
Stohr et al. 2012

III. 2. Ophiuroidea



Ophioderma brevispina

Modifié d'après Richard Fox, Lander University



III. Systématique des classes actuelles

3. Asteroidea

~ 1 900 espèces actuelles

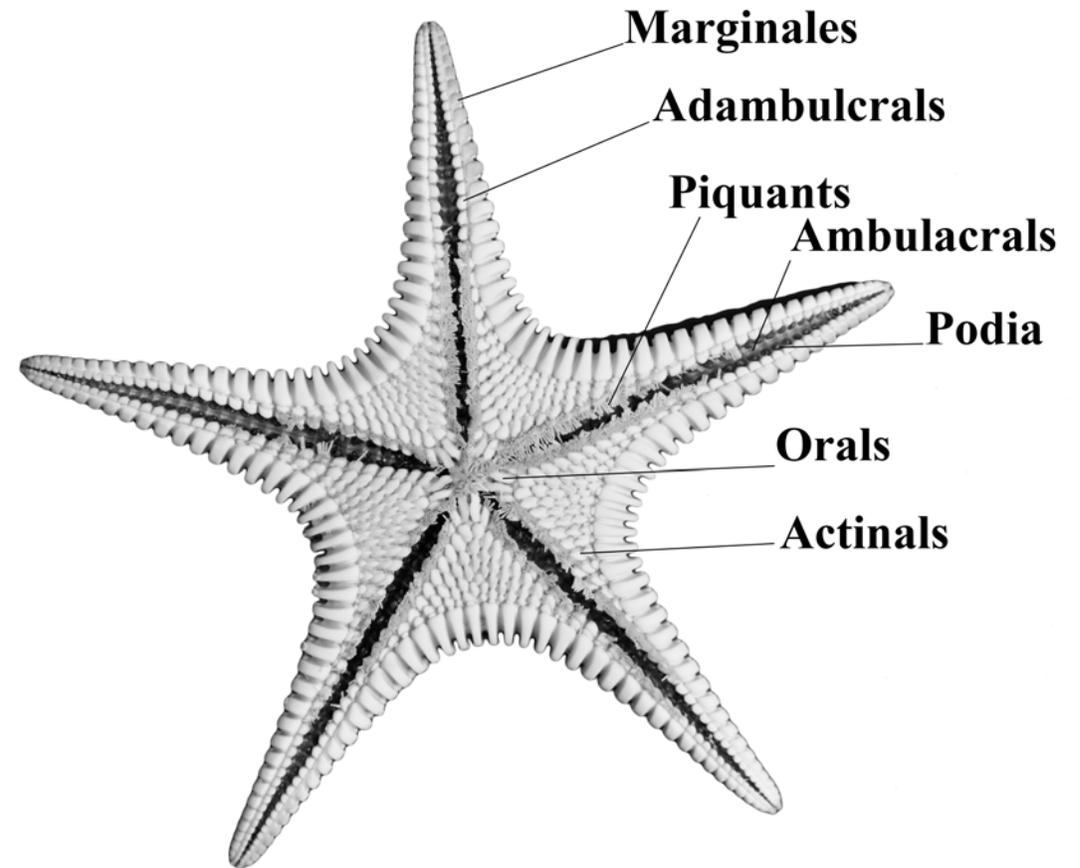
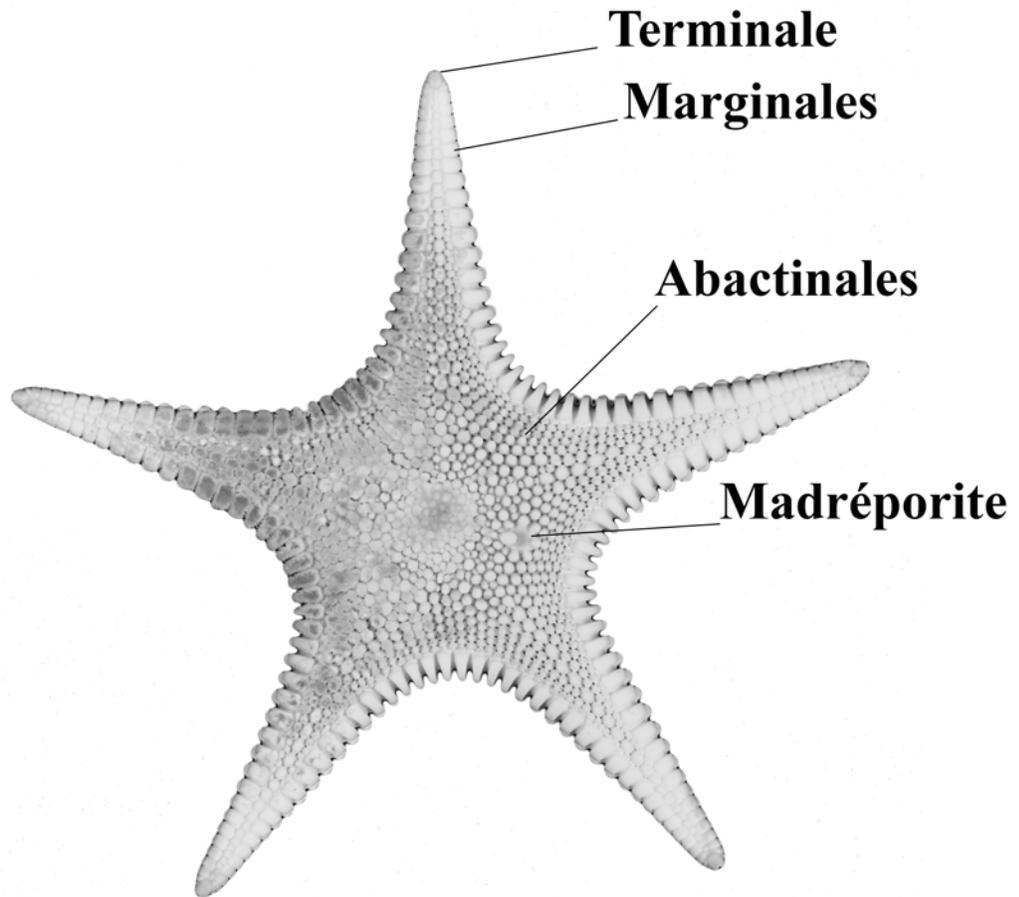
- Ordovicien à l'actuel
- Crise Permo-Trias très importante
- Registre fossile (très) pauvre

<https://www.youtube.com/watch?v=l6dnmLDu6Eg>



Labidiaster annulatus, Southern Ocean

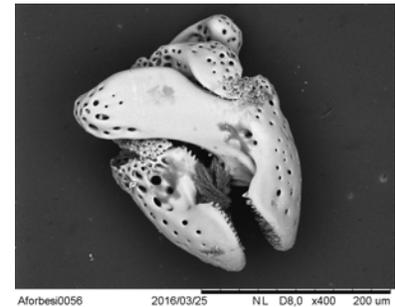
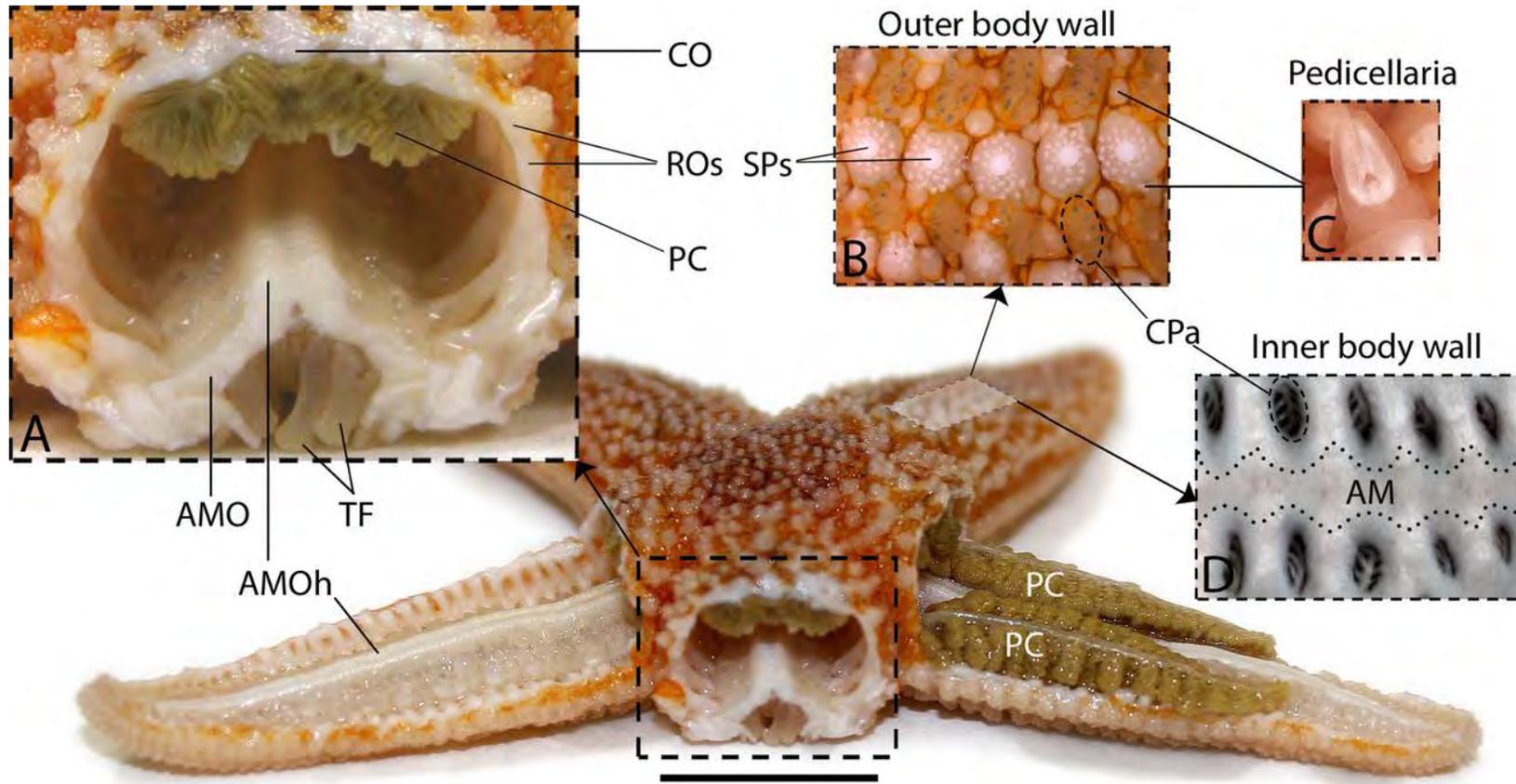
III. 3. Asteroidea



III. 3. Asteroidea

Asterias rubens

Blowes et al. 2017



Aforbesi0053 2016/03/25 NL D8,1 x300 300 um

Aforbesi0056 2016/03/25 NL D8,0 x400 200 um

III. 3. Asteroidea

Marthasterias glacialis
Forcipulatida

Tosia magnifica
Valvatida



Henricia levuscula
Spinulosida



M. Fau



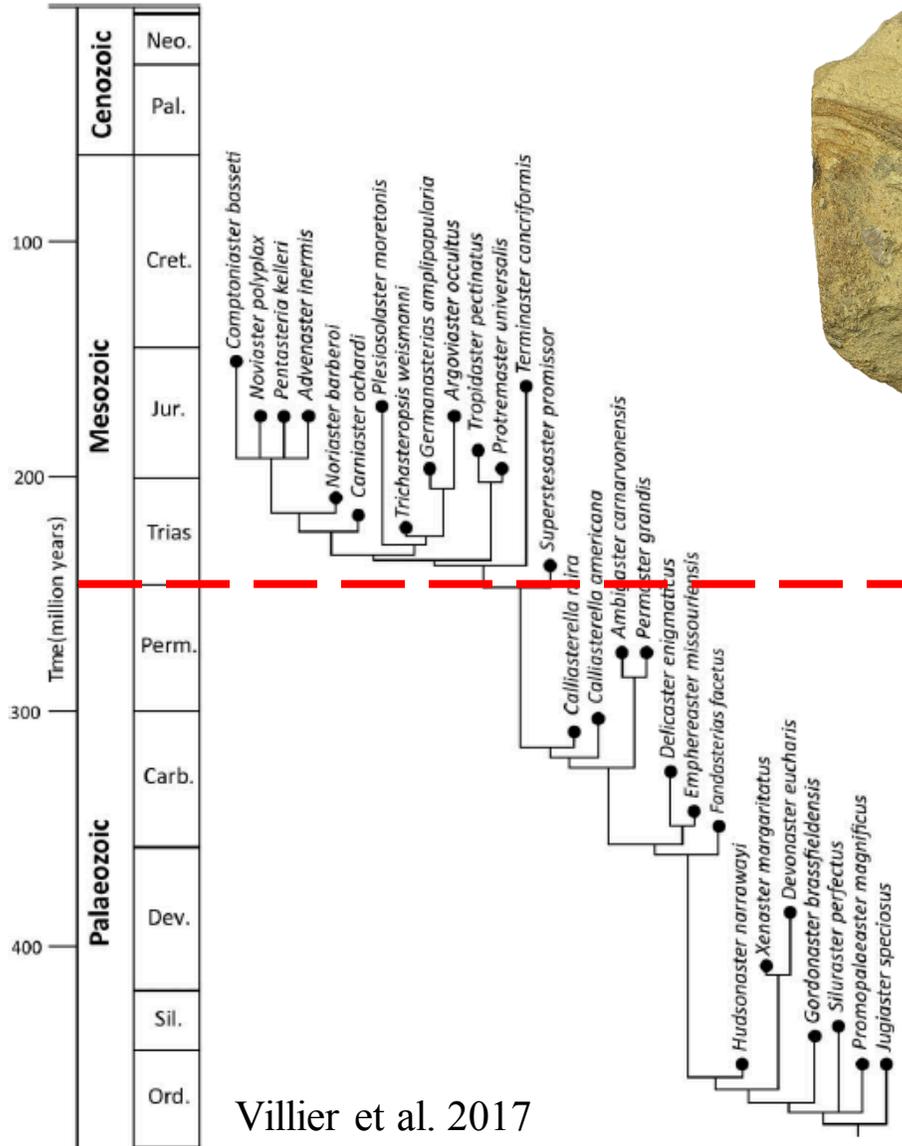
Astropecten aranciacus
Paxillosida



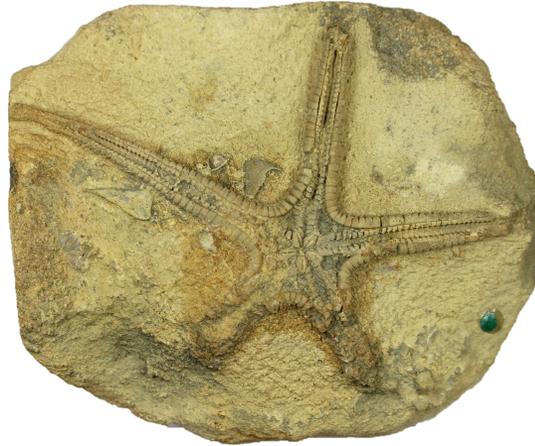
Hymenaster sp.
Velatida



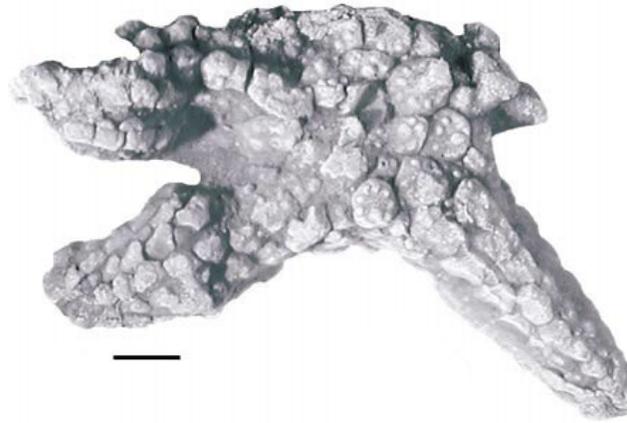
Pycnopodia helianthoides
Forcipulatida



Villier et al. 2017



Pentasteria procera
Jurassique moyen



Eriaster ibexensis
Ordovician inférieur
Blake & Guensburg 2005



Plesiosolaster moretonis
Jurassique moyen

III. Systématique des classes actuelles

4. Echinoidea

~ 1 000 espèces actuelles

> 10 000 espèces fossiles

- Ordovicien à l'actuel
- Explosion de diversité au Jurassique

<https://www.youtube.com/watch?v=nI02svzU0Bw>
<https://www.youtube.com/watch?v=MadvPggTeHQ>

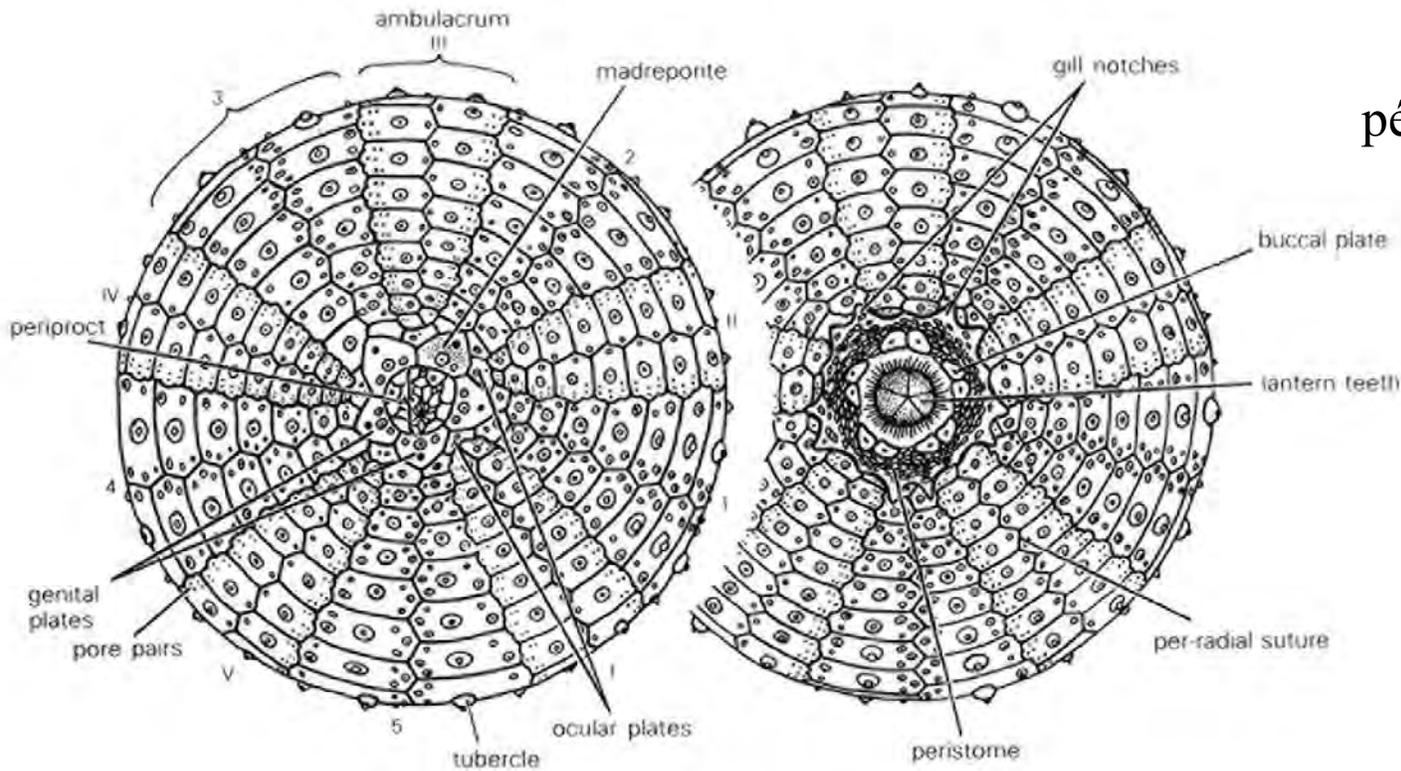




III. 4. Echinoidea

Face aborale

Face orale

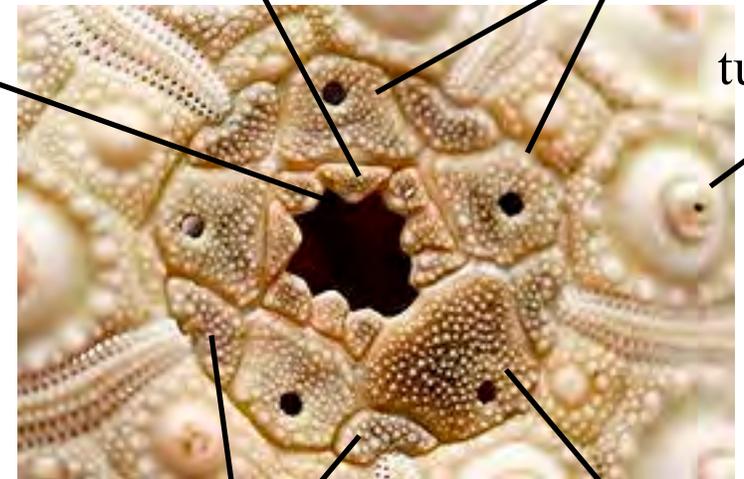


plaques périproctales

plaques génitales

périprocte

tubercule



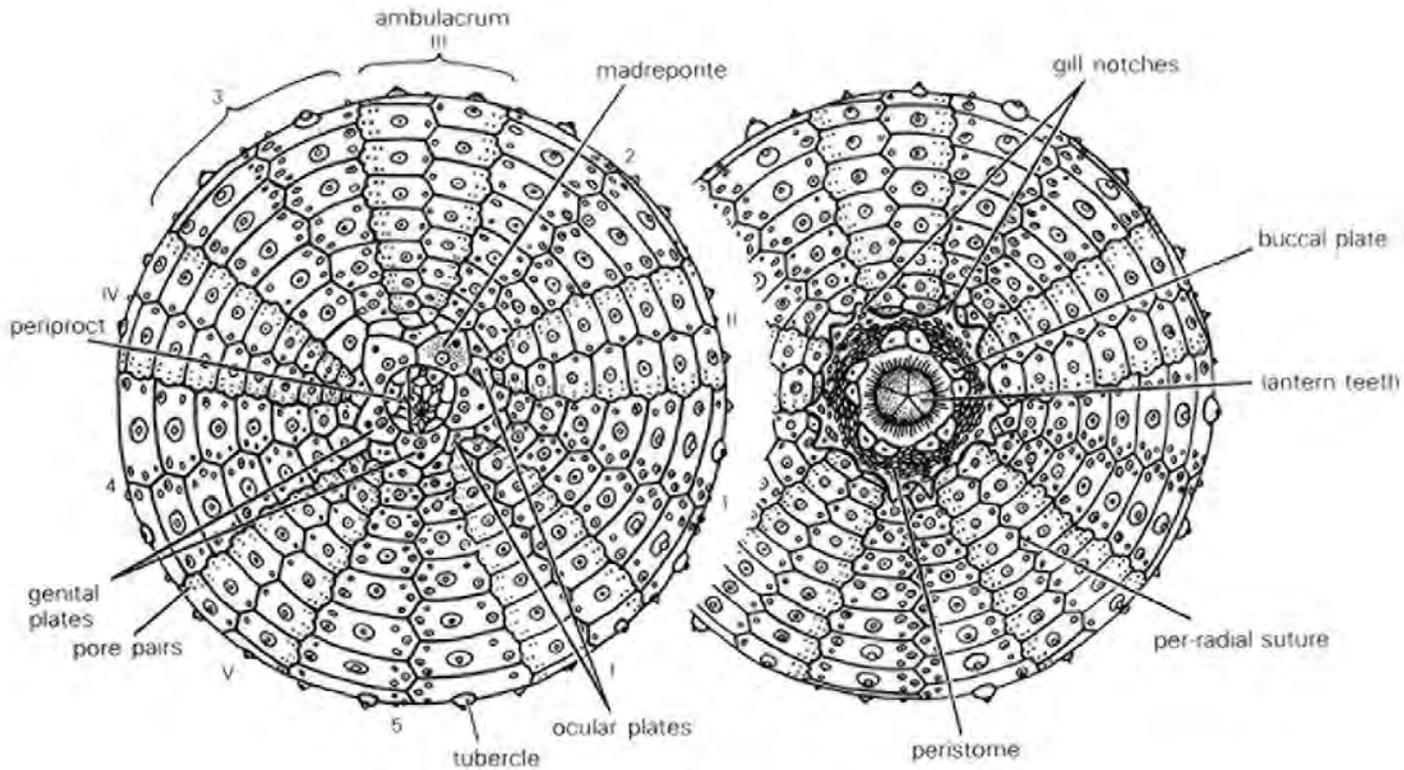
plaques oculaires

madréporite

III. 4. Echinoidea

Face aborale

Face orale

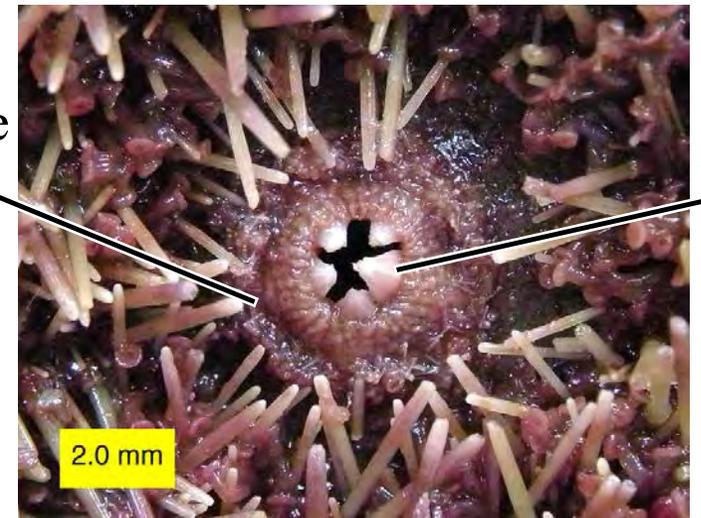


Lanterne d'aristote



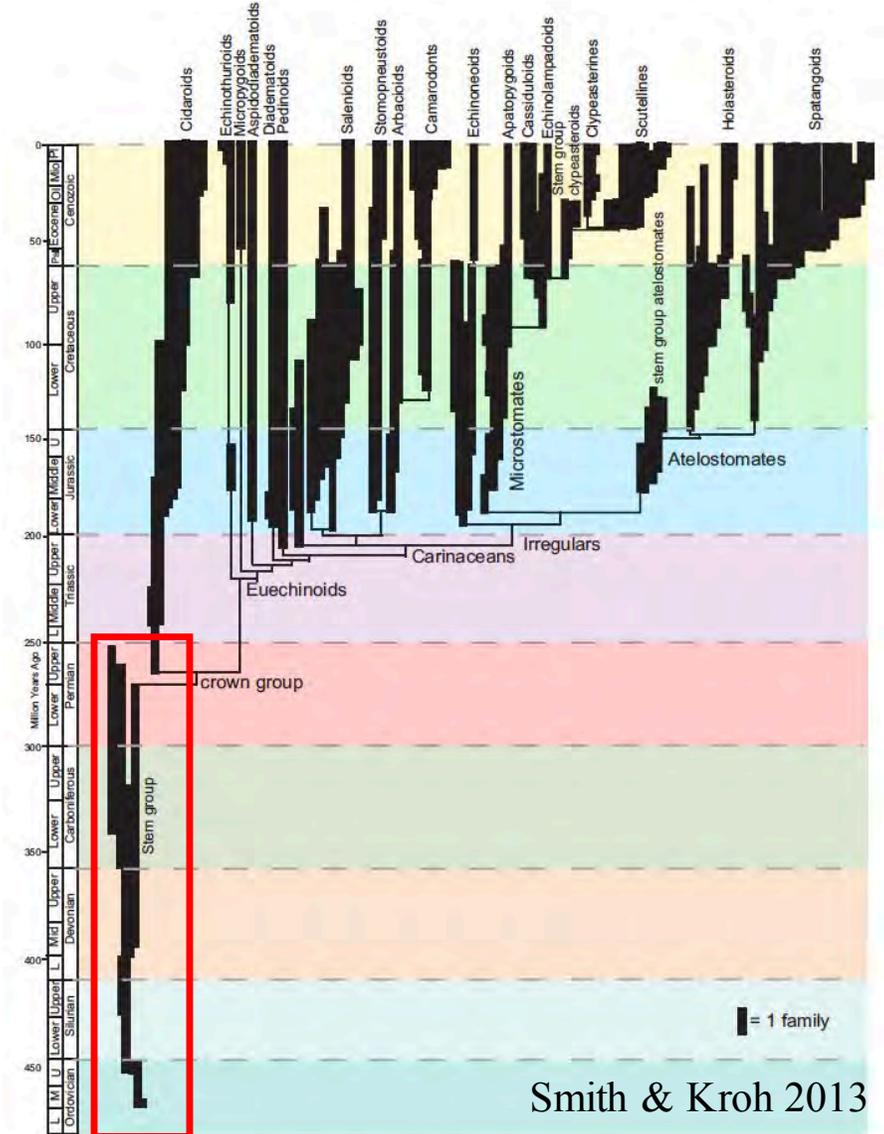
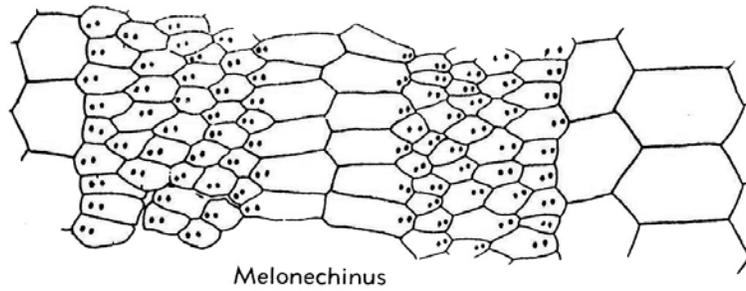
péristome

dents



Oursins paléozoïques

Melonechinus multiporus
Carbonifère inférieur



Oursins réguliers



Diademopsis serialis
Pedinoid



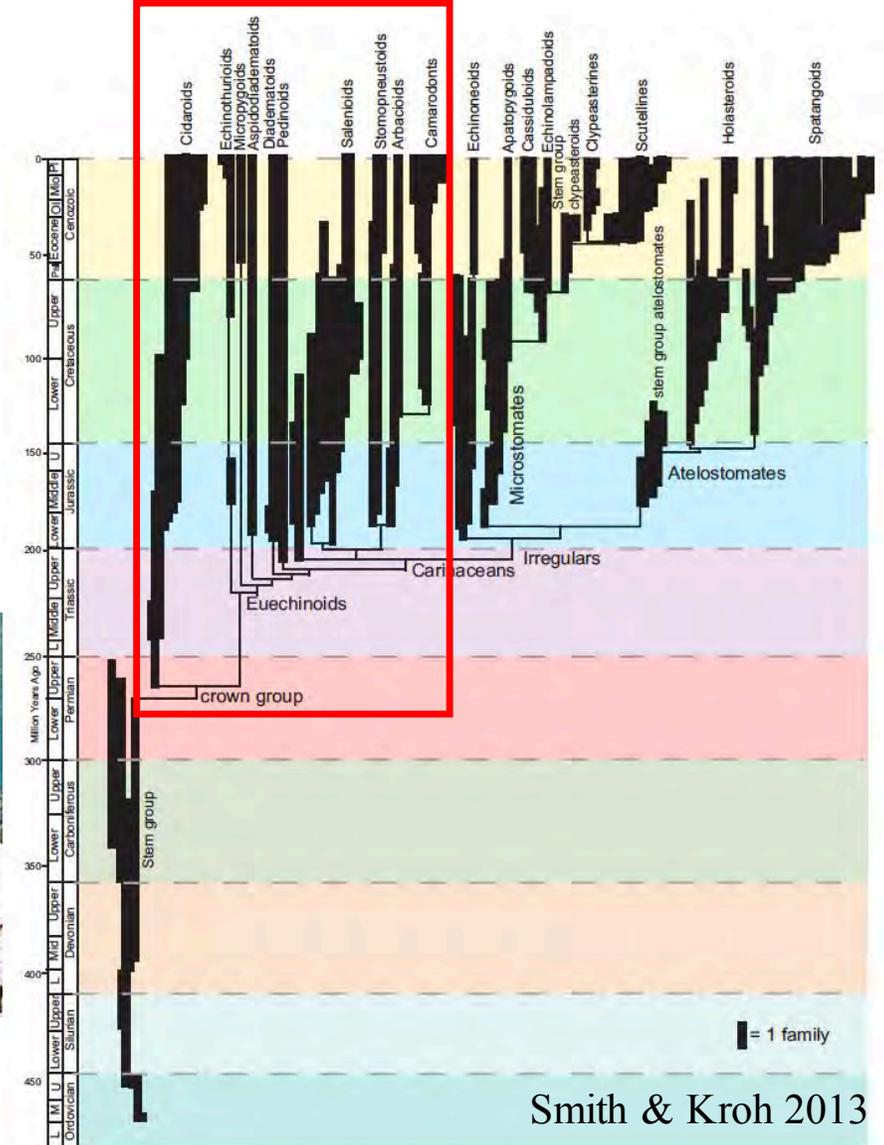
Toxopneustes pileolus
Camarodonte



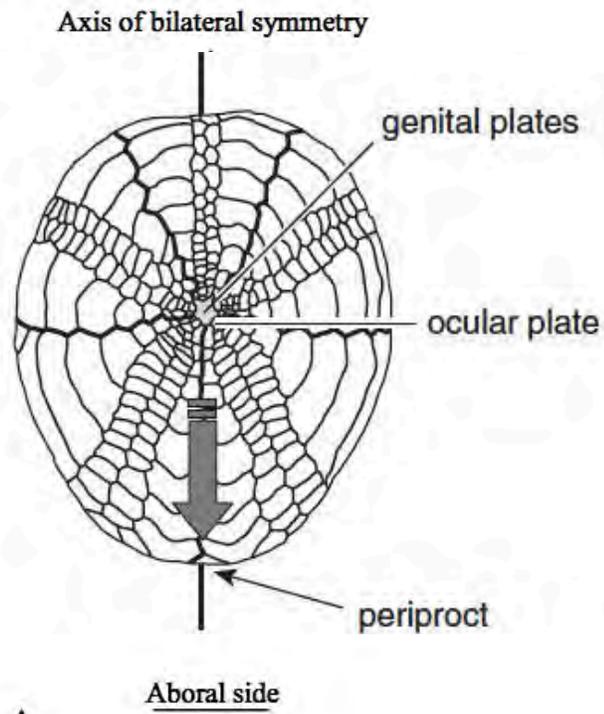
Tylocidaris clavigera
Cidaridé (Crétacé, UK)



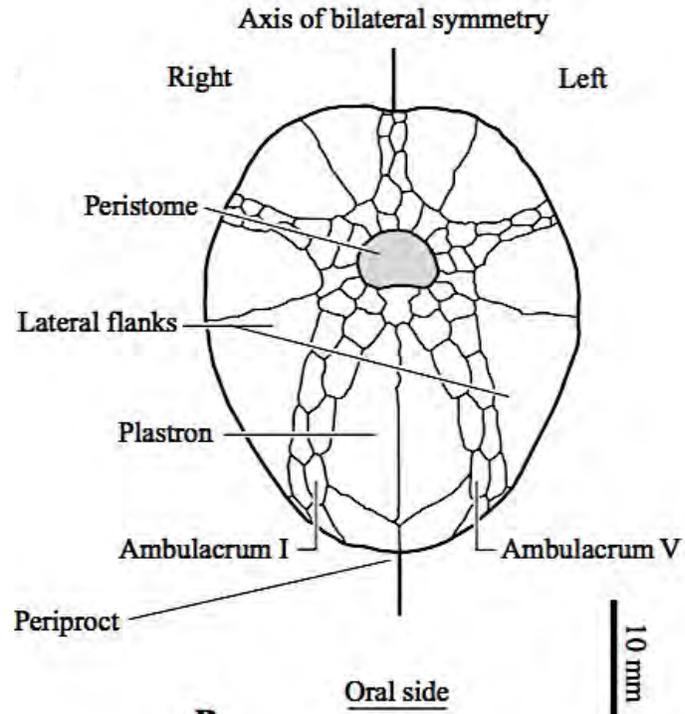
Heterocentrotus sp.
(cidaridé)



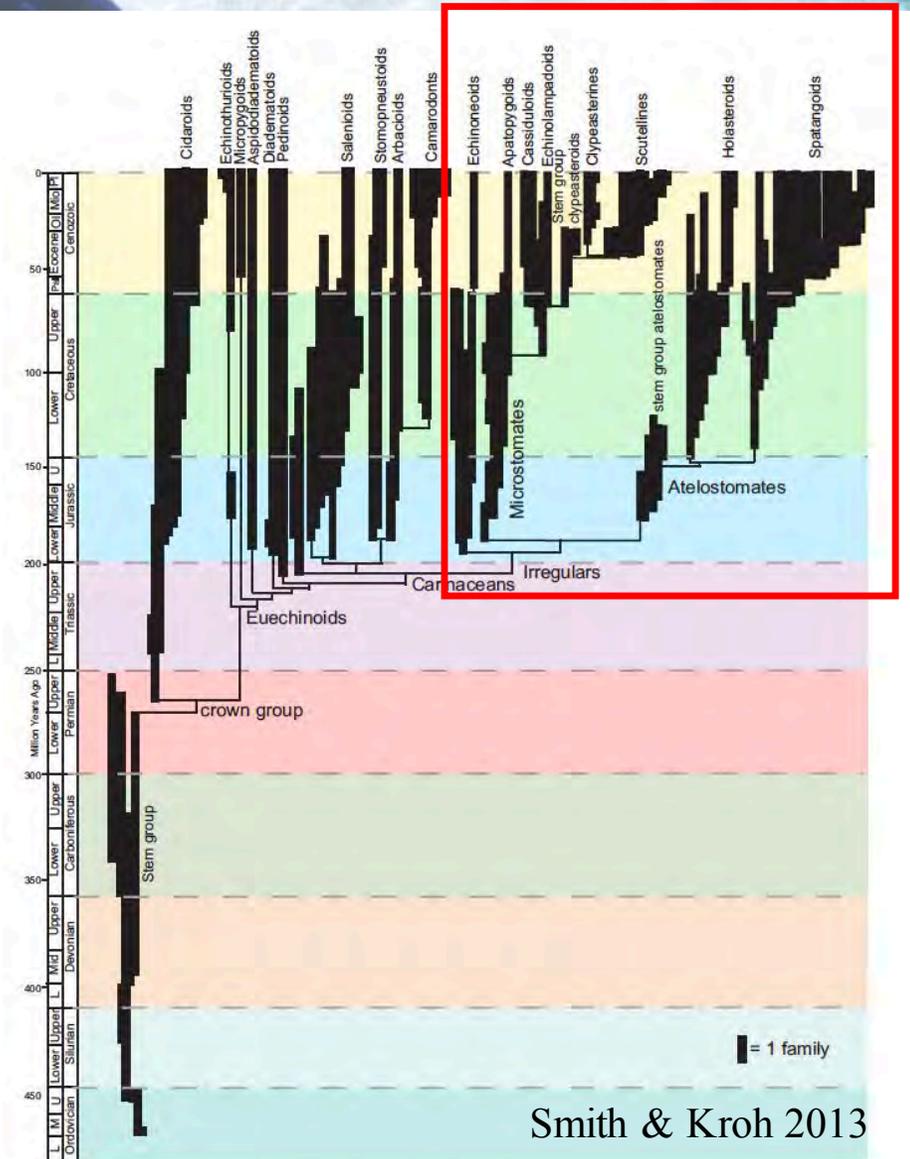
Oursins irréguliers



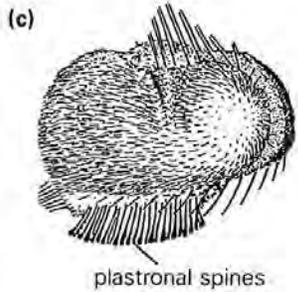
A



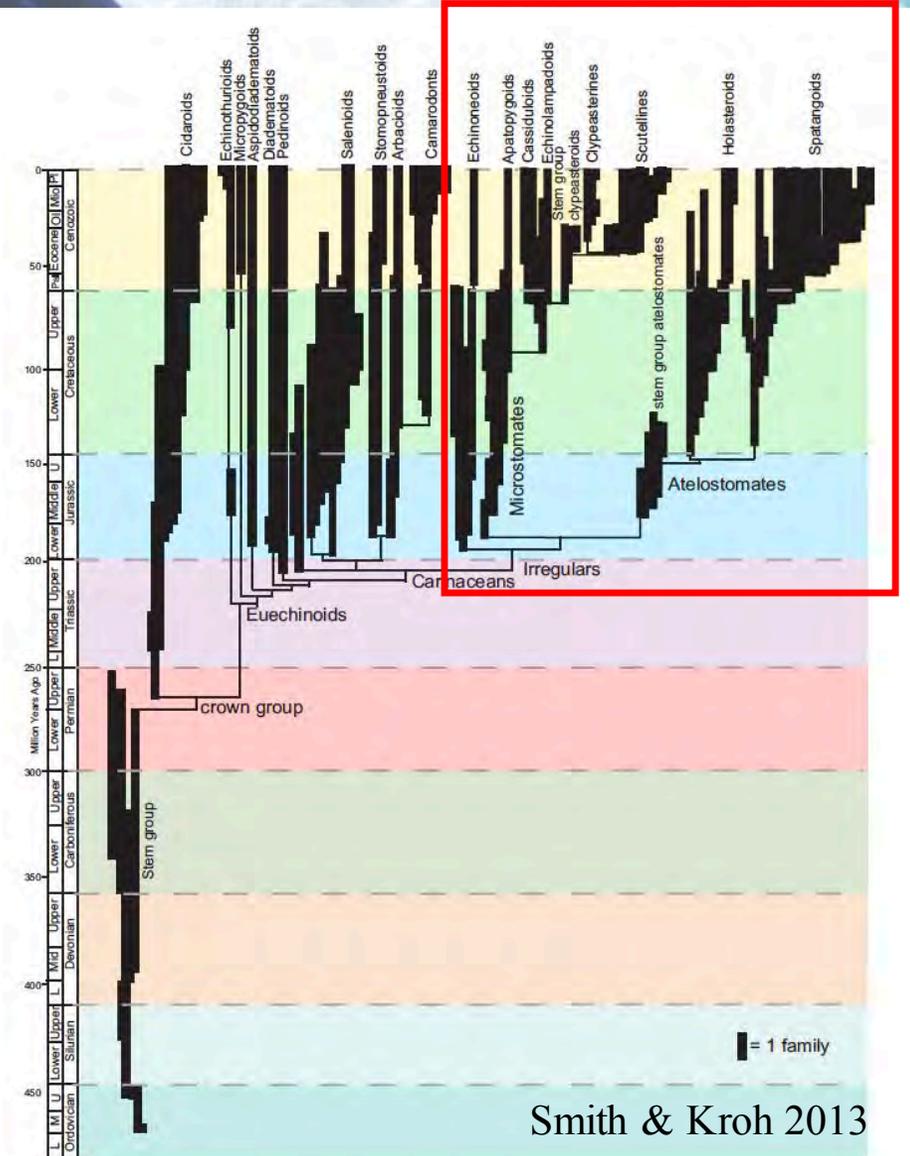
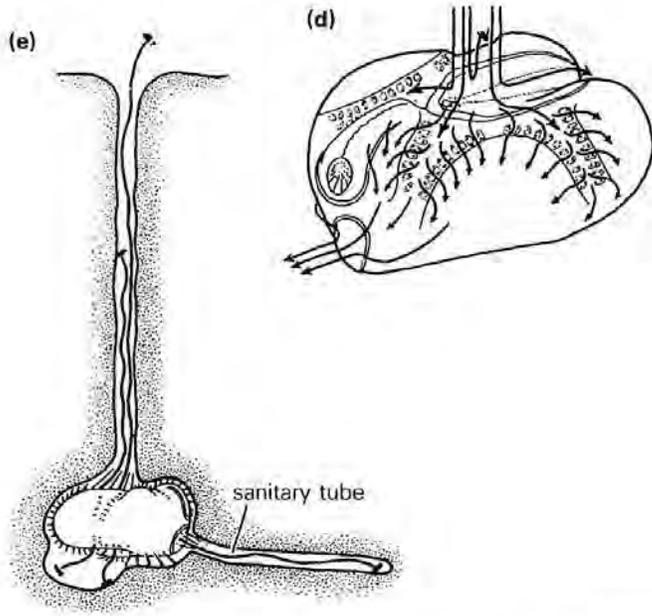
B



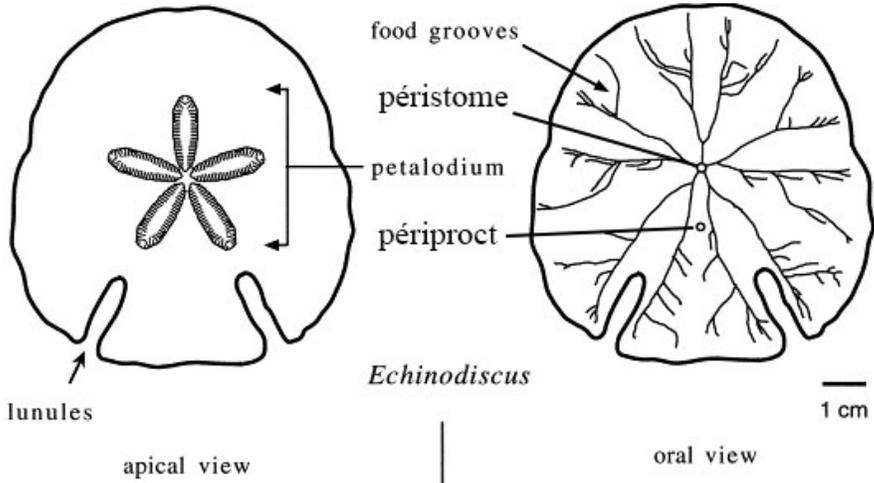
Oursins irréguliers



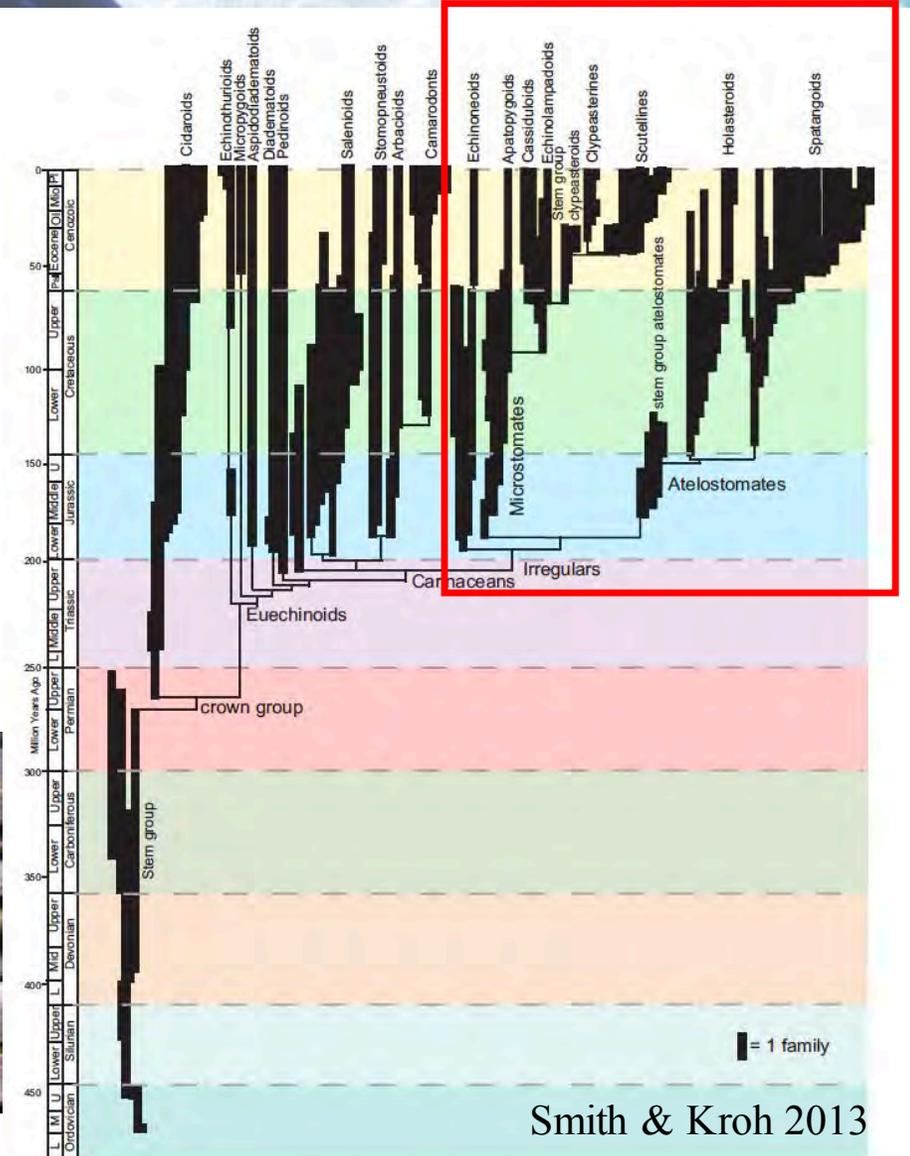
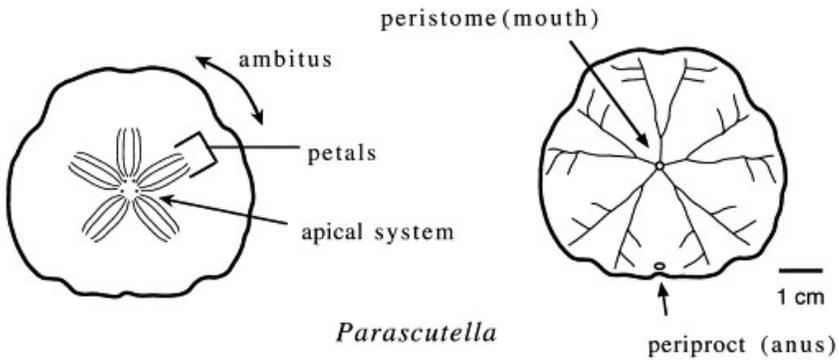
Echinocardium cordatum



Oursins irréguliers



Scutella stelatta
Miocene



III. Systématique des classes actuelles

5. Holothuroidea

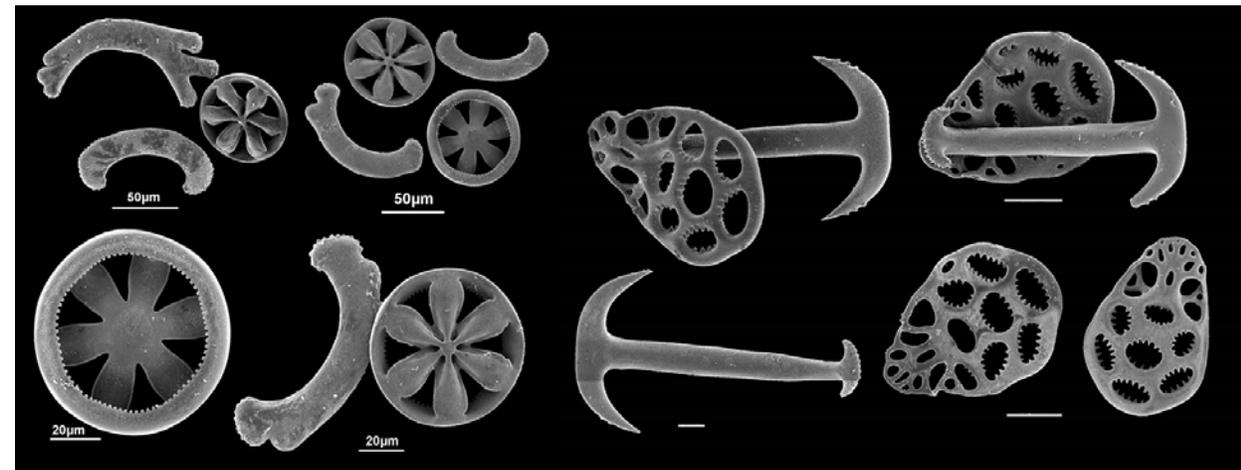
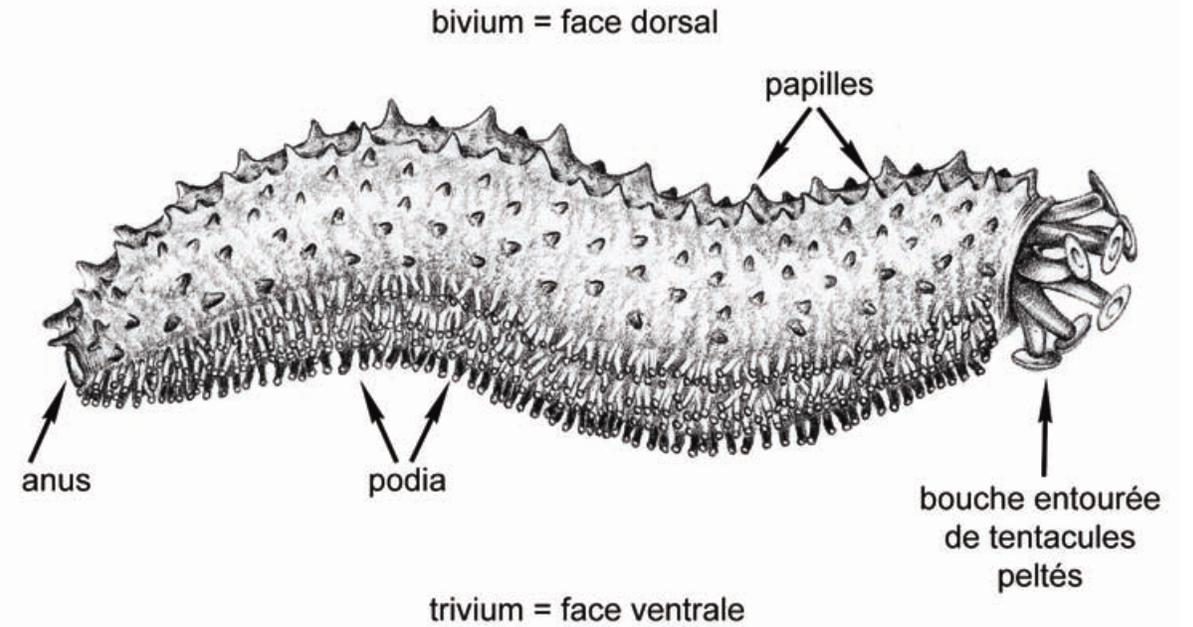
~ 1 700 espèces actuelles

19 espèces fossiles (décrites) => parataxonomie

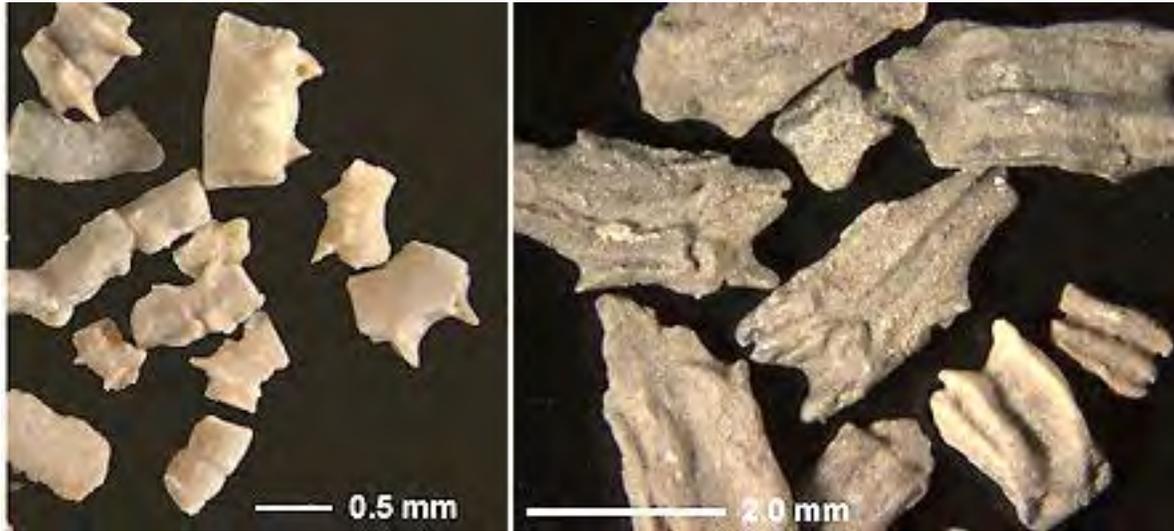
➤ Silurien à l'actuel



M. Fau - Maldives 2018



III. 5. Holothuroidea

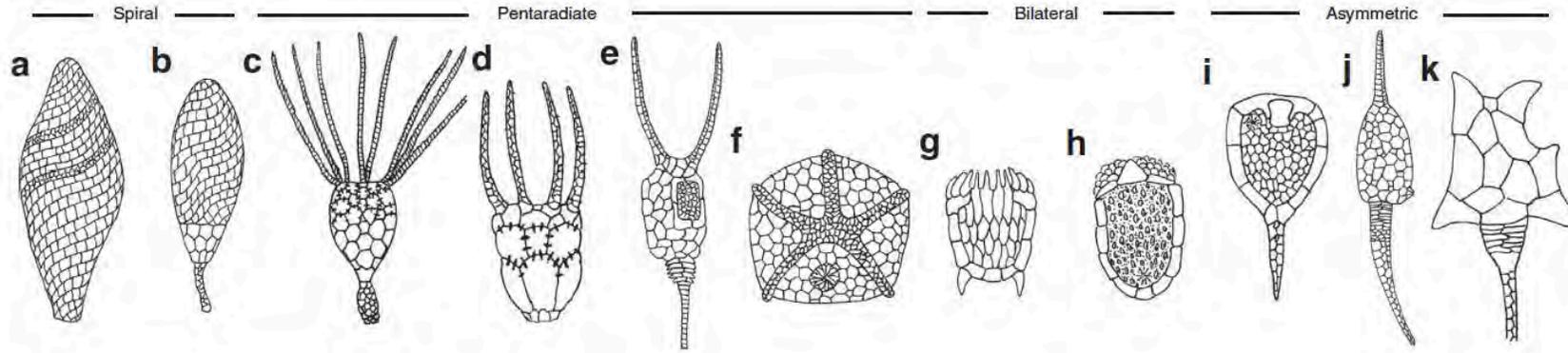


Ossicules d'holothurie fossiles,
Jurassique & Crétacé, par Mike Reich



Achistrum
Pennsylvanian of Mazon Creek, Illinois, USA



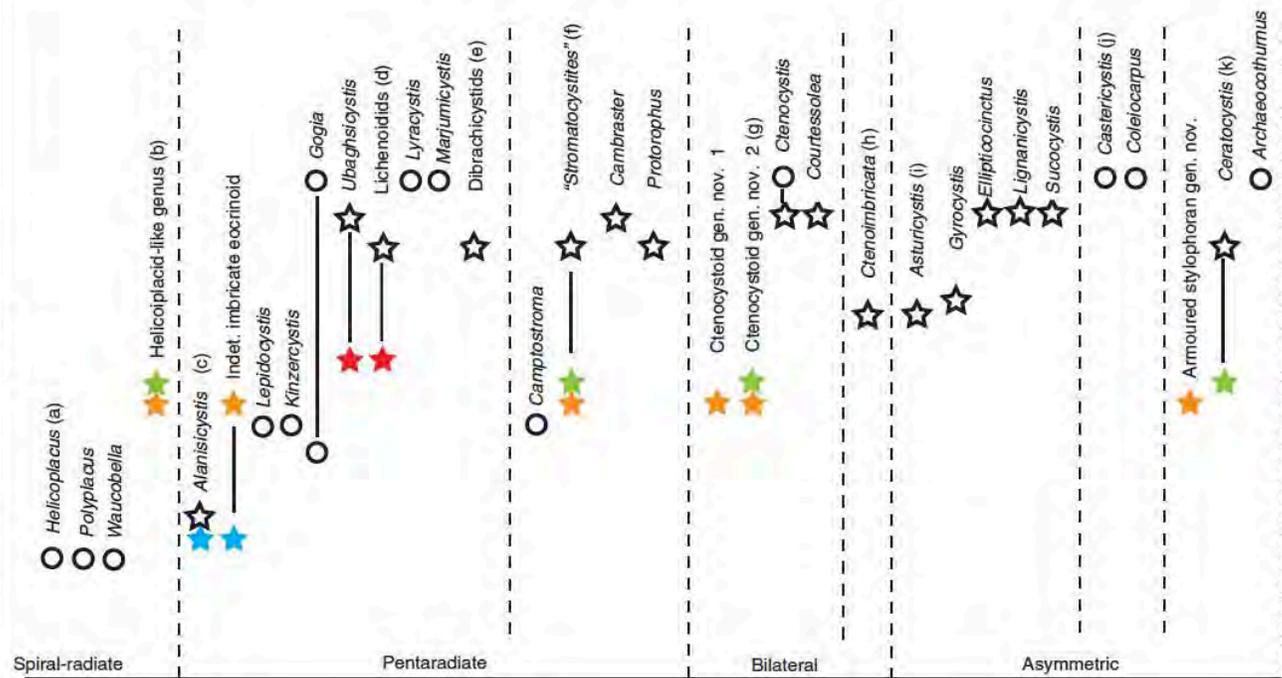


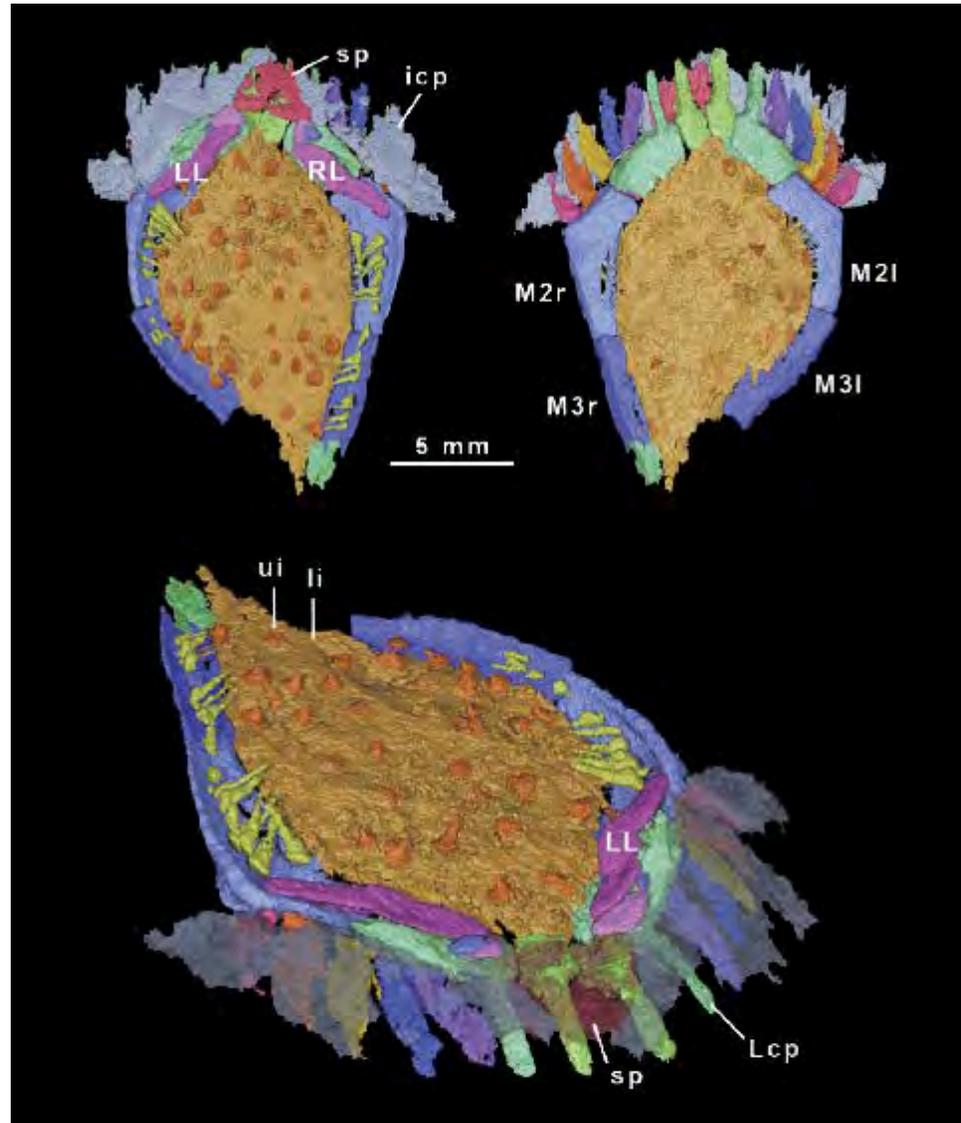
~500 MA

~509 MA

~521 MA

Series 3	Drumian	N America Marjuman (4)	Morocco/SW Europe Languedocian (11)
	Stage 5	Topazan	
Series 2	Delamaran		Caesaraugustan (10)
	Stage 4	Dyeran (3) (2)	Agdzian Leonian (8) (7) (6) Bilibilian
Stage 3	Montez-uman (1)	Banian (5)	Marianian (9) Ovetian

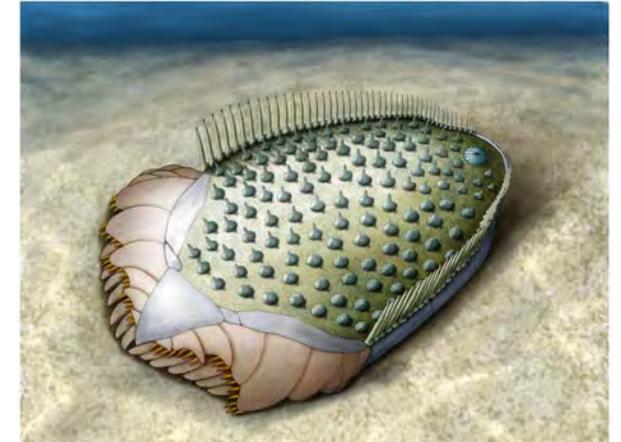


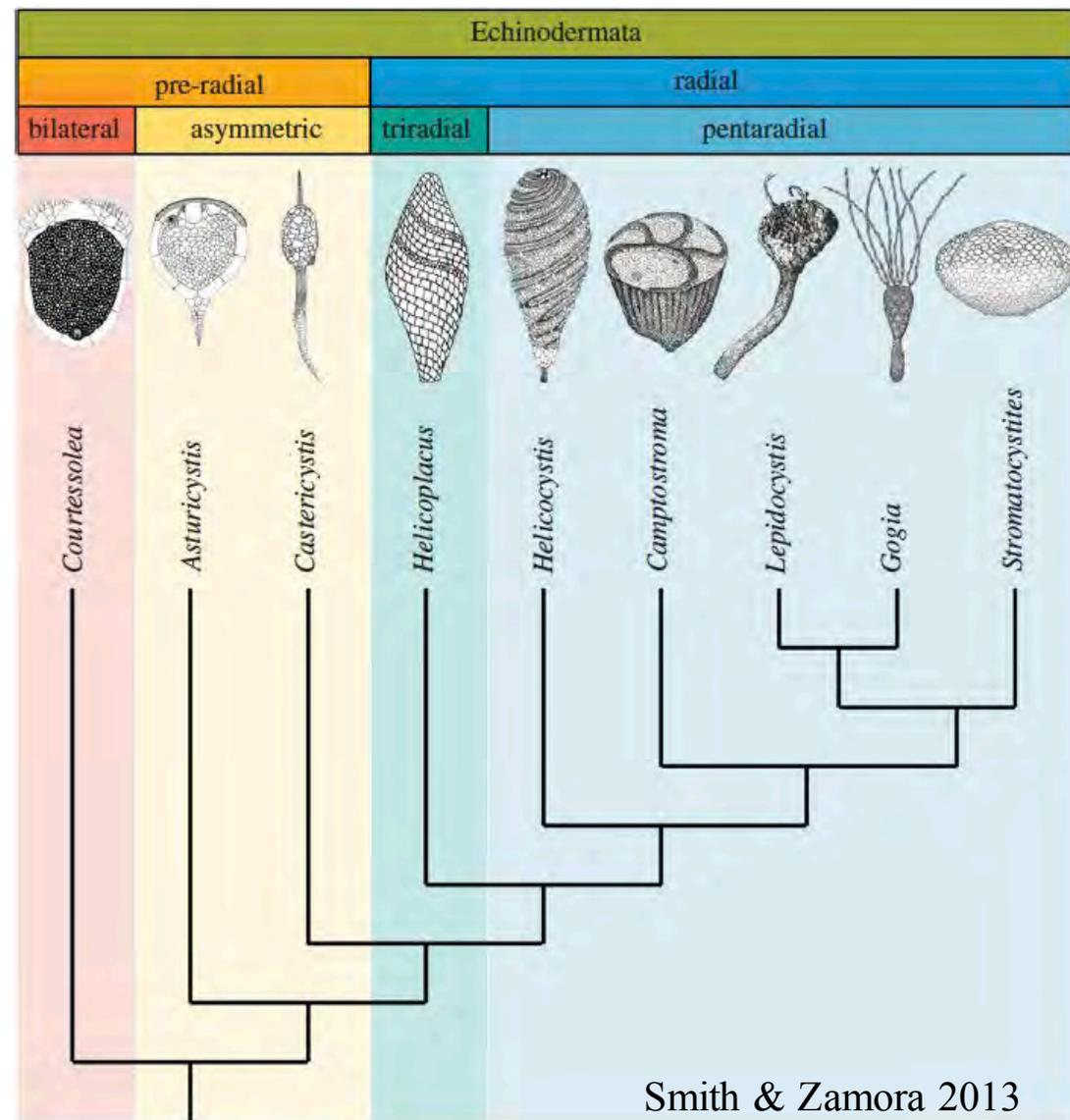


Ctenoimbricata spinosa

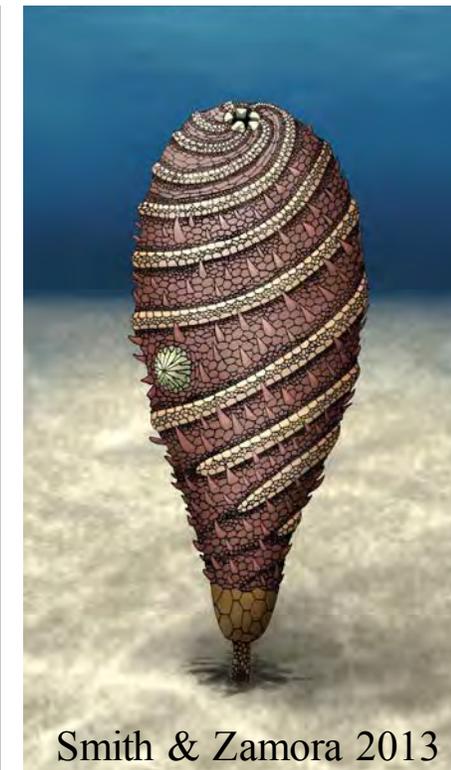
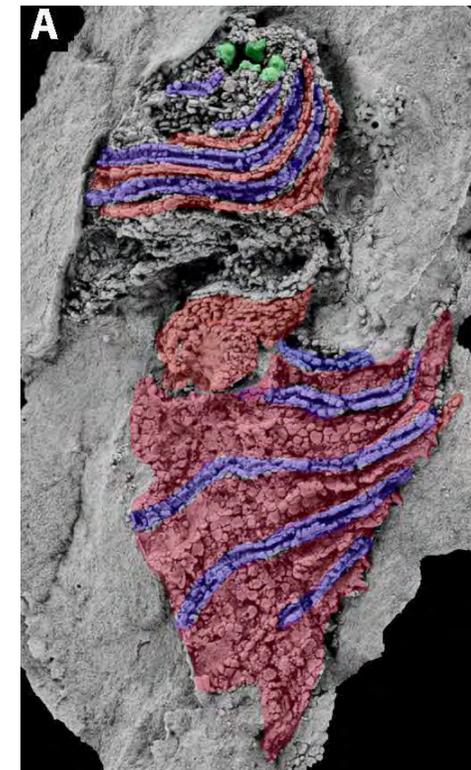
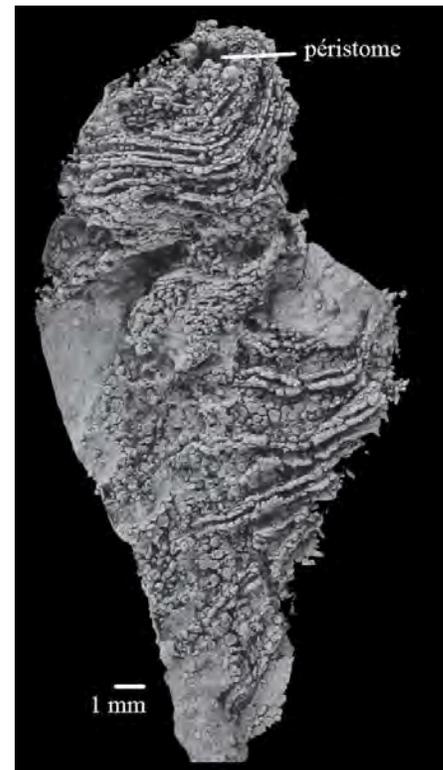
~ 505 MA

Zamora et al. 2012



*Helicocystis moroccoensis*

~ 517 MA



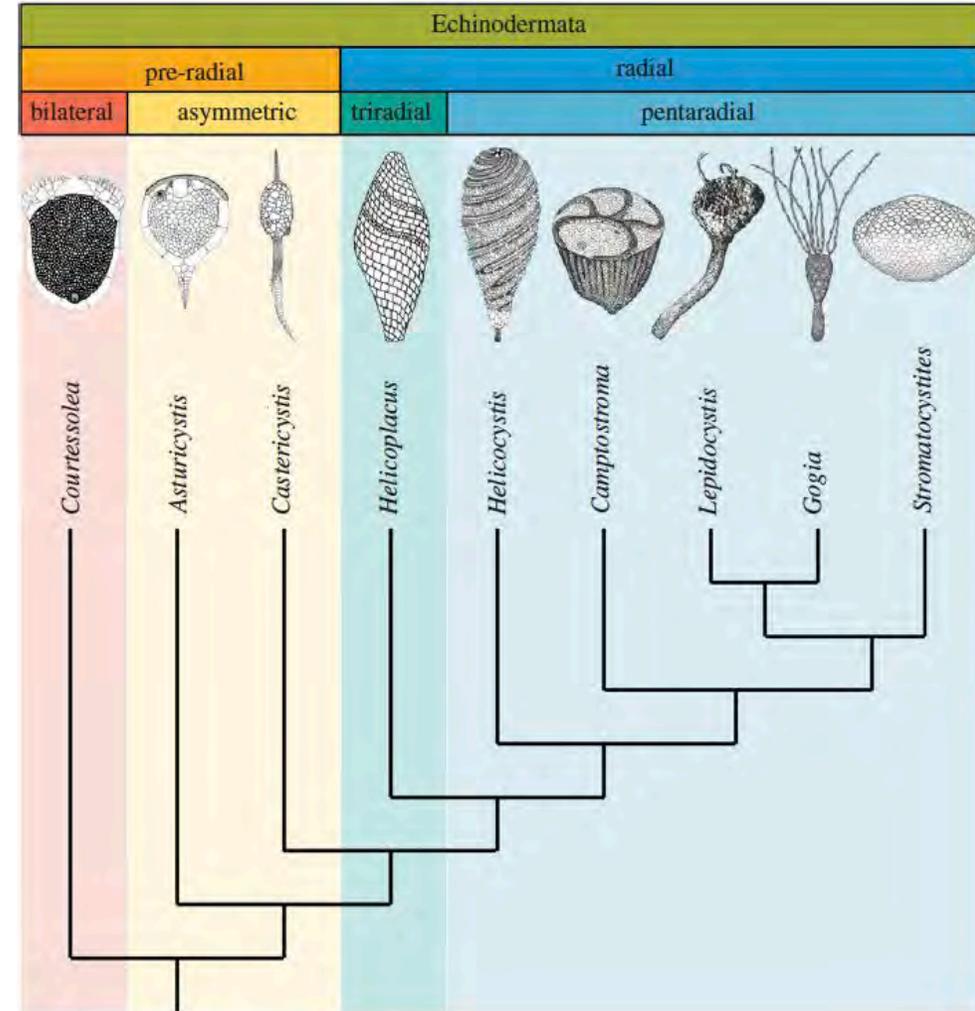
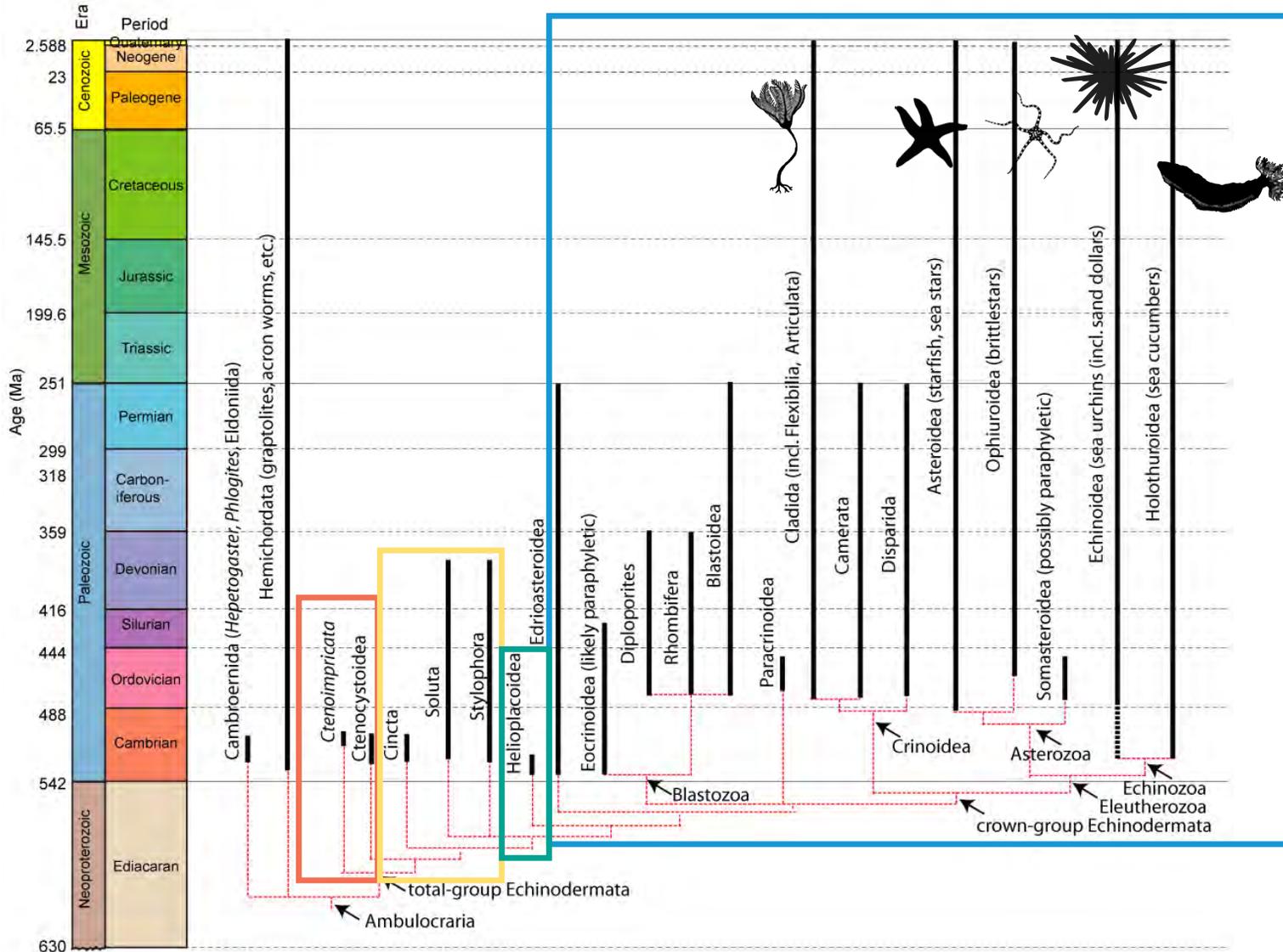
Introduction

I. Caractéristiques morphologiques

II. Écologie

III. Systématique

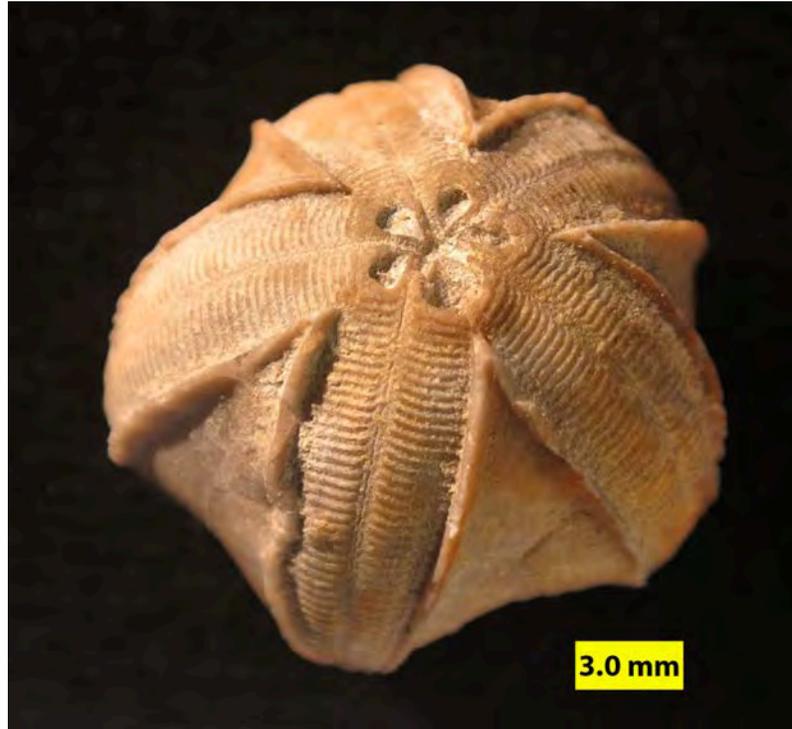
IV. Echinodermes paléozoïques



Edrioasteroidea
(*Streptaster vorticellatus*)



Blastoidea
(*Pentremites godoni*)



Helicoplacoidea
(*Helicoplacus*)

