

EDIACARA

L'aube de la
vie animale



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AGSE, Gréasque
27 janvier 2018

Laboratoire de Géochronologie, Université de Wollongong, AU



Flinders Ranges, 2016

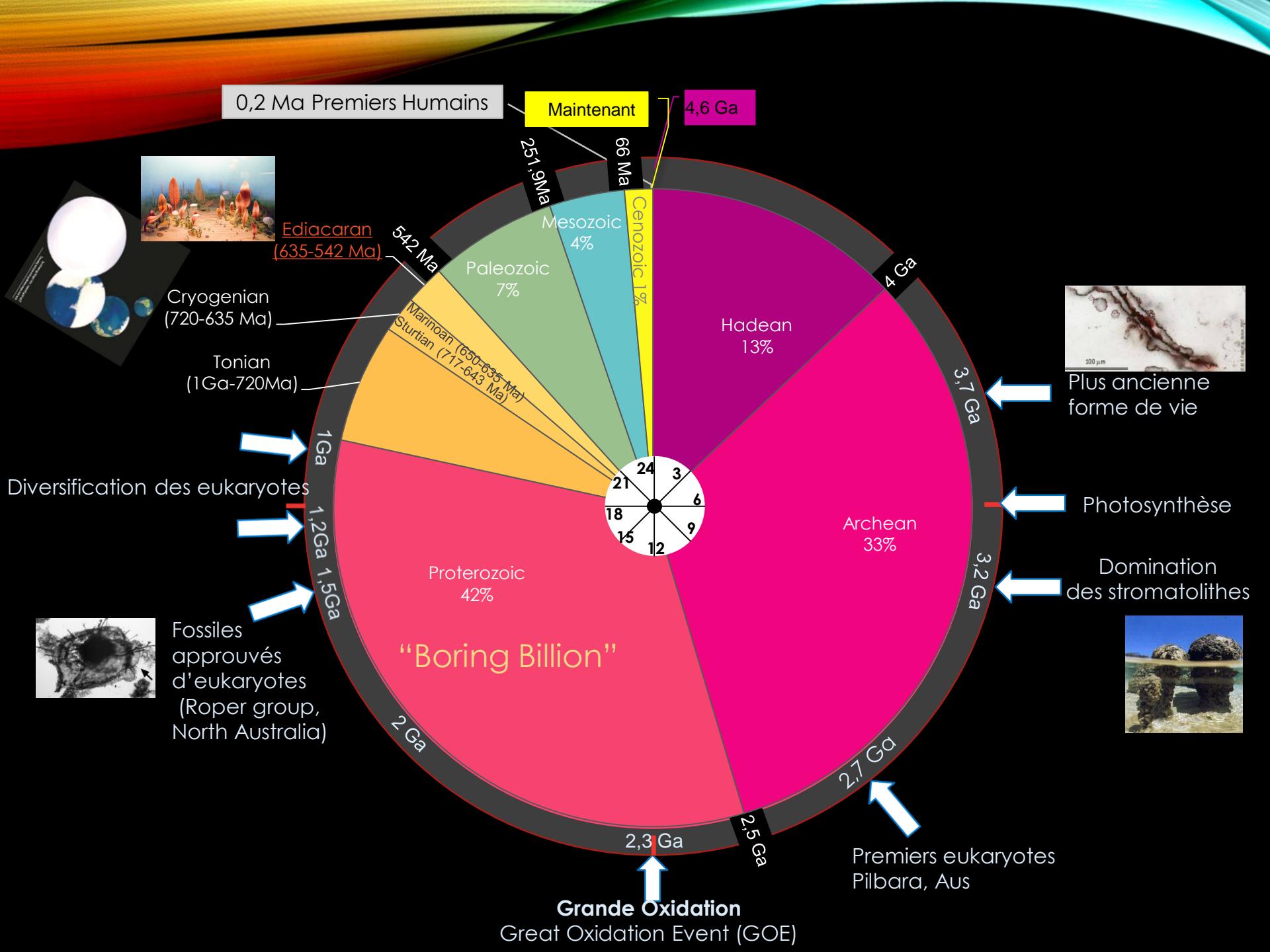
Stratotype [base de la Période Ediacara (635-542 Ma), Enorama creek, AU]

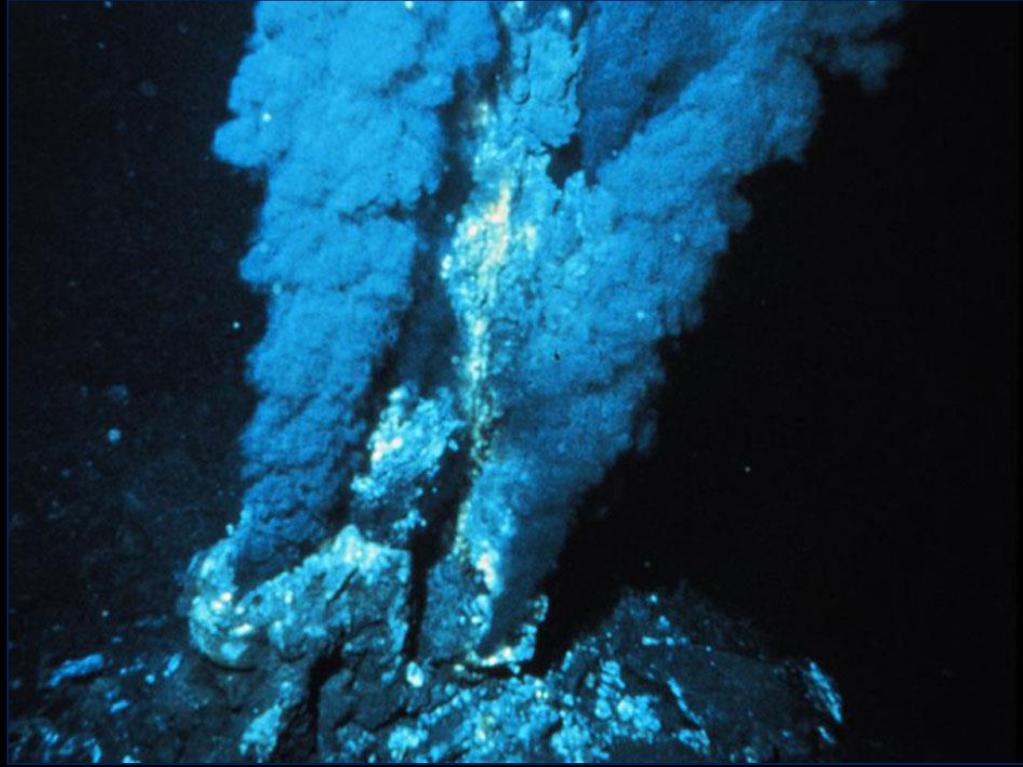
PLAN DE LA PRÉSENTATION

Echelles de temps géologique et biologique

- 1. **QUOI ?** Le monde animal
- 2. **QUI ?** La Faune d'Ediacara
- 3. **OÙ ?** Distribution des taxa
- 4. **COMMENT ?** Taphonomie et diversité écologique

Perspectives: Faune d'Ediacara OÙ fossiles du système édiacarien ?





QUOI ?

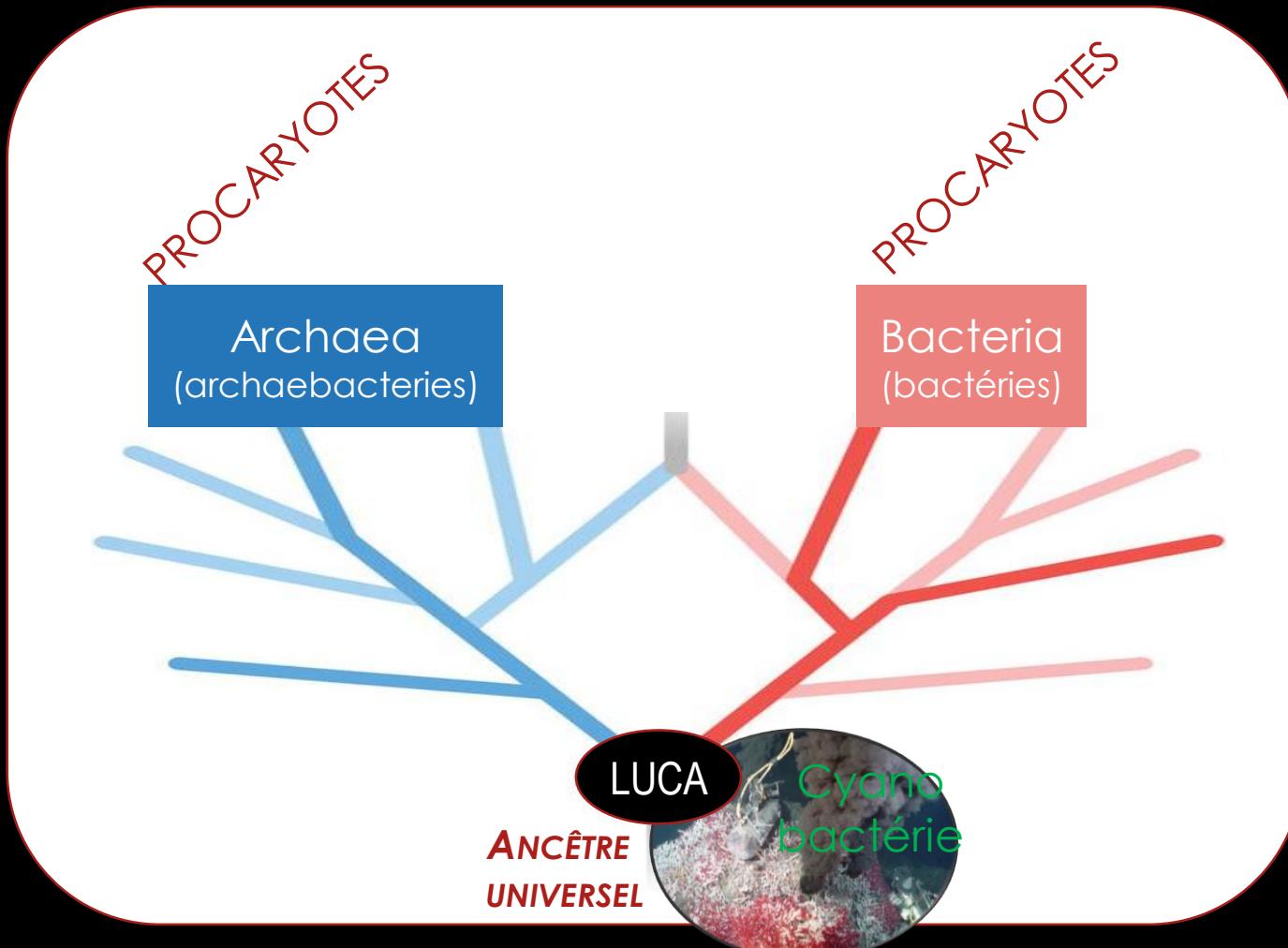
Le Monde Animal

A L'ORIGINE DU MONDE ANIMAL

Cellules

Deux domaines:

Bacteria et Archaea

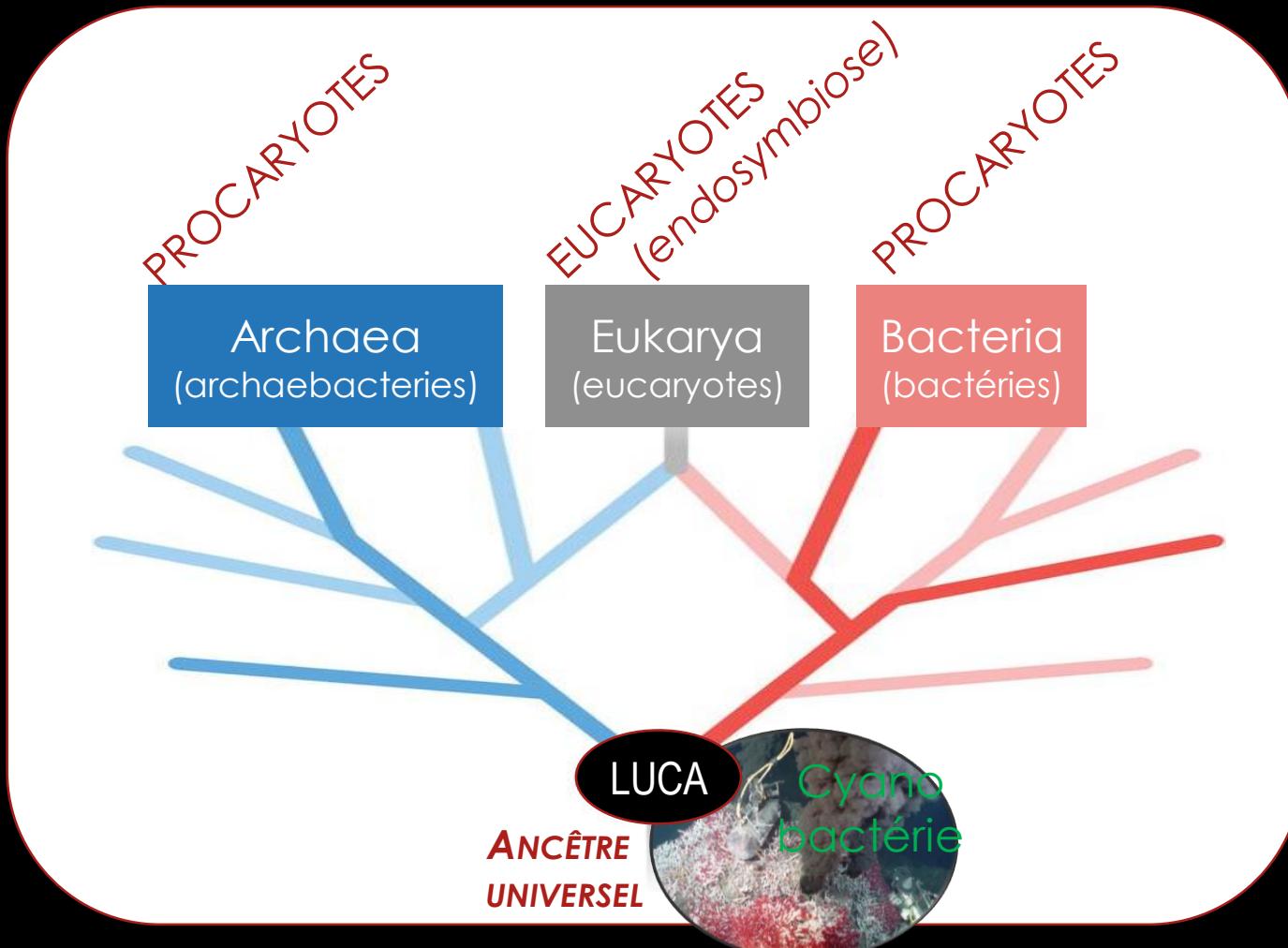


A L'ORIGINE DU MONDE ANIMAL

Cellules

Deux domaines:
Bacteria et Archaea

Deux catégories:
PROCARYOTES ET EUKARYOTES



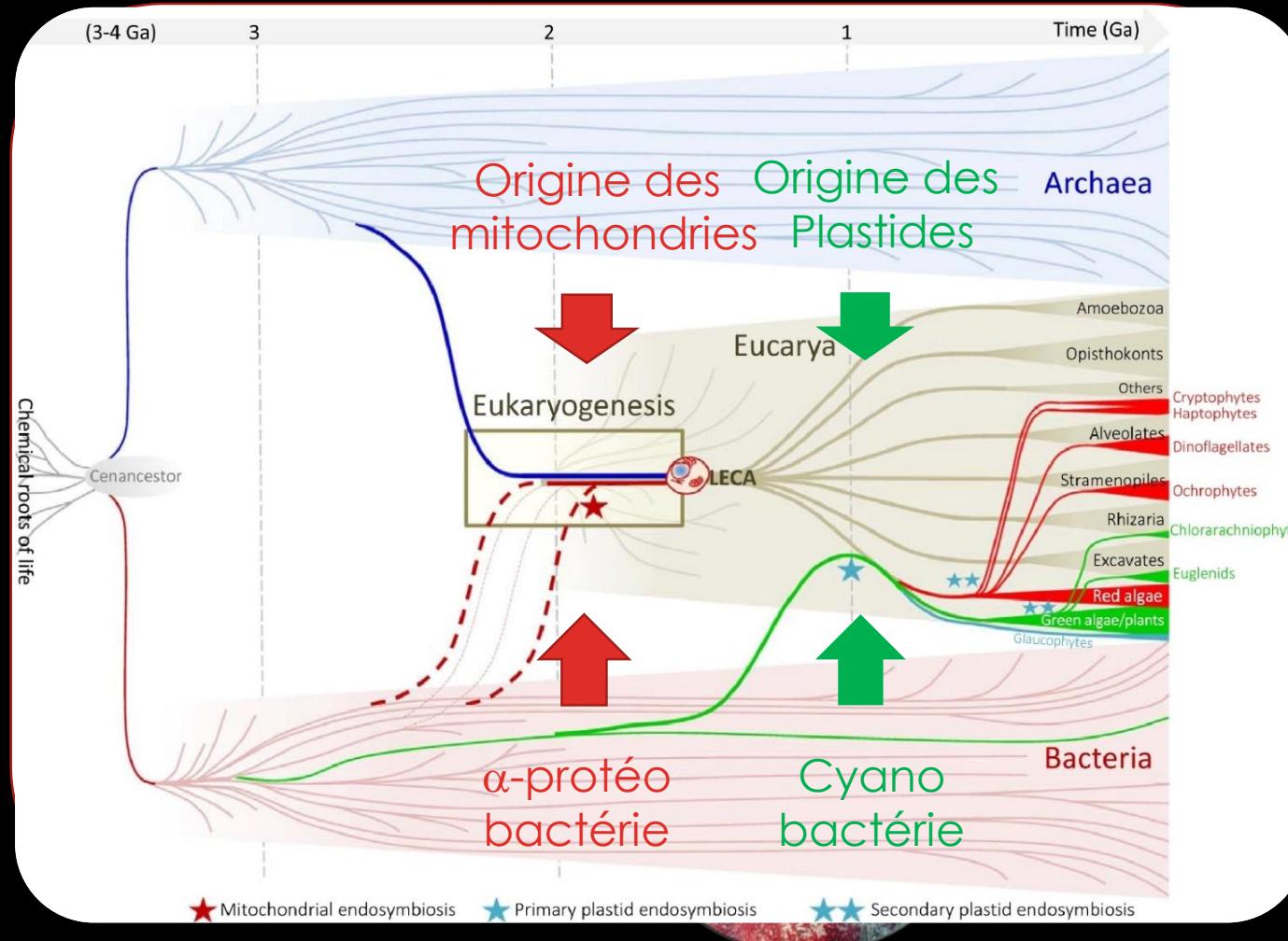
A L'ORIGINE DU MONDE ANIMAL

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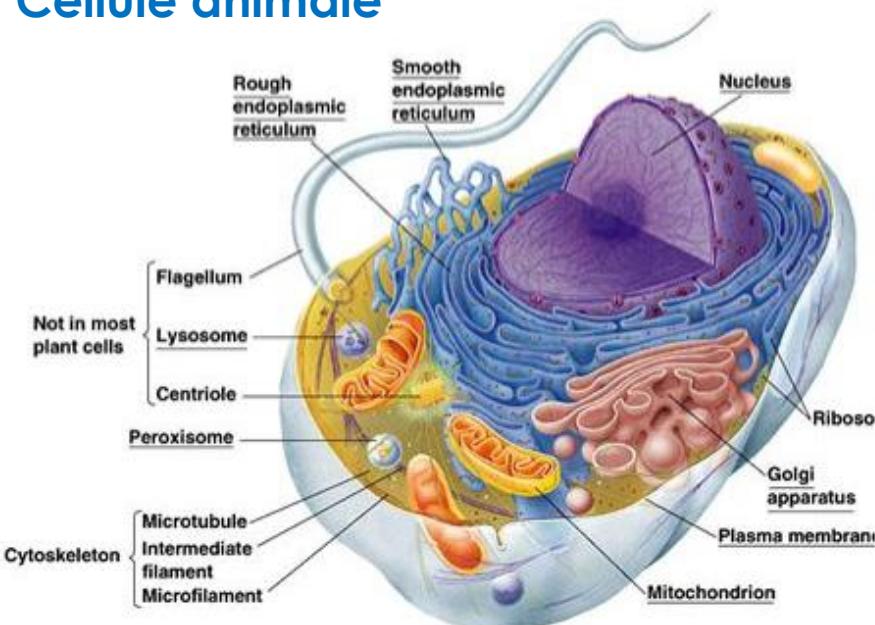
Lopez-Garcia et al. J. Theor. Biol. 434 (2017) 20-33



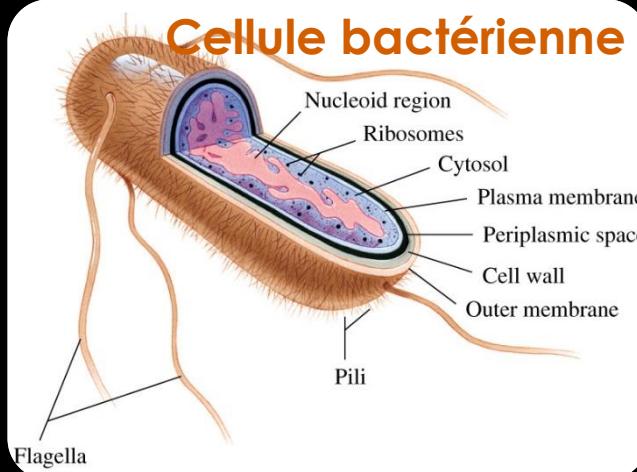
PROKARYOTES

EUCARYOTES

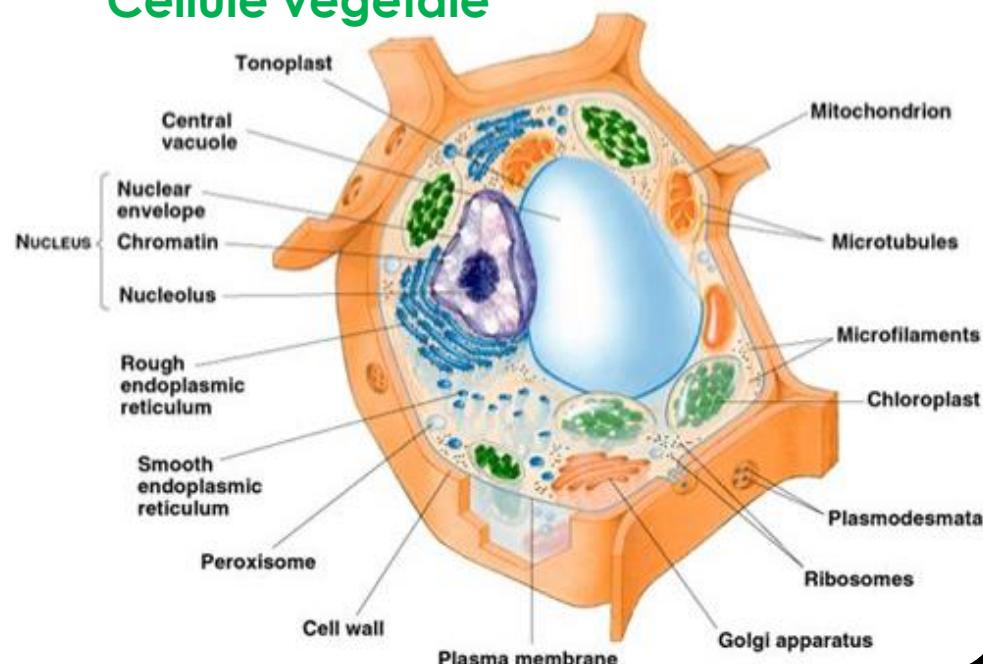
Cellule animale



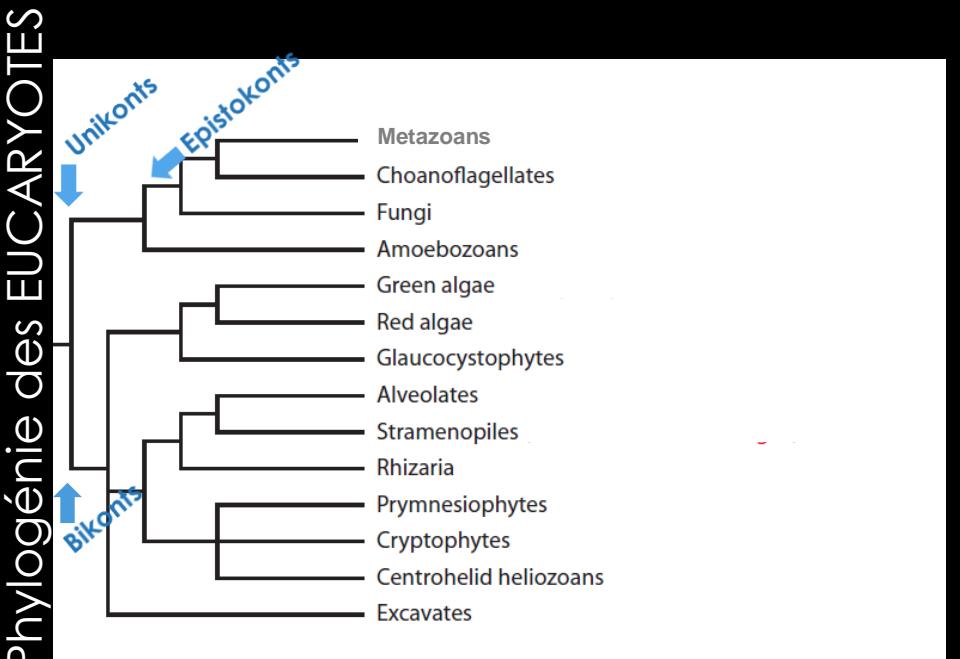
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Cellule végétale

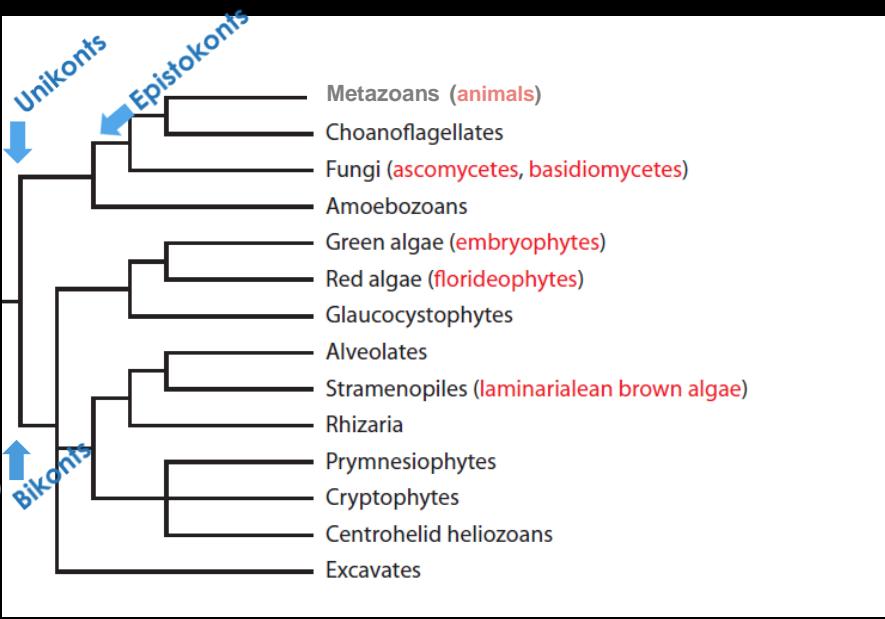


MULTICELLULARITÉ COMPLEXE



MULTICELLULARITÉ COMPLEXE

Phylogénie des EUKARYOTES

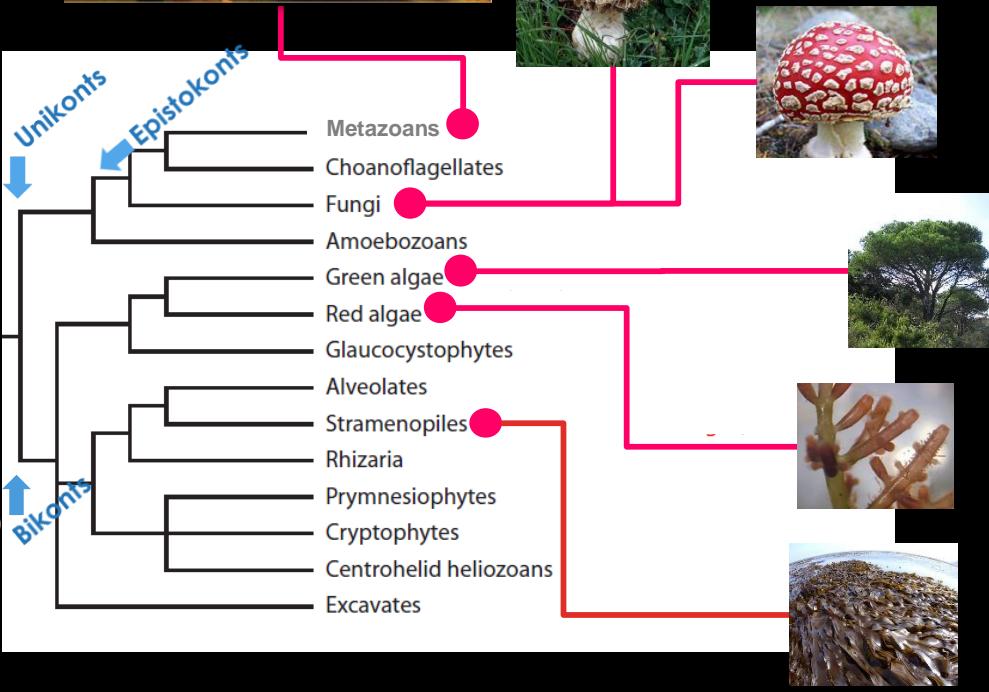


MULTICELLULARITÉ COMPLEXE

(Animaux: des Eponges à l'Homme)



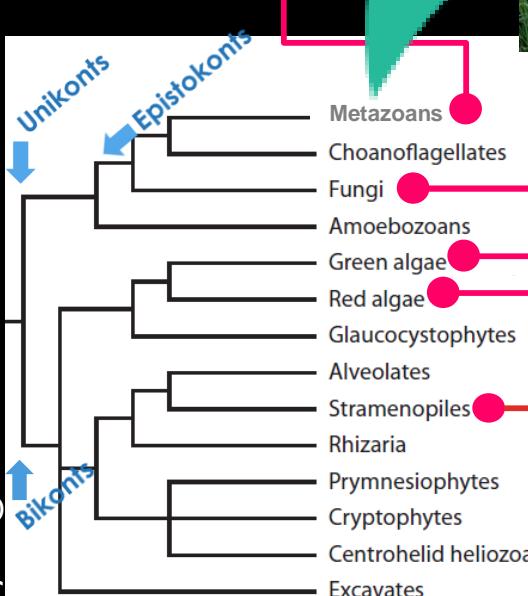
Phylogénie des EUKARYOTES



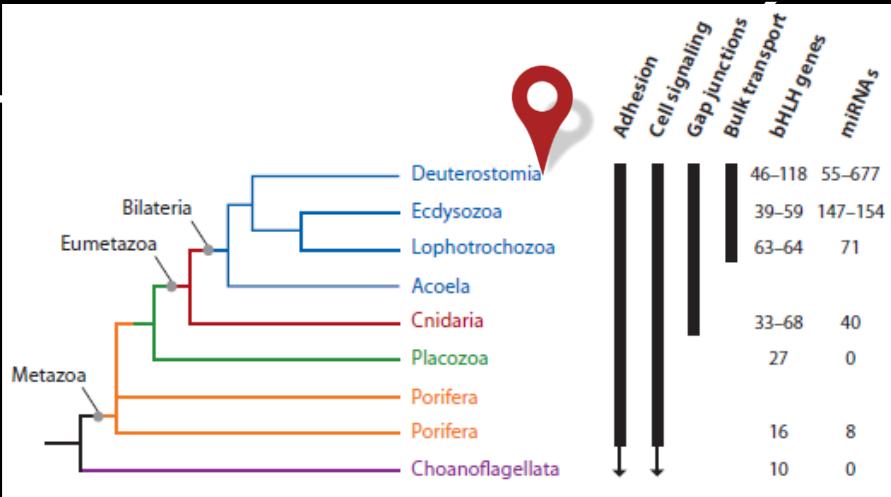
Phylogénie des EUCAHYOTES



Phylogénie des MÉTAZOAIRES

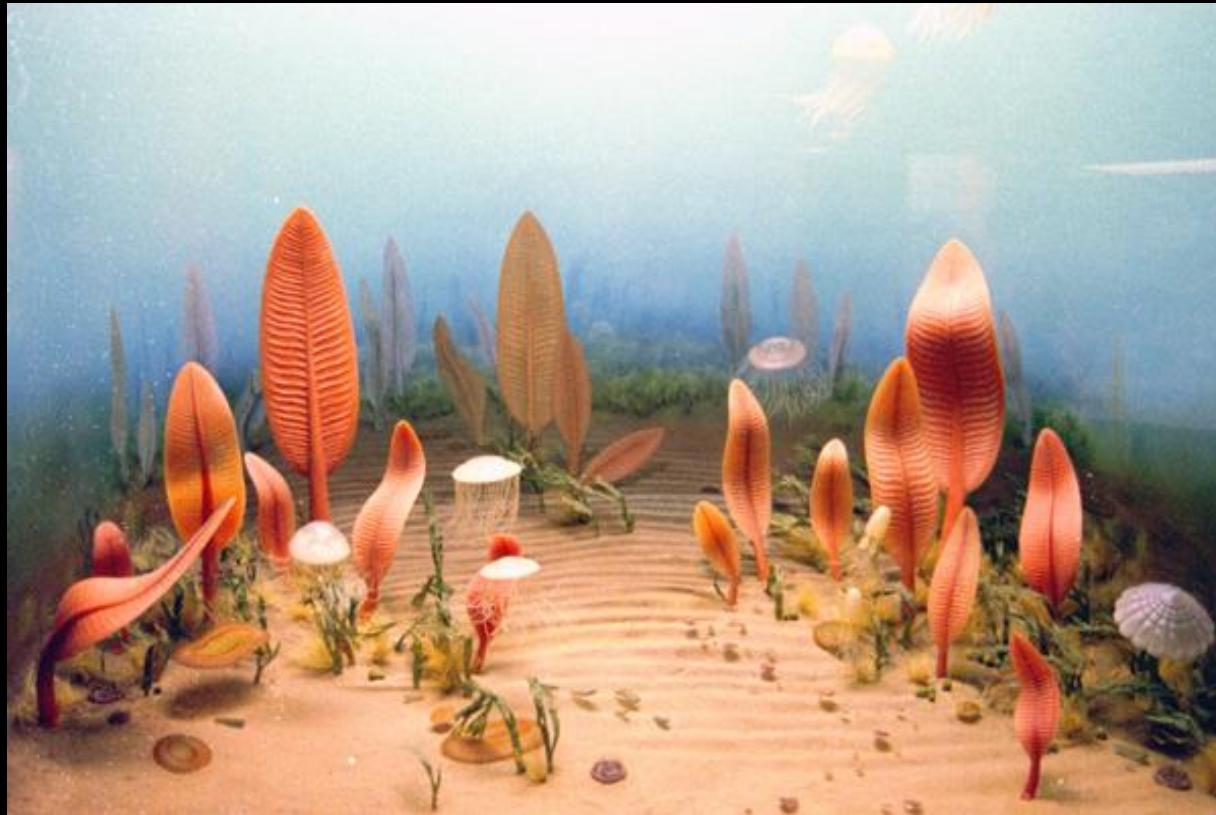


MU



Organismes Multicellulaires (multicellularité complexe)

- Adhésion cellulaire
- Communication cellulaire
- Cytosquelette dynamique
- Programme génétique de développement

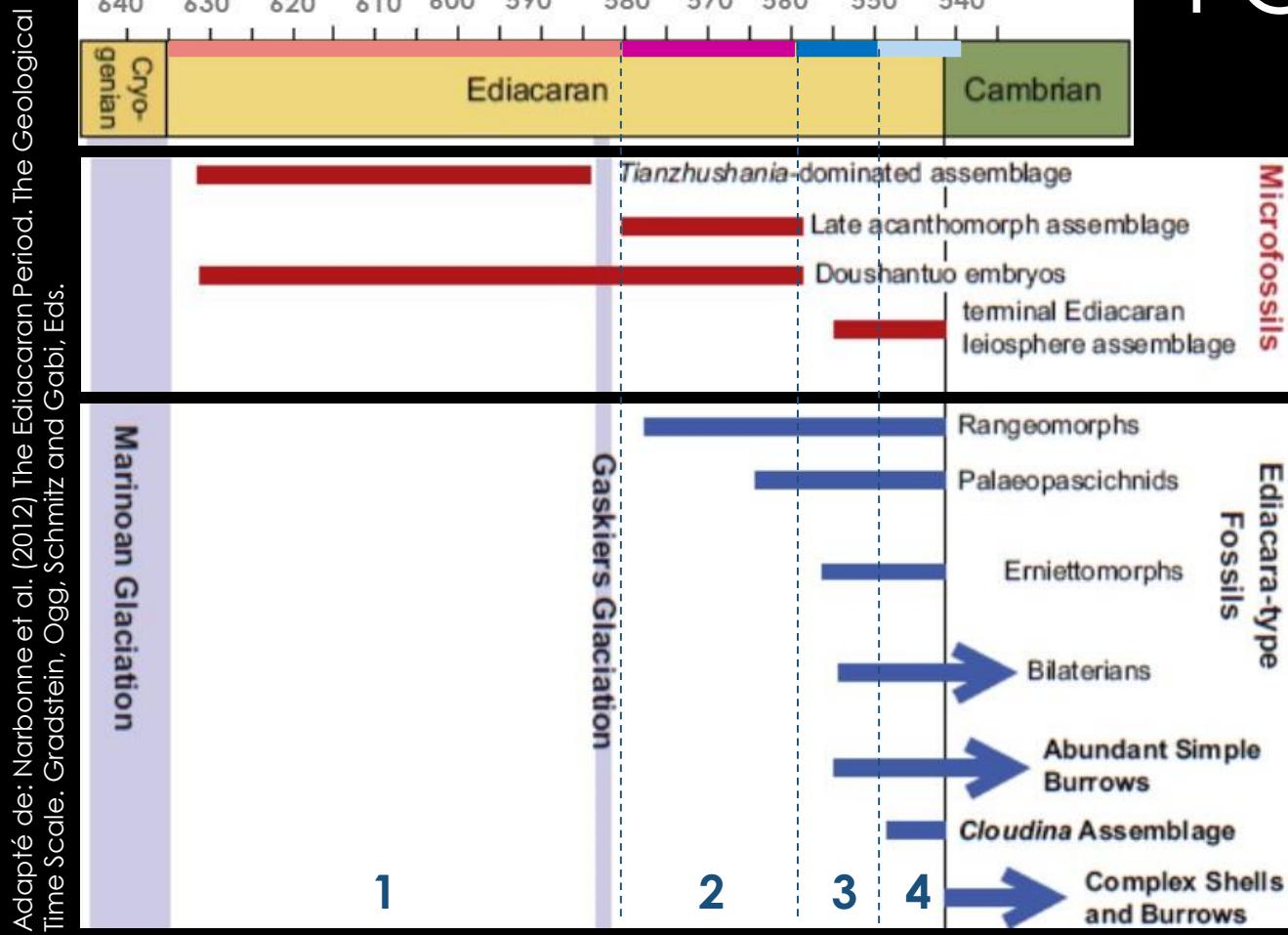


Smithsonian Museum, Washington (USA); Photo: P.-A. Bourque, 1995

QUI ?

La Faune d'Ediacara

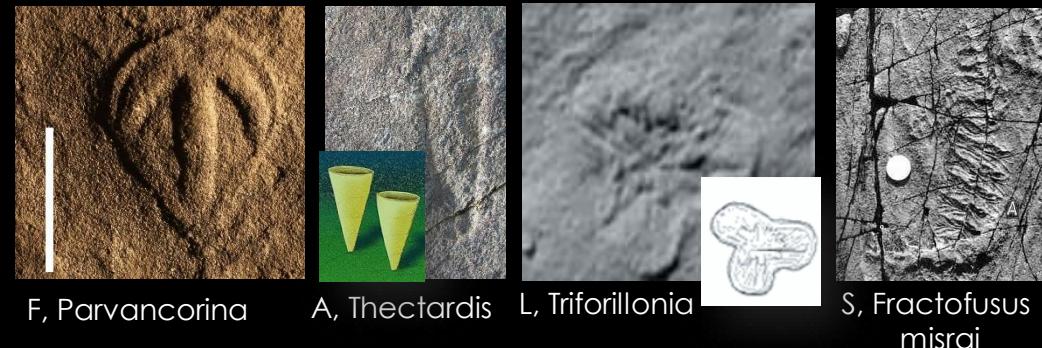
MICRO- ET MEGA-FOSSILES



MORPHOLOGIE

Général:

- **Circulaire** (C, *Aspidella*);
- **En éventail** (F, *Parvancorina minchami*);
- **Ovale** (O, *Dickinsonia*);
- **Angulaire/Triangulaire/Polygonale** (A, *Thectardis*);
- **Lobée** (L, *Triforillonia*);
- **Fuseau** (S, *Fractofusus misrai*).



Structures dans différentes régions:

Shen, B. et al (2008) The Avalon Explosion: Evolution of Ediacara Morphospace Science 319, 81.

Centrale



Arête centrale :
Vendia

Intermédiaire



Ramification radiale dichotomique: Solza
margarita

Pérophérique



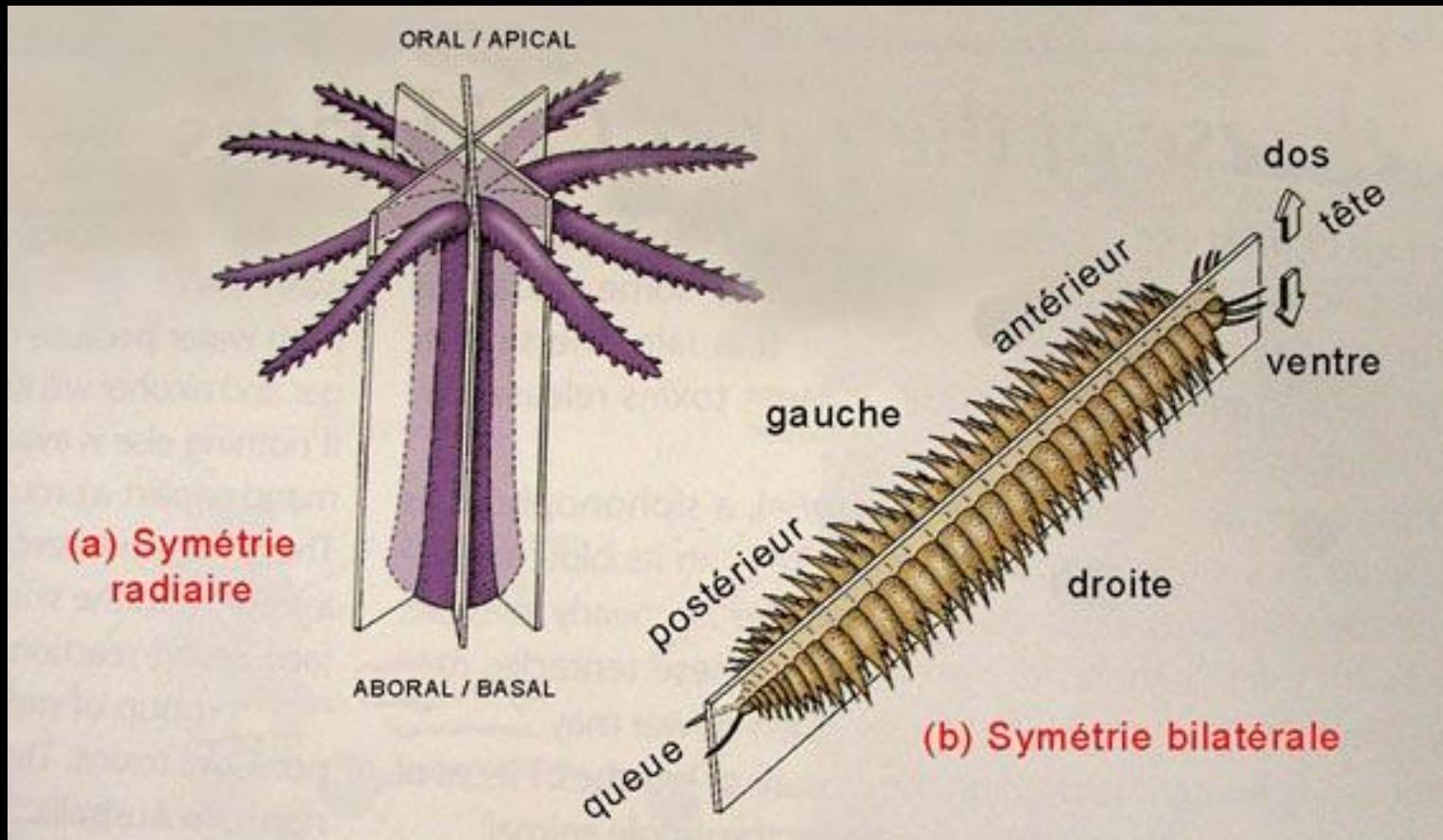
Fuseaux radiaires: Plastron sternal
Mawsonites

Autre



Ventogyrus

AXES ET PLAN DE SYMÉTRIE





Radiale

(Aspidella)



Tri-radiale

(Tribrachidium)

SYMÉTRIE RADIALE



Penta-radiale

(Arkarus)



Tetra-radiale

(Conomedusa)



Octa-radiale

(Eoandromeda)



Radiale

(Aspidella)



Tri-radiale

(Tribrachidium)

SYMÉTRIE RADIALE



Penta-radiale

(Arkarus)

Aujourd'hui...



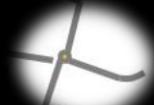
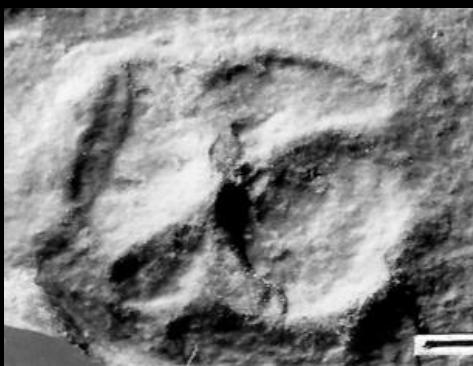
Oursin

Aujourd'hui...



Octa-radiale

(Eoandromeda)



Tetra-radiale

(Conomedusa)

**Bilatérale et
bipolaire**

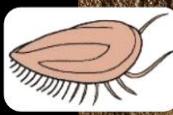
SYMÉTRIE BILATÉRALE



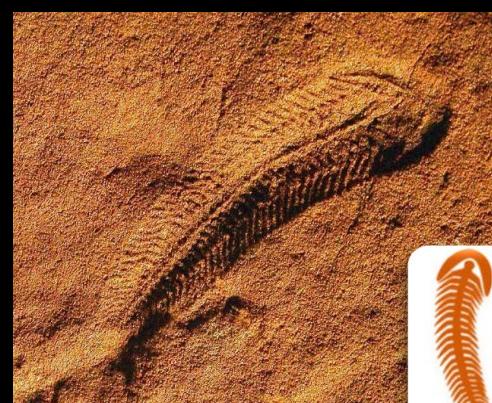
Dickinsonia



Kimberella



F. Parvancorina



Spriggina

**Bilatérale et
unipolaire**



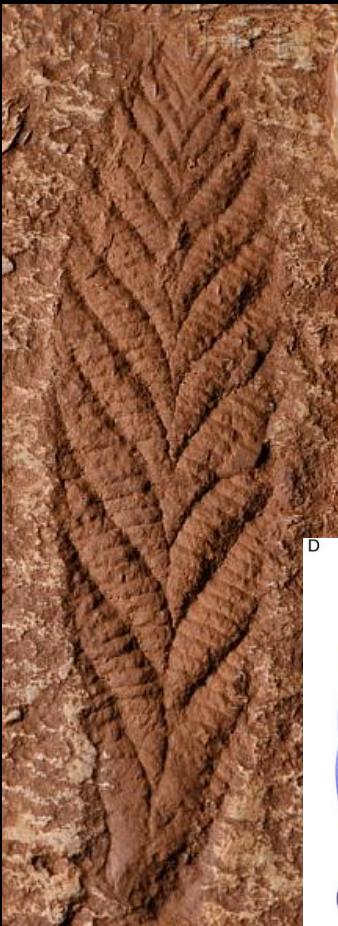
Charniodiscus

Rangeomorphes



Rangea

RANGIDA

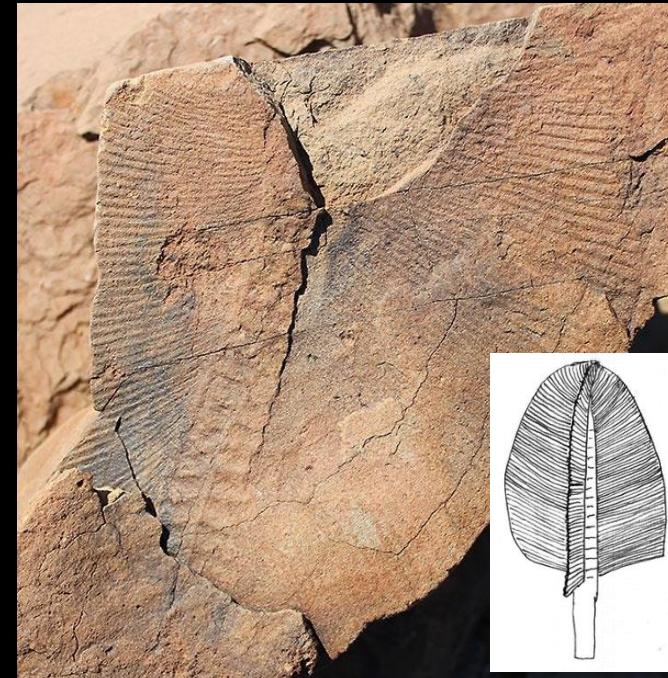


Charnia masoni

CHARNIDA

ORGANISATION FRACTALE

Erniettomorphes



Swartpunktia

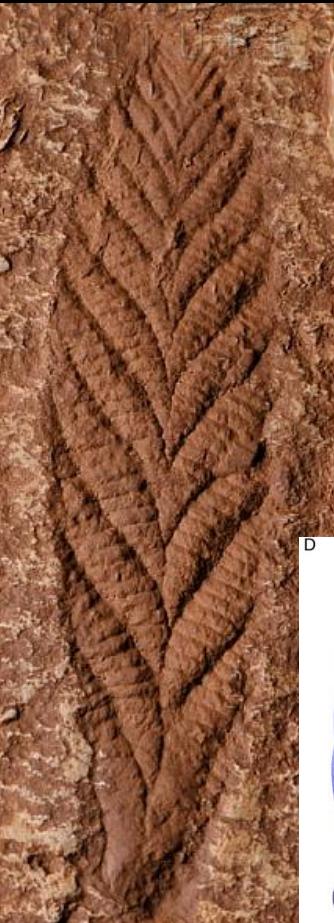


Rangeomorphes



Avalofractus abaculus

RANGIDA



Charnia masoni

CHARNIDA

ORGANISATION FRACTALE

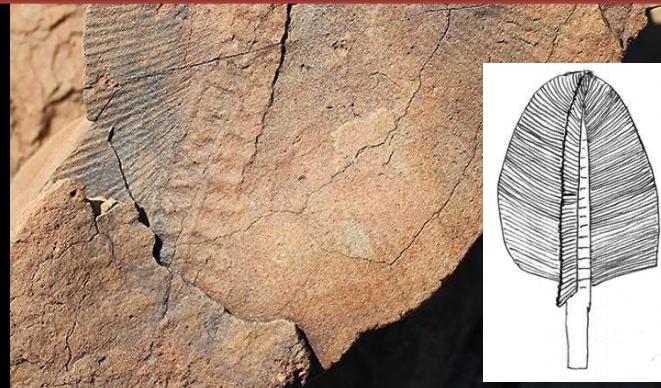
Aujourd'hui...



Fougère



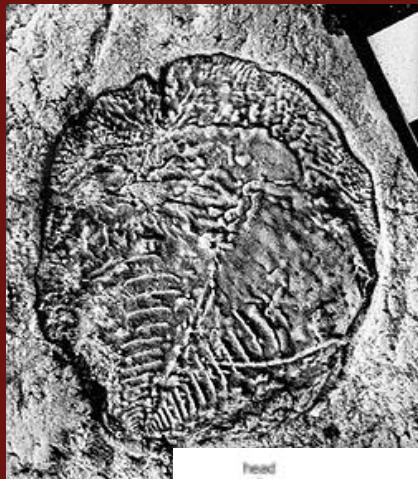
Chou Romanesco



Swartpuntia



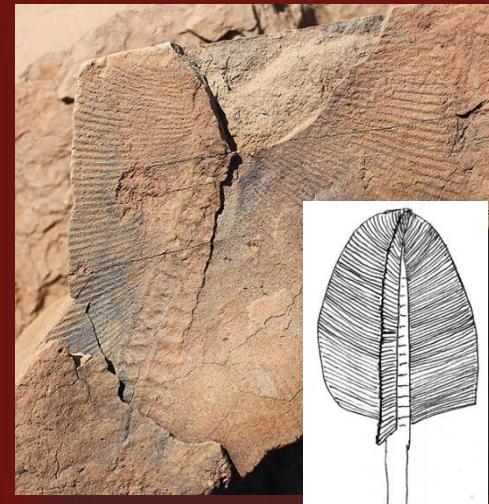
SYMÉTRIE GLISSÉE



Yorgia



Dickinsonia

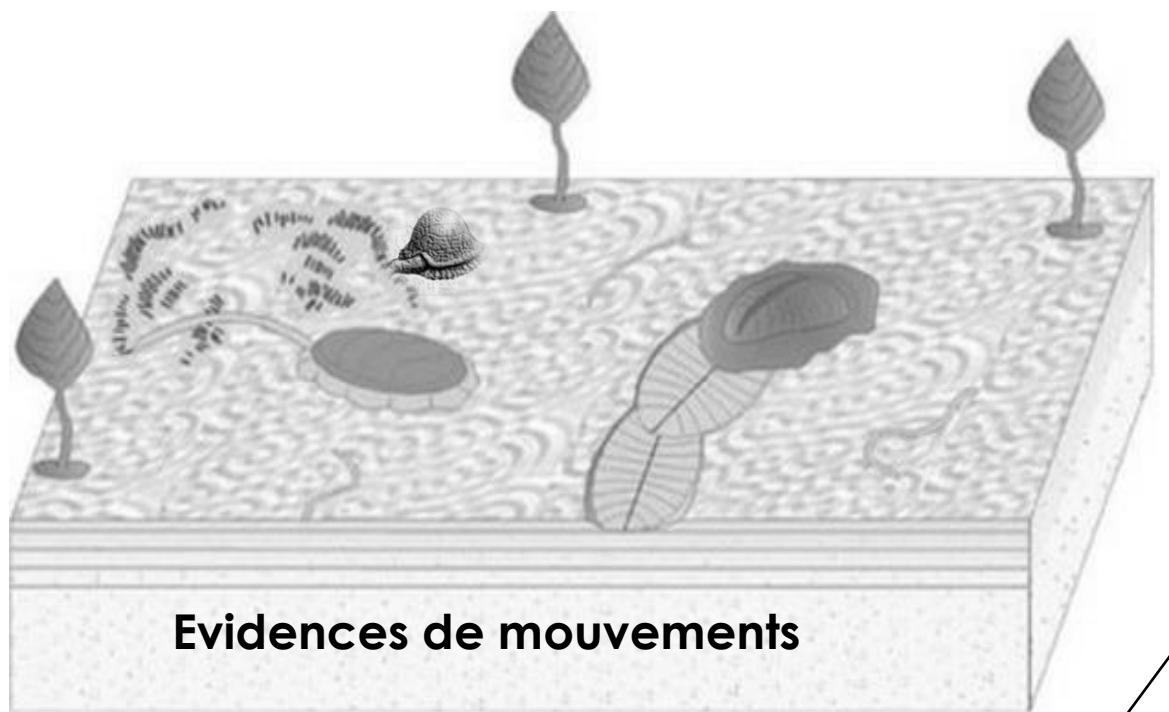


Swartpuntia

Erniettomorpha

Proarticulata





Evidences de mouvements

Traces de broutage

Helminthopsis ichnoguild
Helminthopsis
Helminthoidichnites
Gordia

TRACES FOSSILES



Traces de grattement

Radulichnus ichnoguild
Kimberichnus

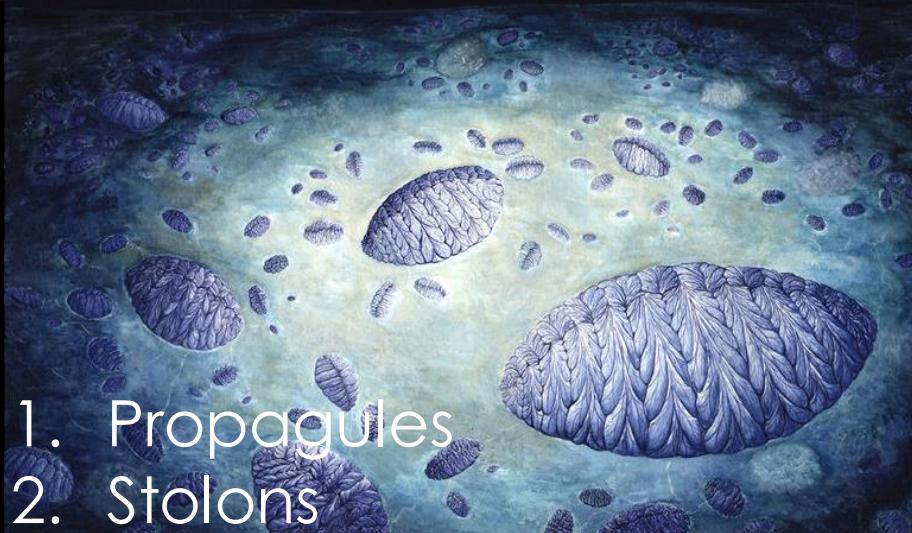


Traces d'enfouissement

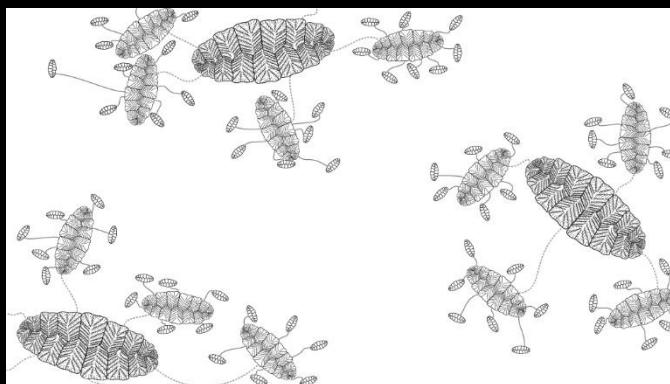
Epibaion ichnoguild
Epibaion



REPRODUCTION



1. Propagules
2. Stolons

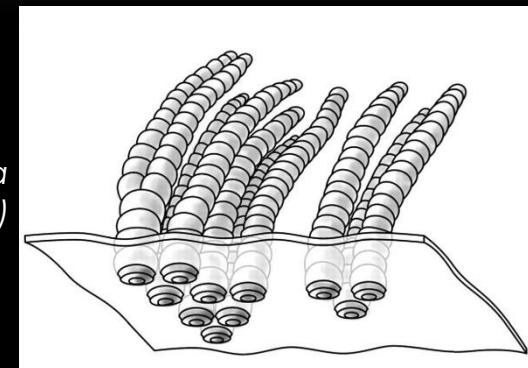


Fractofusus (Rangeomorpha)

E. G. Mitchell et al. (2015) Reconstructing the reproductive mode of an Ediacaran macro-organism. *Nature* **524**, 343–346



1. Naissance
2. Attachement



Fusinia dorothea (Fusinia)

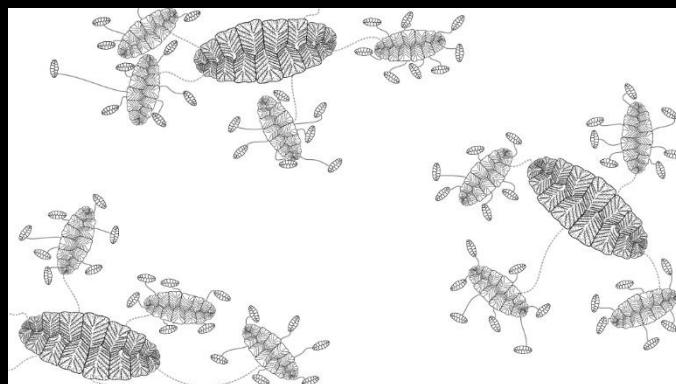
M.L. Droser, J.G. Gehling **Synchronous aggregate growth in an abundant new Ediacaran tubular organism** *Science*, 319 (2008), pp. 1660-166

REPRODUCTION

Aujourd'hui...



Stolon d'Ascidies



Fractofusus (Rangeomorpha)

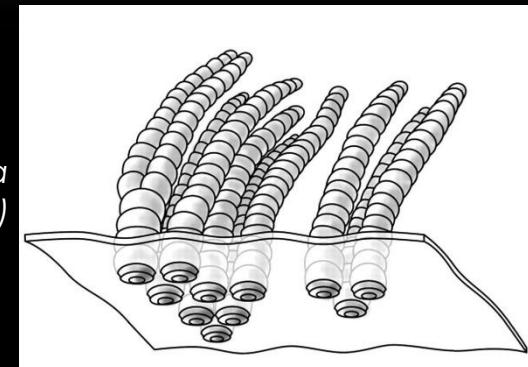
E. G. Mitchell et al. (2015) Reconstructing the reproductive mode of an Ediacaran macro-organism. *Nature* **524**, 343–346

Aujourd'hui...



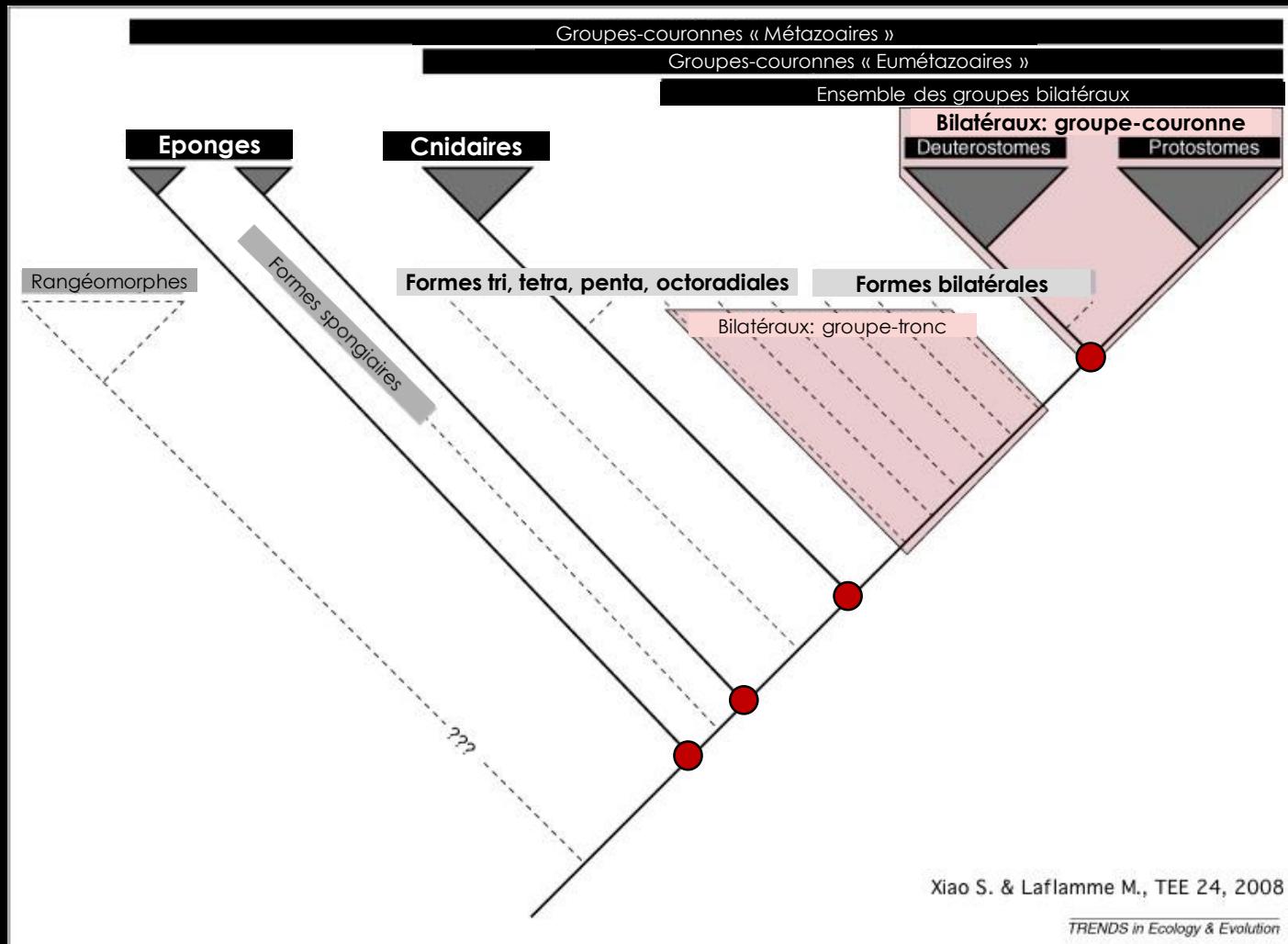
Naissain d'huîtres

Fusinia dorothea
(*Fusinia*)

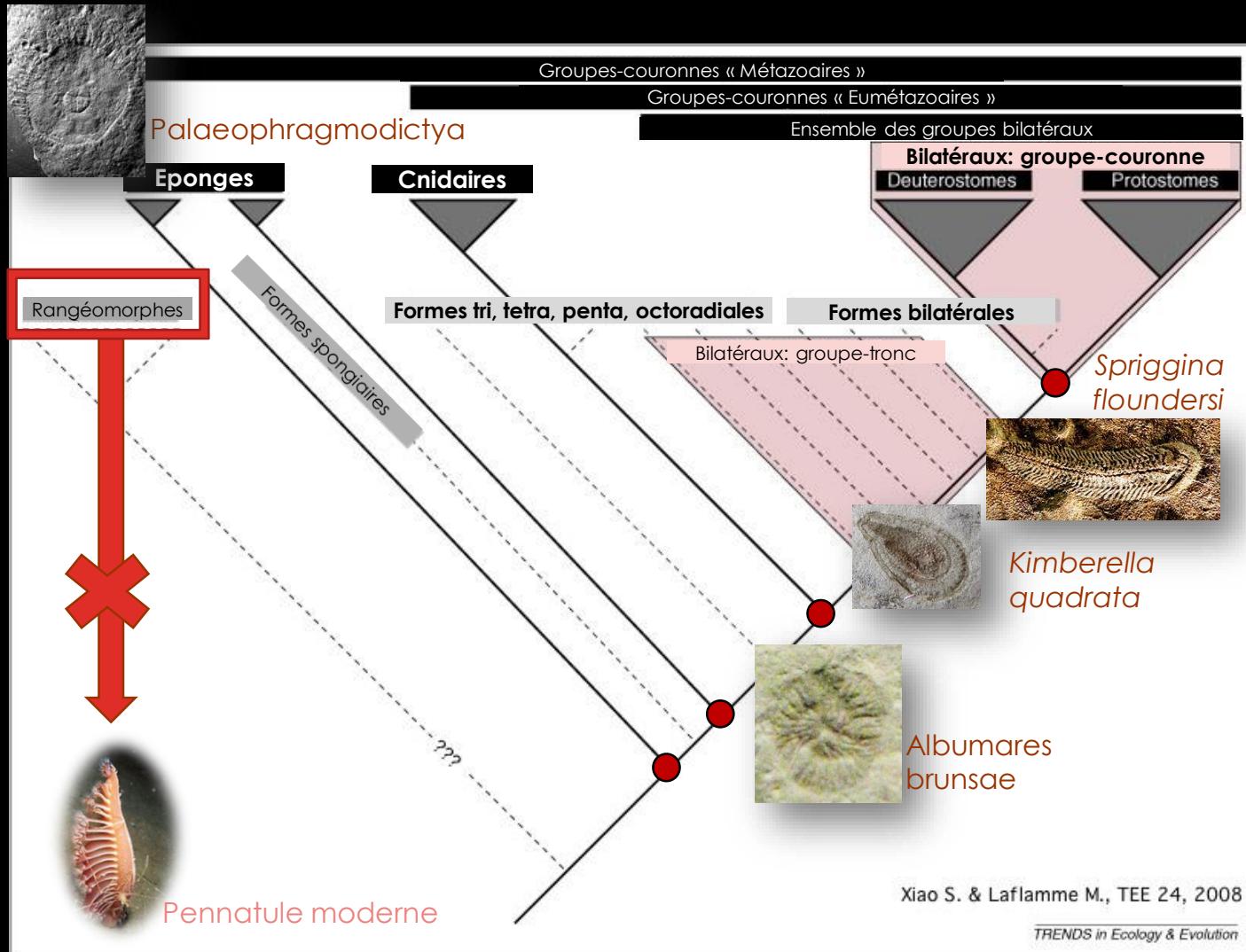


M.L. Droser, J.G. Gehling **Synchronous aggregate growth in an abundant new Ediacaran tubular organism** *Science*, 319 (2008), pp. 1660-166

QUELS TYPES D'ANIMAUX?



QUELS TYPES D'ANIMAUX?



OÙ ?

Assemblages



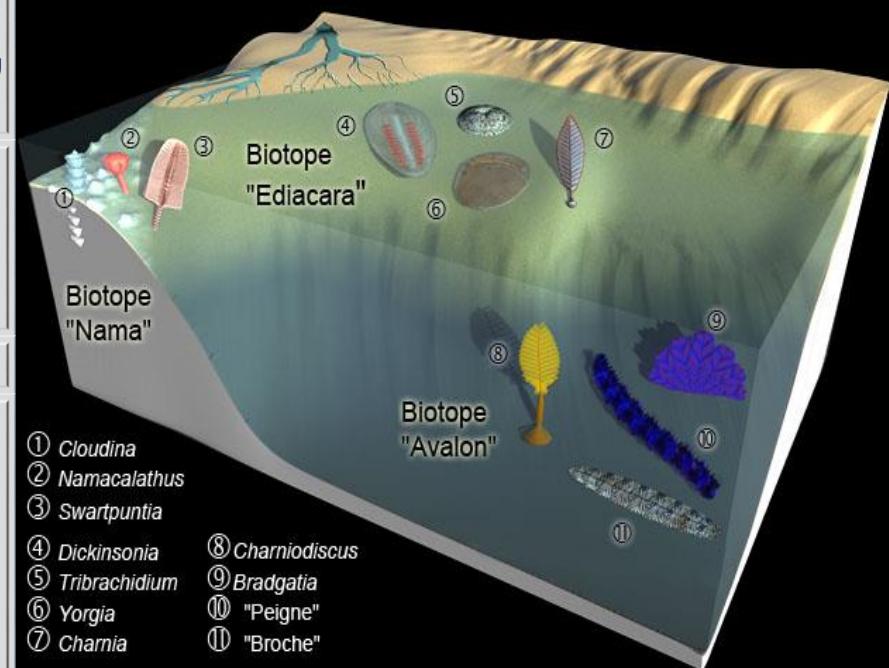
PRINCIPAUX SITES FOSSILES



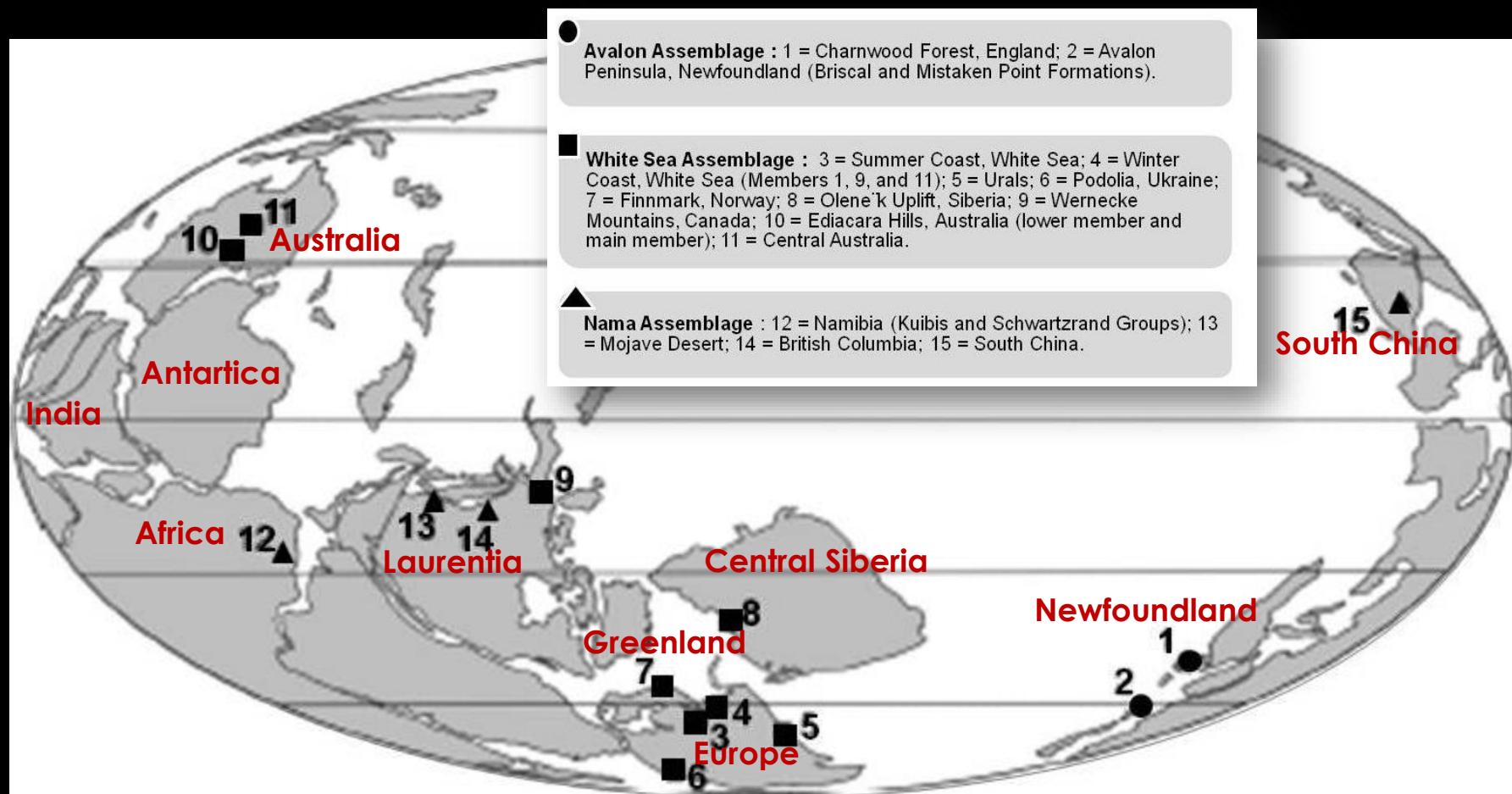
REGROUPEMENT

Trois assemblages

Avalon	Mer blanche/ Ediacara	Nama
Est du Canada, Angleterre	Russie, Sibérie, Norvège, Australie	Namibie, Sud de la Chine, Ouest de l'Amérique du Nord
Rangéomorphes	Proarticulés, Spriggina, Tribachidium, Kimberella	Cloudina, Namacalathus (animaux à coquilles)
Turbidites	Grès et schistes	Calcaires et grès
Talus continental	Mer peu profonde, deltas	Mer peu profonde, chenaux et bancs à l'embouchure des fleuves.
575-560 Ma	560-550 Ma	550-541 Ma

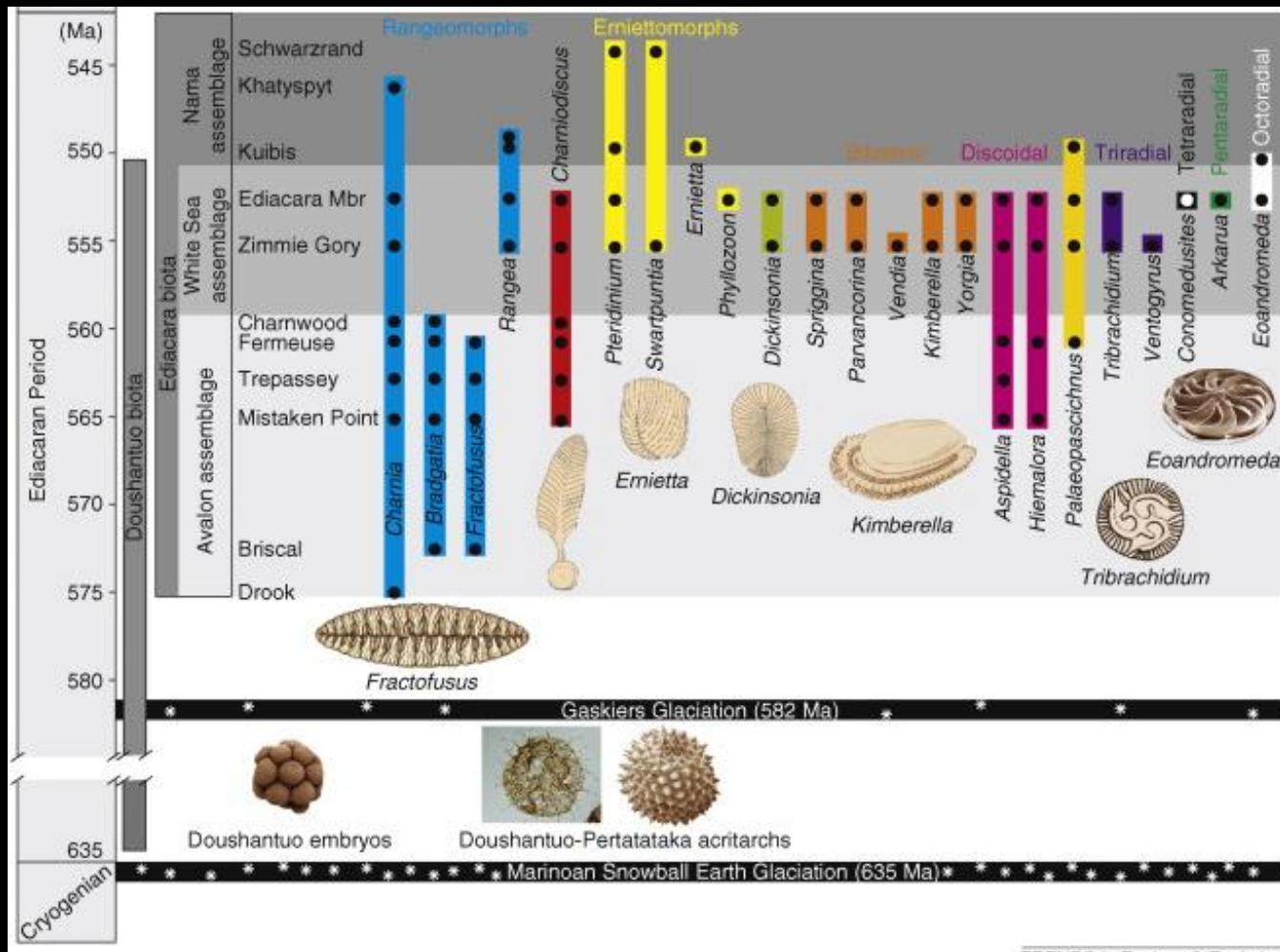


PROVINCIALITÉ DE LA FAUNE D'EDIACARA



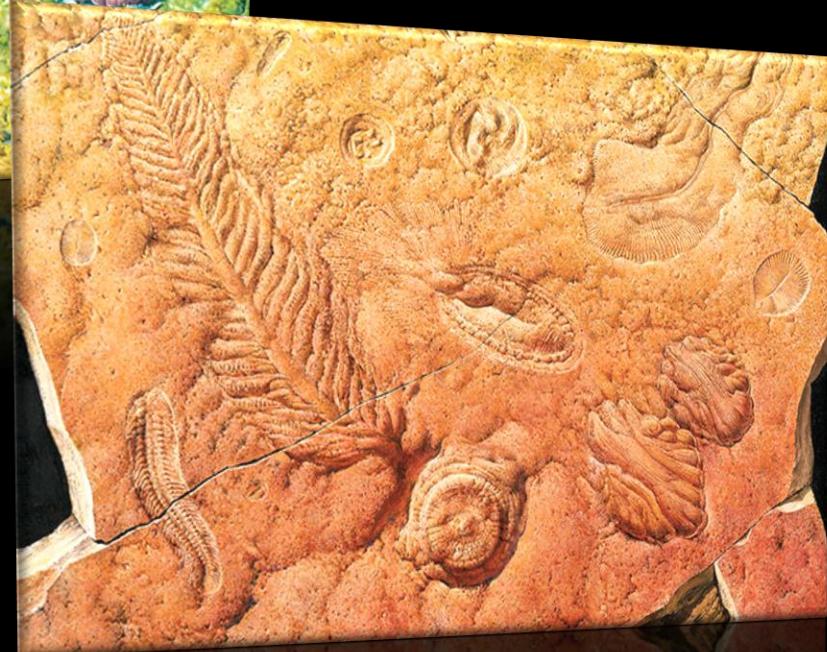
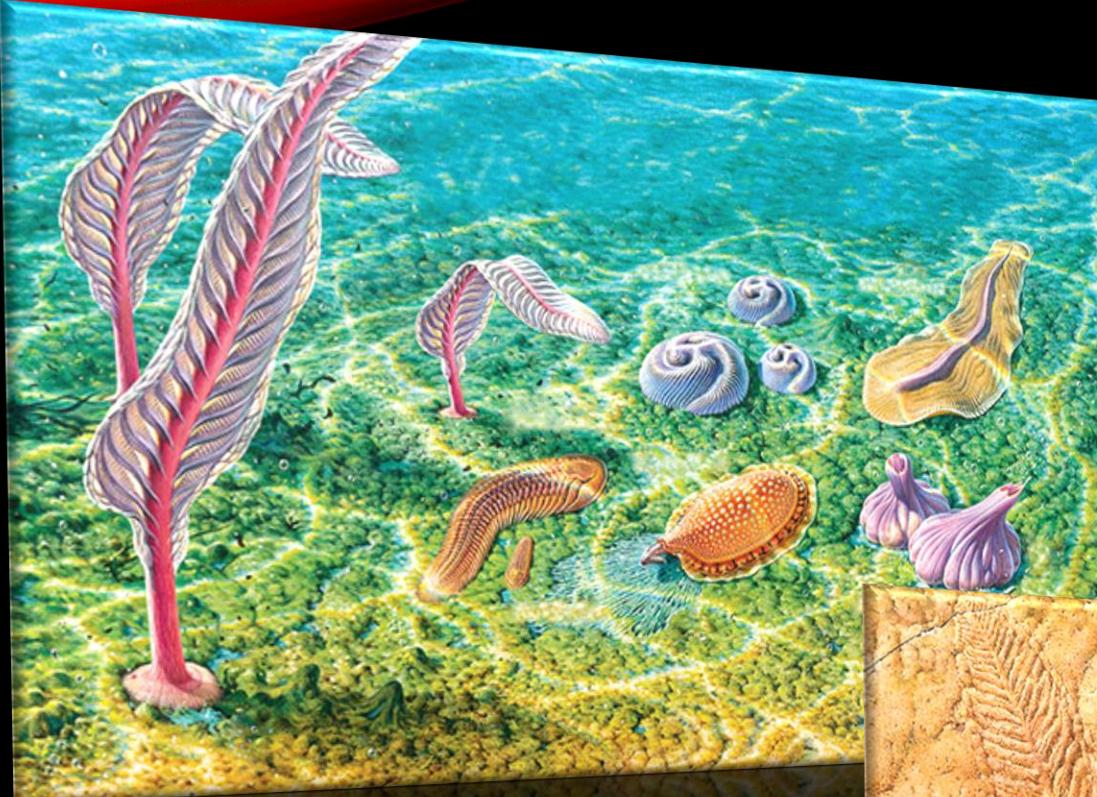
LES TROIS ASSEMBLAGES

Trois biotopes?



Xiao and Laflamme (2008) On the eve of animal radiation: phylogeny, ecology and evolution of the Ediacara biota. *Trends Ecology and Evolution* 24 (1): 31-40.

COMMENT?



TYPE DE PRESERVATION

FLINDERS



Kimberella



Medusinites

FERMEUSE



Helminthoidichnites



Aspidella

CONCEPTION



Charnodiuscus



Rangeomorphe

NAMA



Rangeomorphe



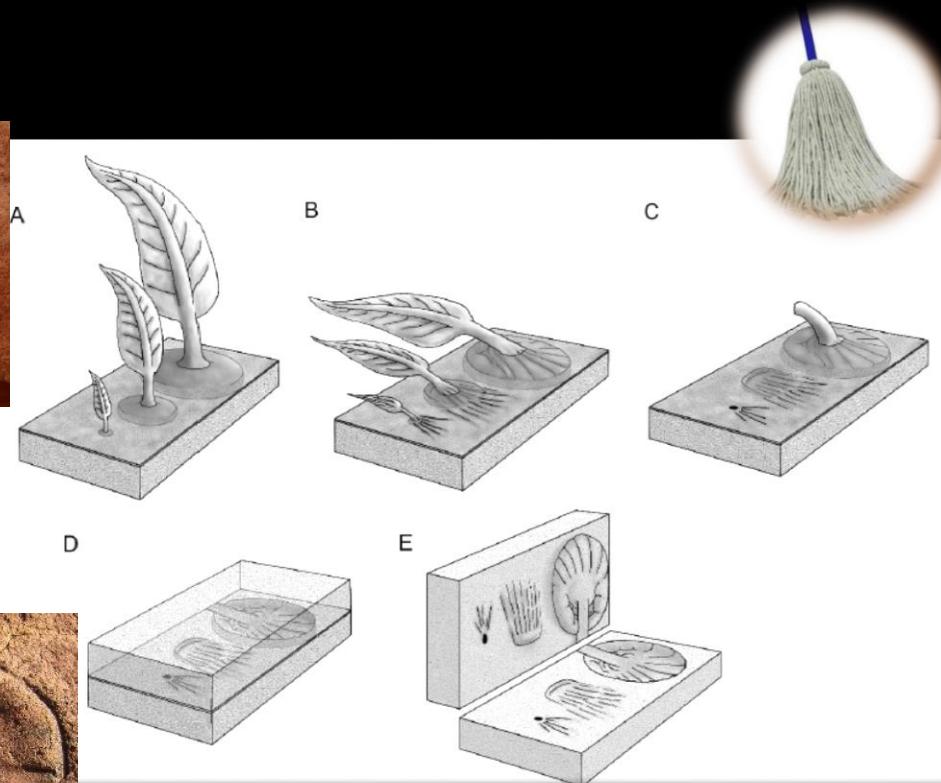
Swartpuntia

Charniodiscus-like

DIVERSITÉ ET TAPHONOMIE

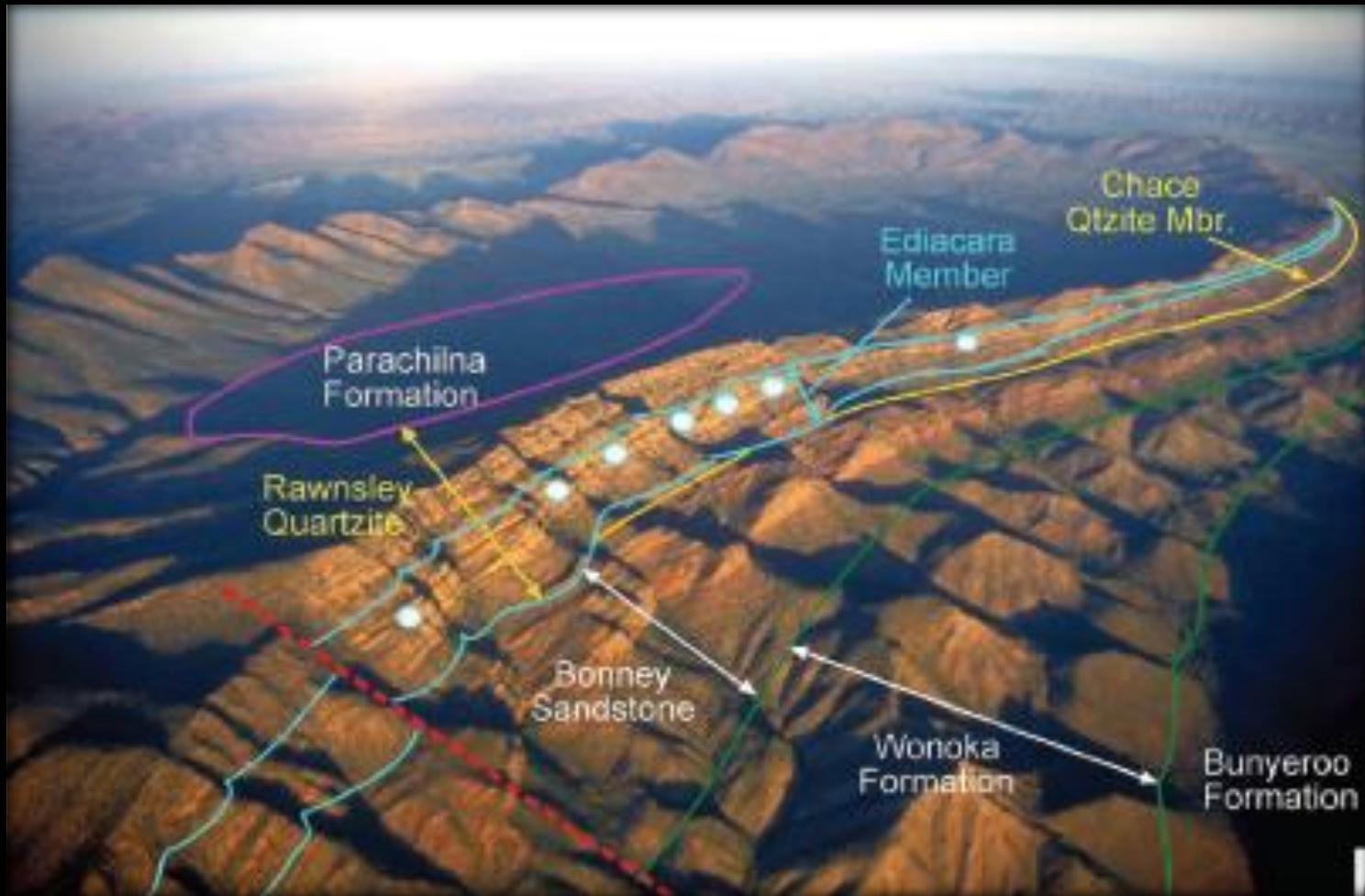


Aspidella



TAPHONOMIC CONTROLS ON EDIACARAN DIVERSITY: UNCOVERING THE HOLDFAST
ORIGIN OF MORPHOLOGICALLY VARIABLE ENIGMATIC STRUCTURES
Tarhan et al. (2010) PALAIOS 25 (12): 823-830.

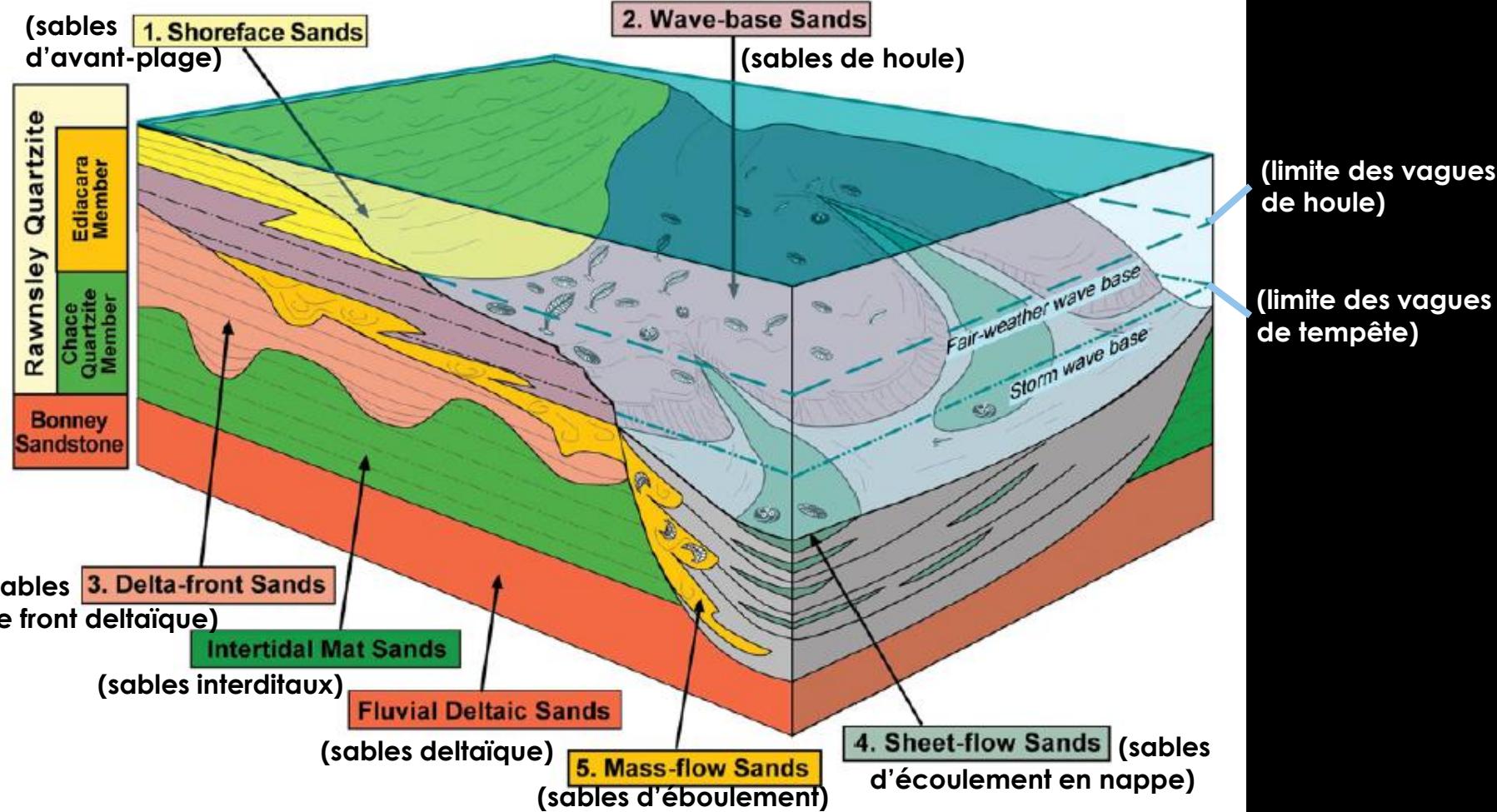
DIVERSITÉ ET ENVIRONNEMENT



Gehling and Droser (2012) Episode Vol.35 n°1.

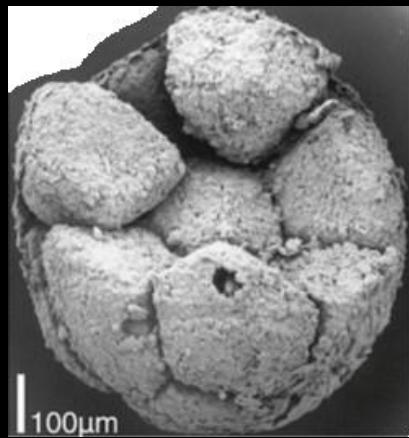
DIVERSITÉ ET ENVIRONNEMENT

Gehling, J. G. and Dreser, M. (2013) L. How well do fossil assemblages of the Ediacara Biota tell time? *Geology* 41 (4) 447-450.



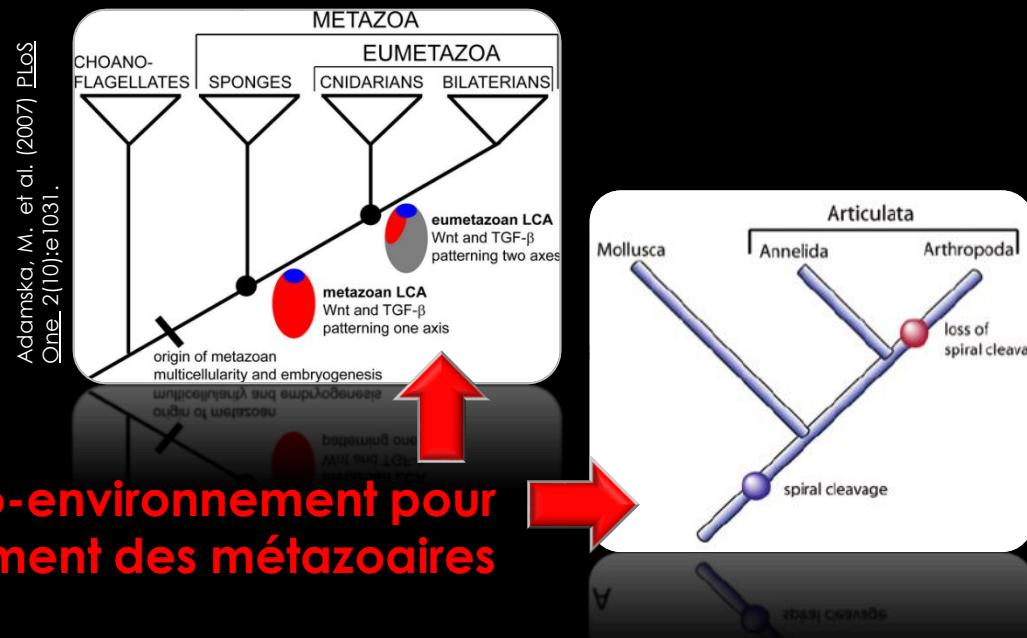
IL N'Y A PAS DE "FAUNE D'EDIACARA"

MAIS des fossiles du Système Ediacarien



Fossile d'embryon (Doushantuo Formation, South China.)

Perspectives
Géochronologie et phylogénie



Rôle vs importance du paléo-environnement pour l'apparition vs le développement des métazoaires