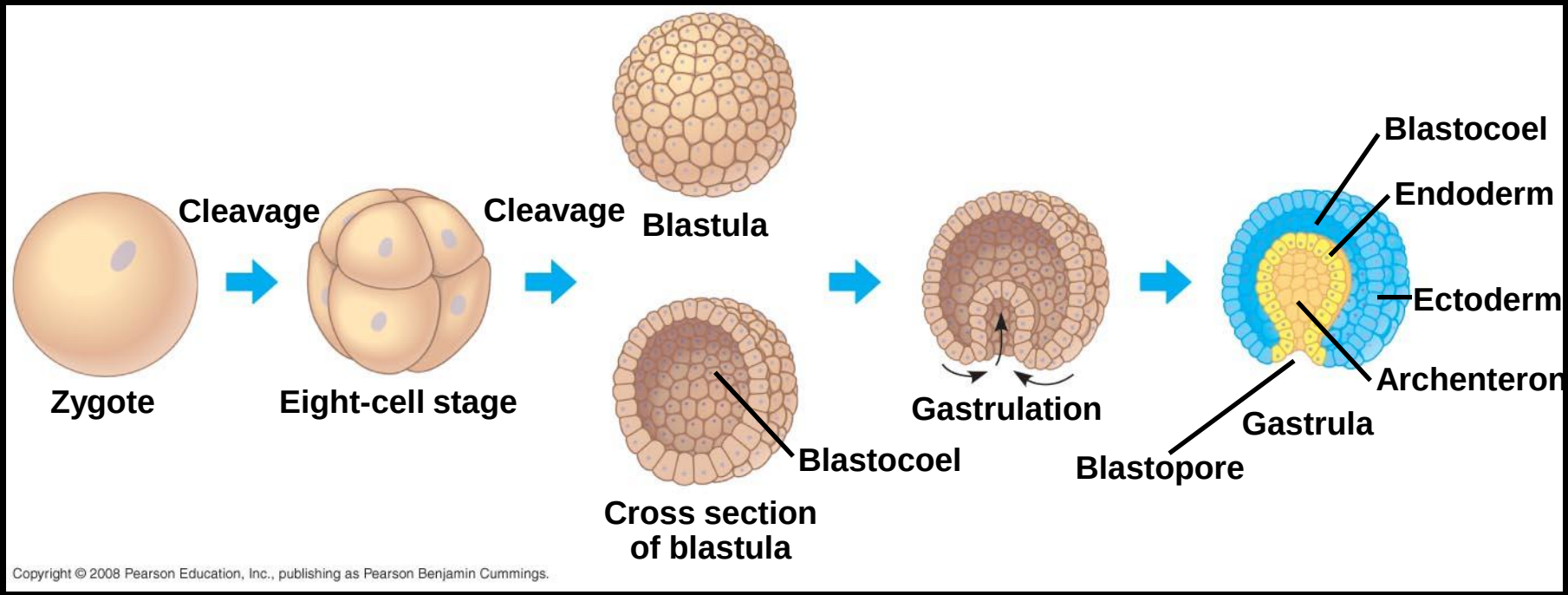
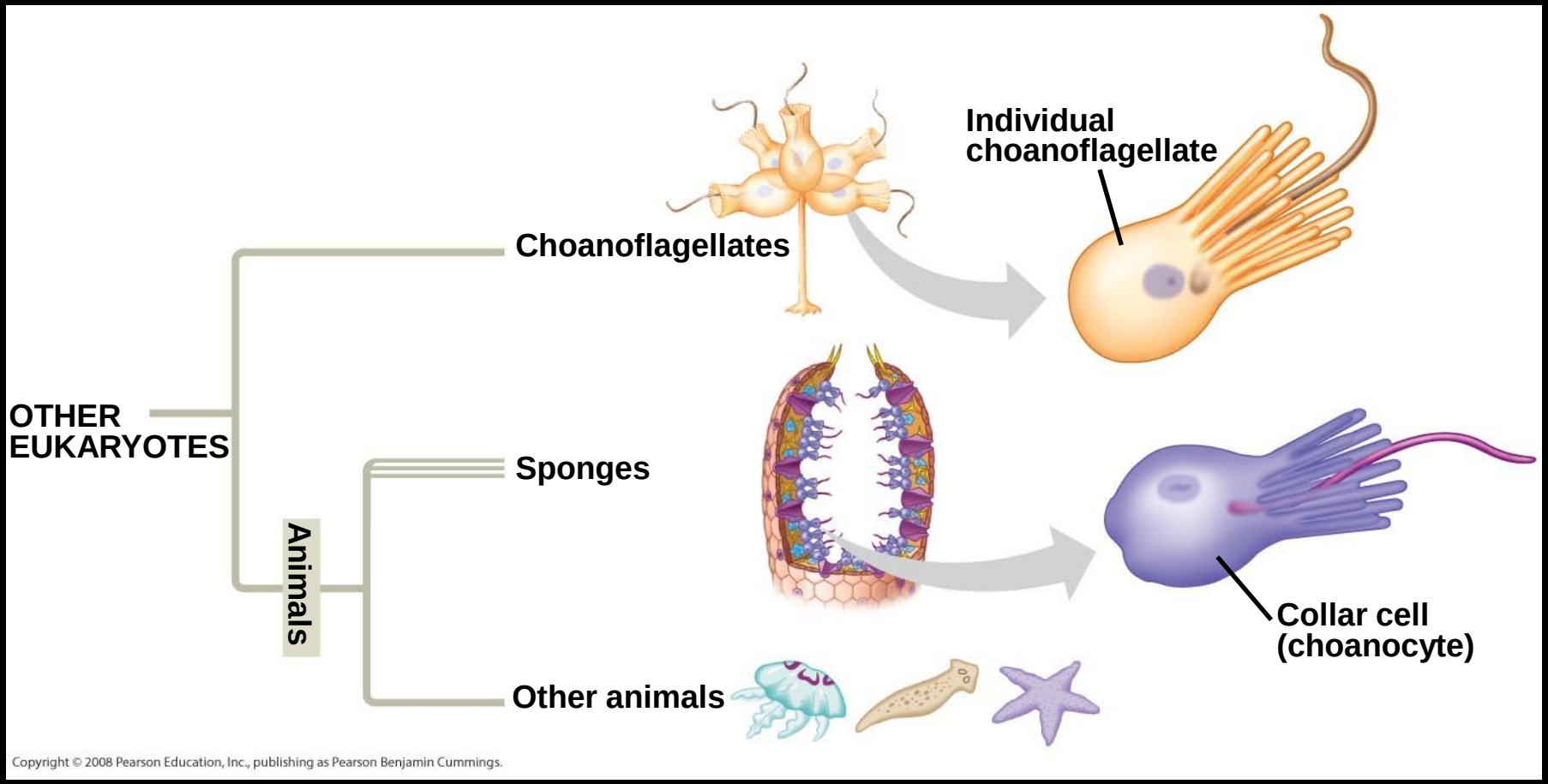
Chapter 32

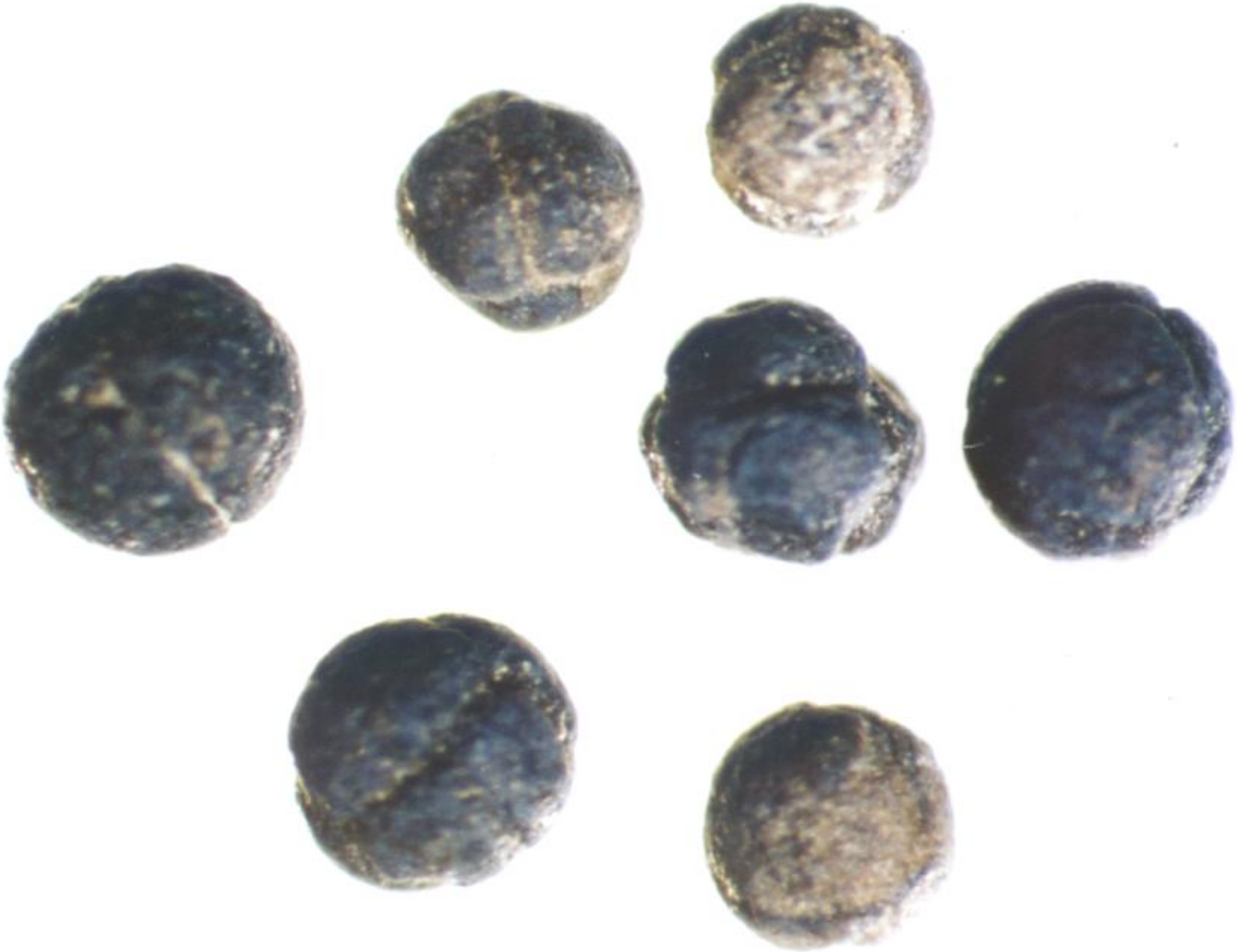
An Introduction to Animal Diversity

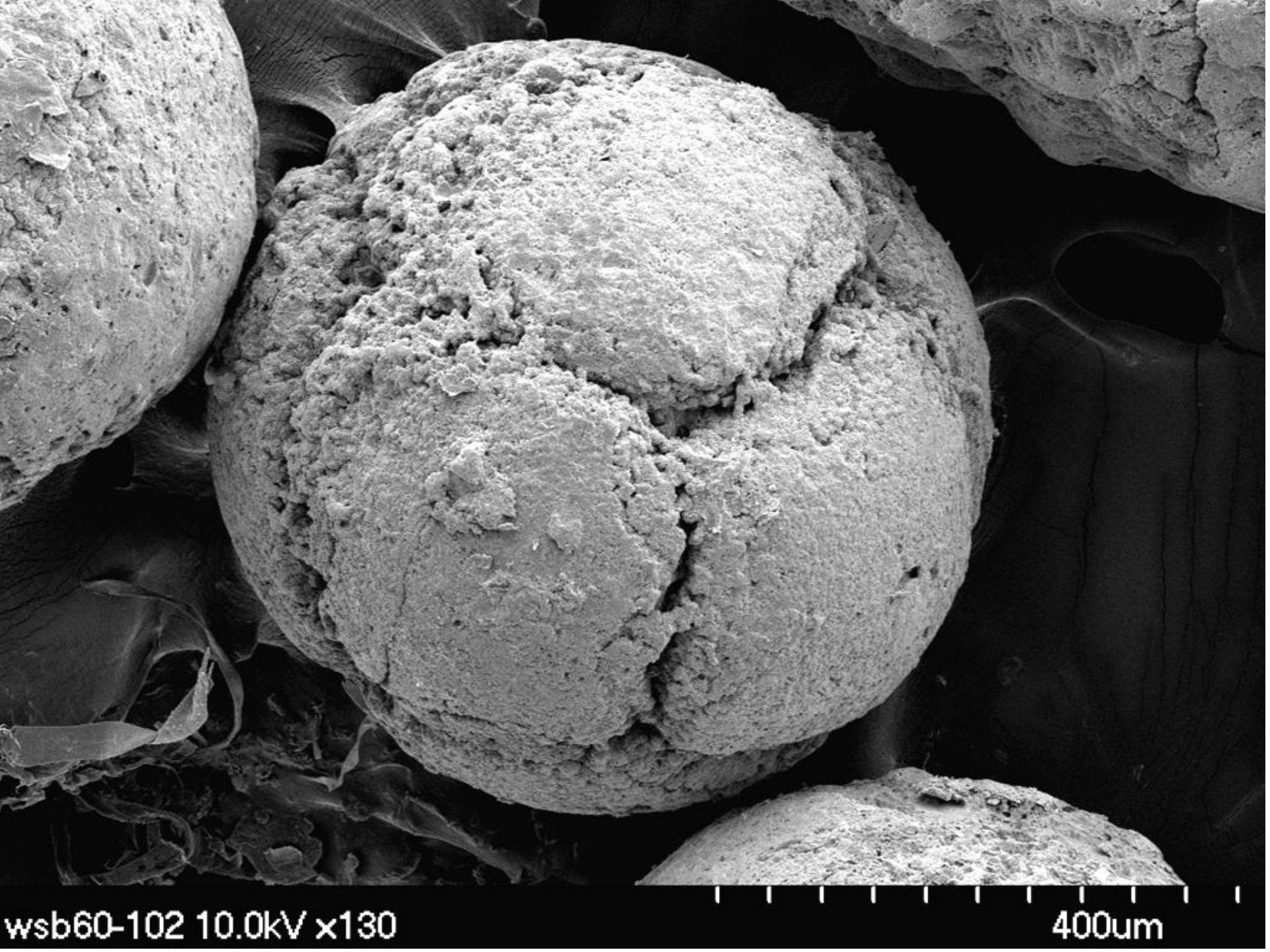




Neoproterozoic Era (1 Billion–524 Million Years Ago)

- Early members of the animal fossil record include the **Ediacaran biota**, which dates from 565 to 550 million years ago

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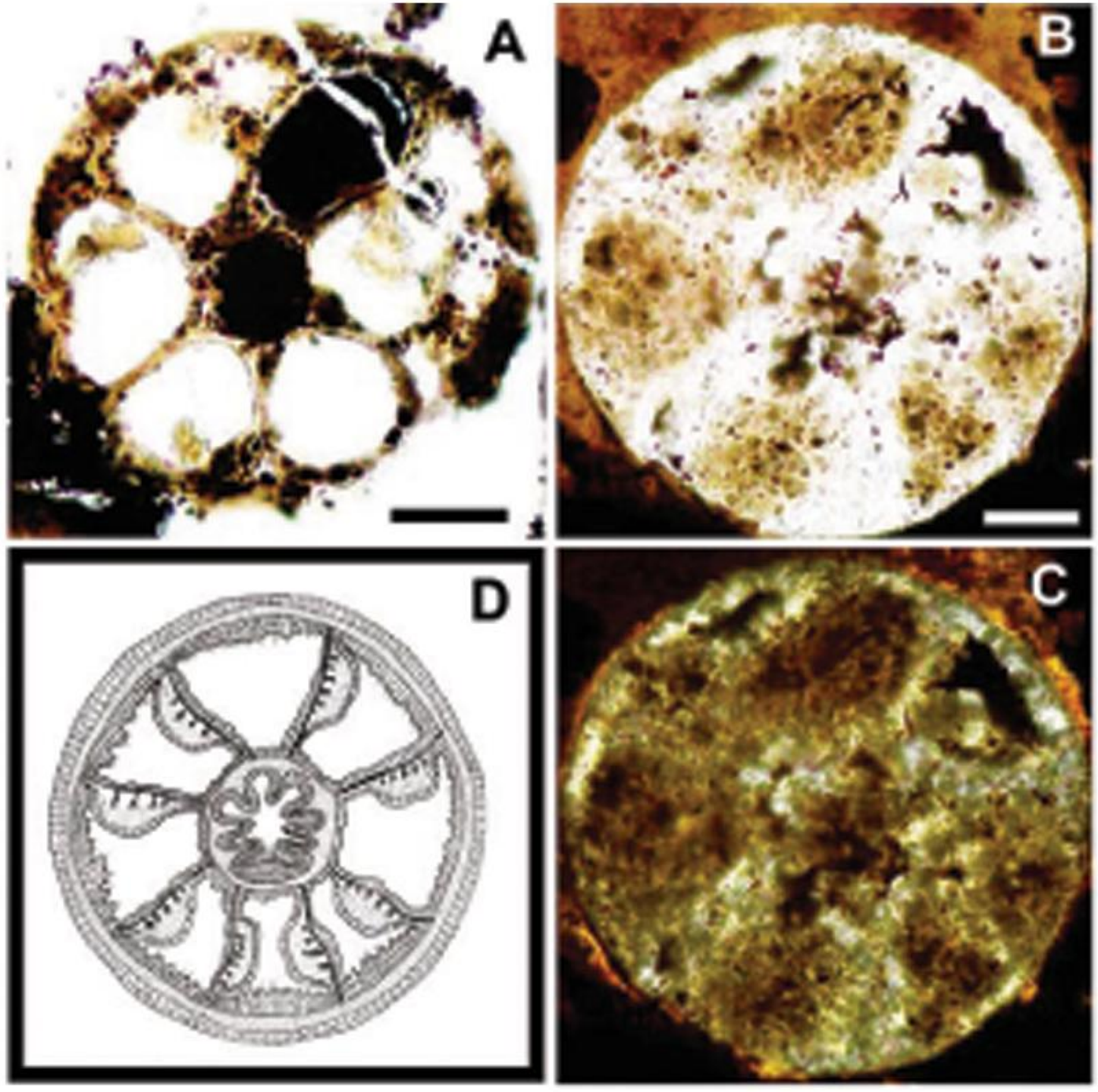

A
B
D
C

- **Ectoderm** is the germ layer covering the embryo's surface
- **Endoderm** is the innermost germ layer and lines the developing digestive tube, called the **archenteron**
- **Diploblastic** animals have ectoderm and endoderm
- **Triploblastic** animals also have an intervening **mesoderm** layer; these include all bilaterians


23

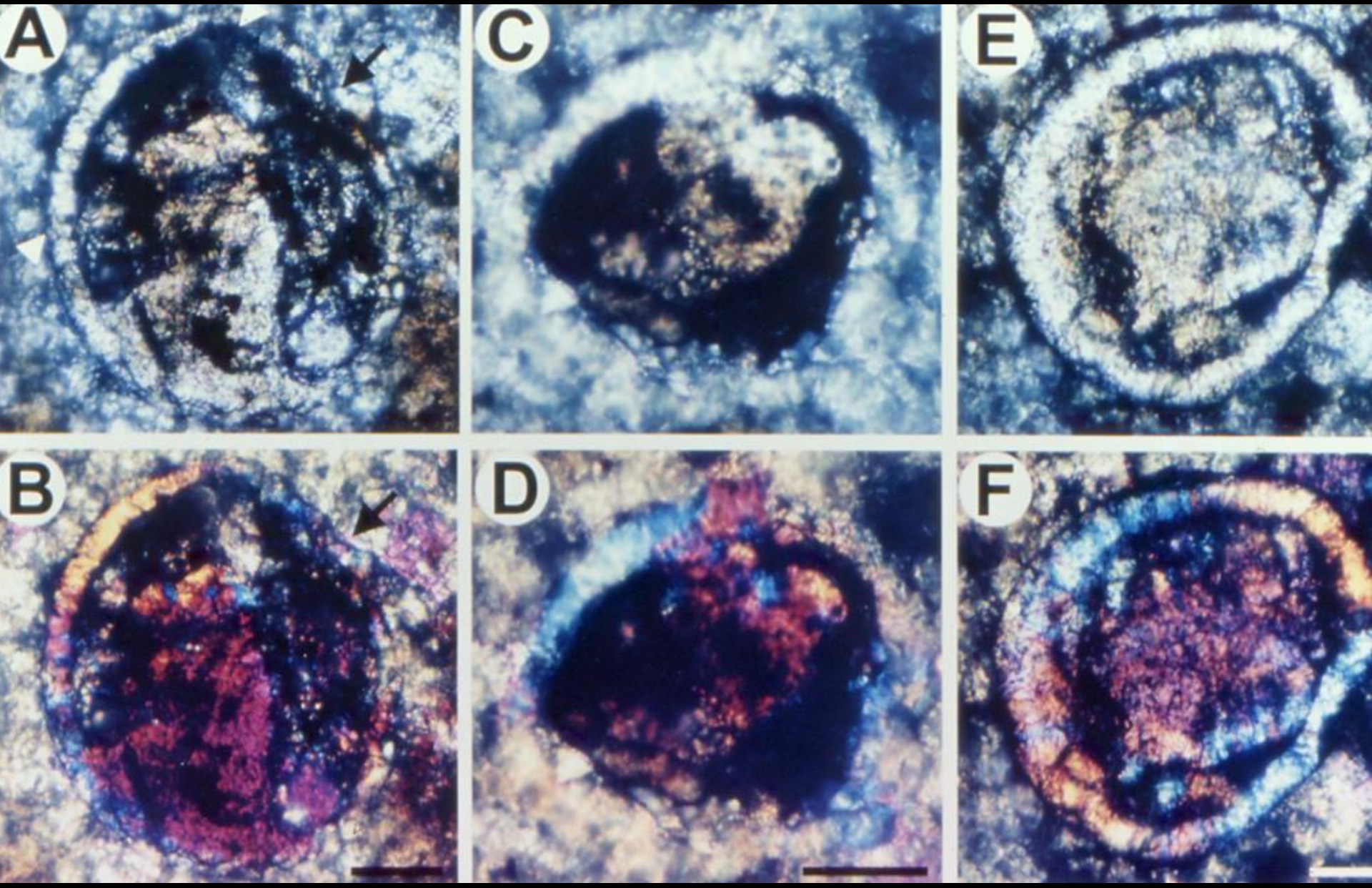

26


29

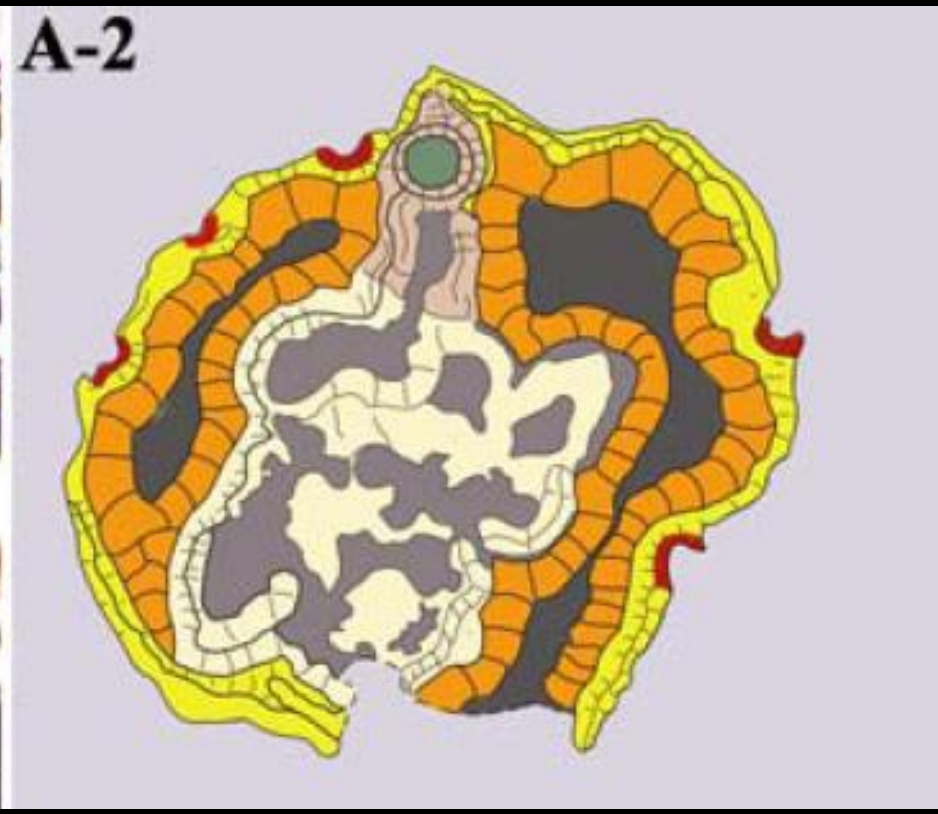

32


35

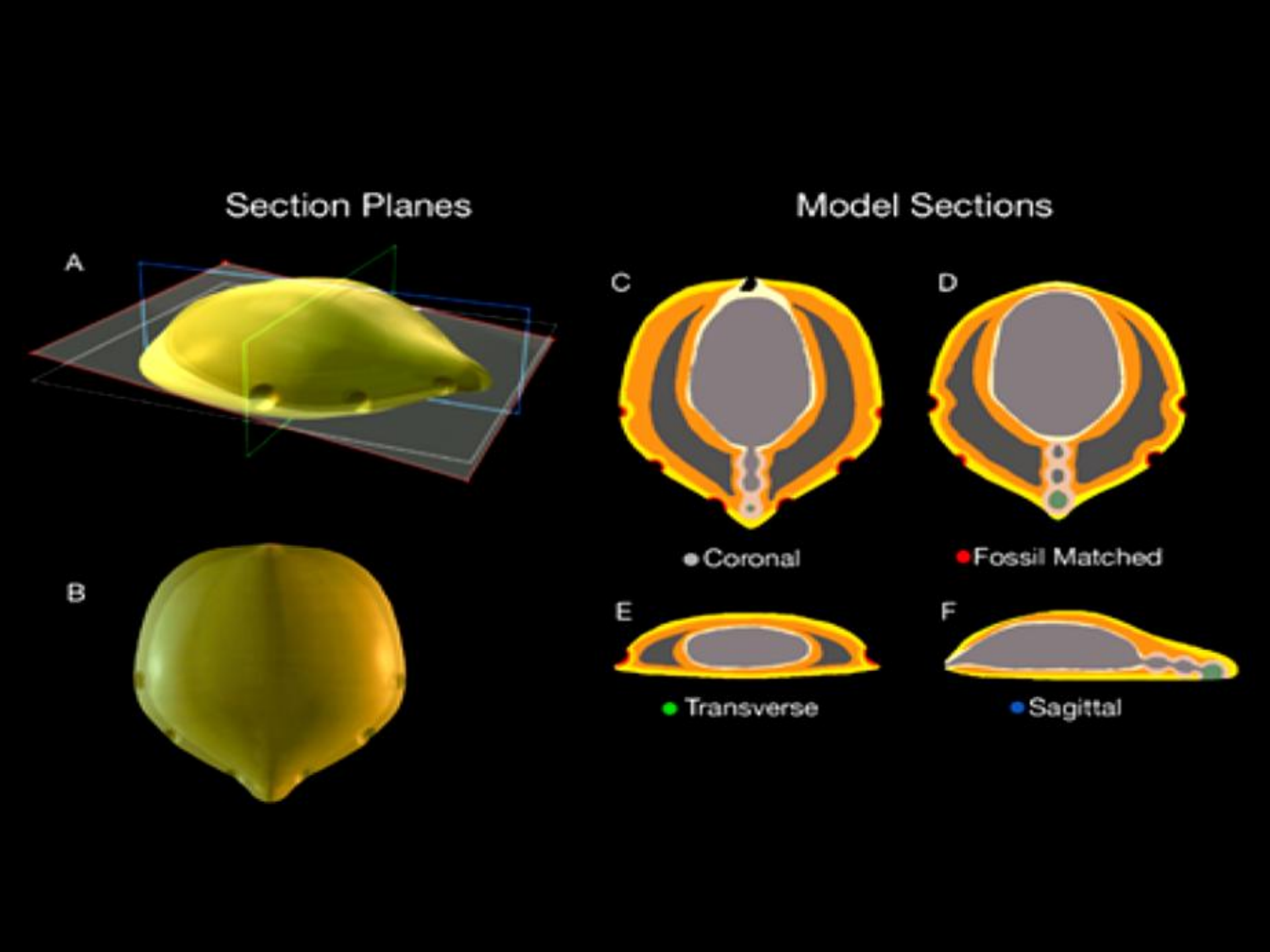

38



PNAS 2000



Science 2004


Section Planes
Model Sections
A
B
C
D
Coronal
Fossil Matched
E
F
Transverse
Sagittal

SCIENTIFIC AMERICAN 中文版
NO.43
2005年9月號
科學人
sa.ylib.com

【特別報導】p.46
專訪張子文：
台灣生技產業，需要跨領域人才

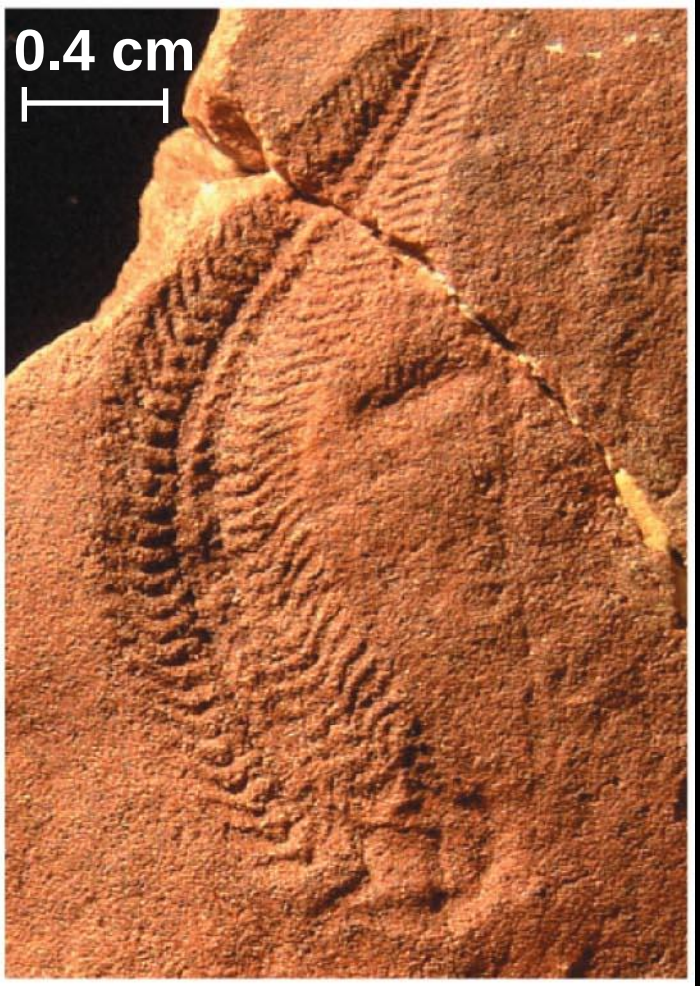
貴州小春蟲
改寫動物演化史

中國瓮安磷礦裡發現的微小化石，
揭露六億年前動物演化關鍵！

Neoproterozoic Era (1 Billion–524 Million Years Ago)

- Early members of the animal fossil record include the **Ediacaran biota**, which dates from 565 to 550 million years ago

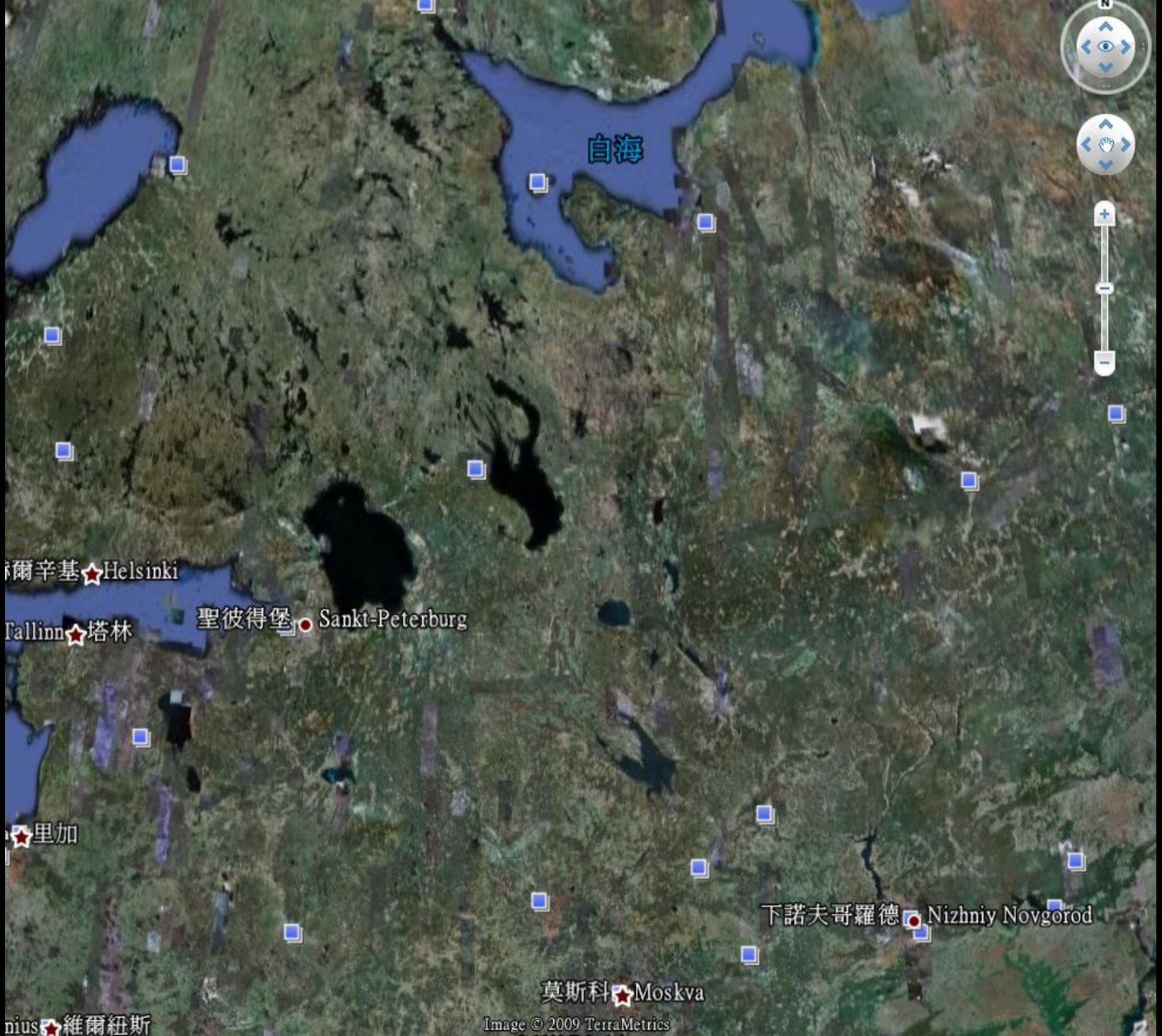
(a) *Mawsonites spriggi*



(b) *Spriggina floundersi*

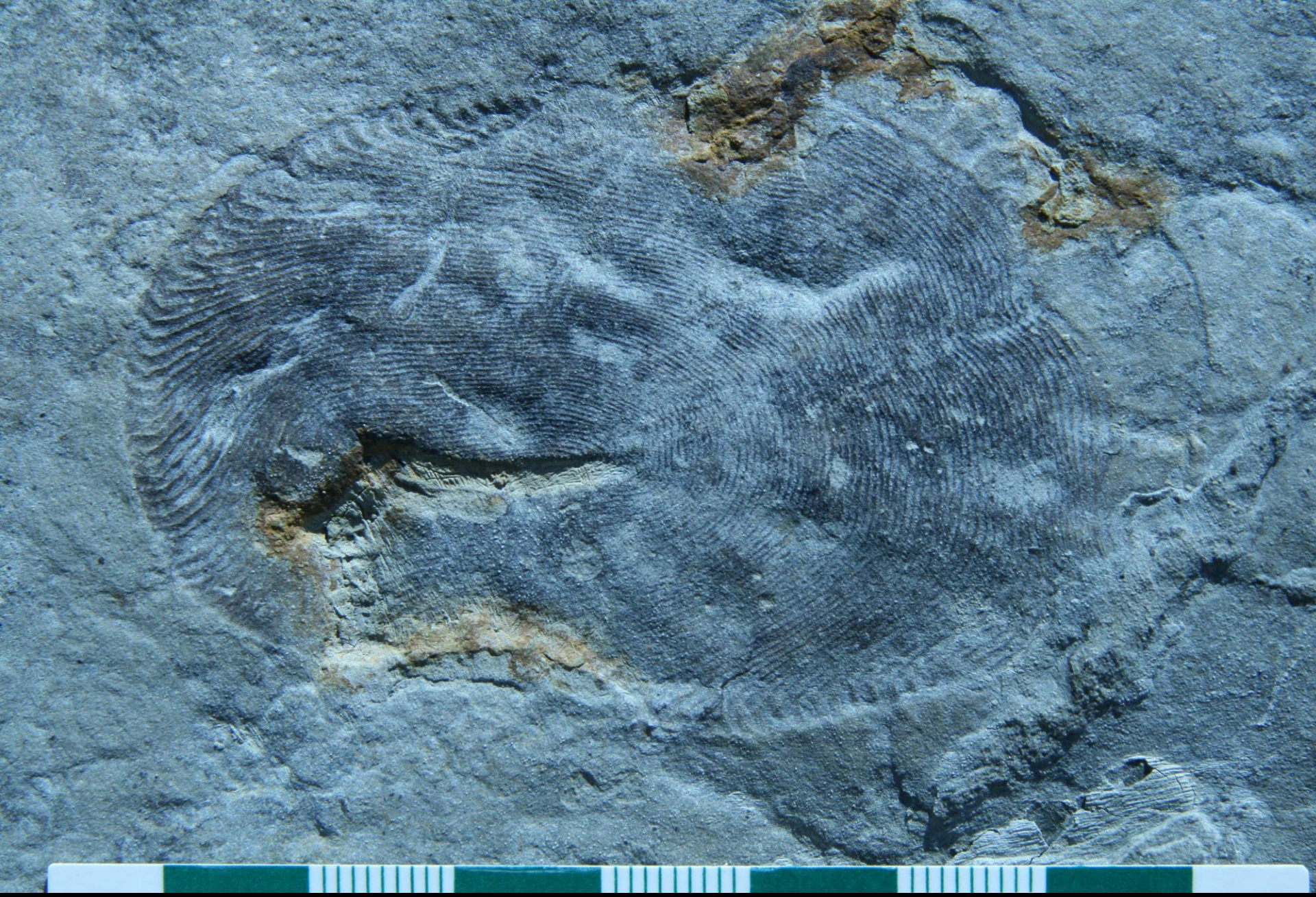

Elizabeth
阿德雷德
Adelaide


3
5
7


白海
爾辛基 Helsinki
聖彼得堡 Sankt-Peterburg
Tallinn 塔林
里加
下諾夫哥羅德 Nizhniy Novgorod
莫斯科 Moskva
nius 維爾紐斯
Image © 2009 TerraMetrics


О "2-ОЙ АРХАНГЕЛЬСКИЙ ОАО"
МИ-8


ВОДКА 29
ВОДКА 29
ВОДКА 29
Lipton




Harare 哈拉雷
Windhoek 文豪克
Molepolole
Gaborone
普勒多利亞 Pretoria
Maputo
墨巴本 Mbabane
馬塞魯 Maseru
開普敦


200 µm

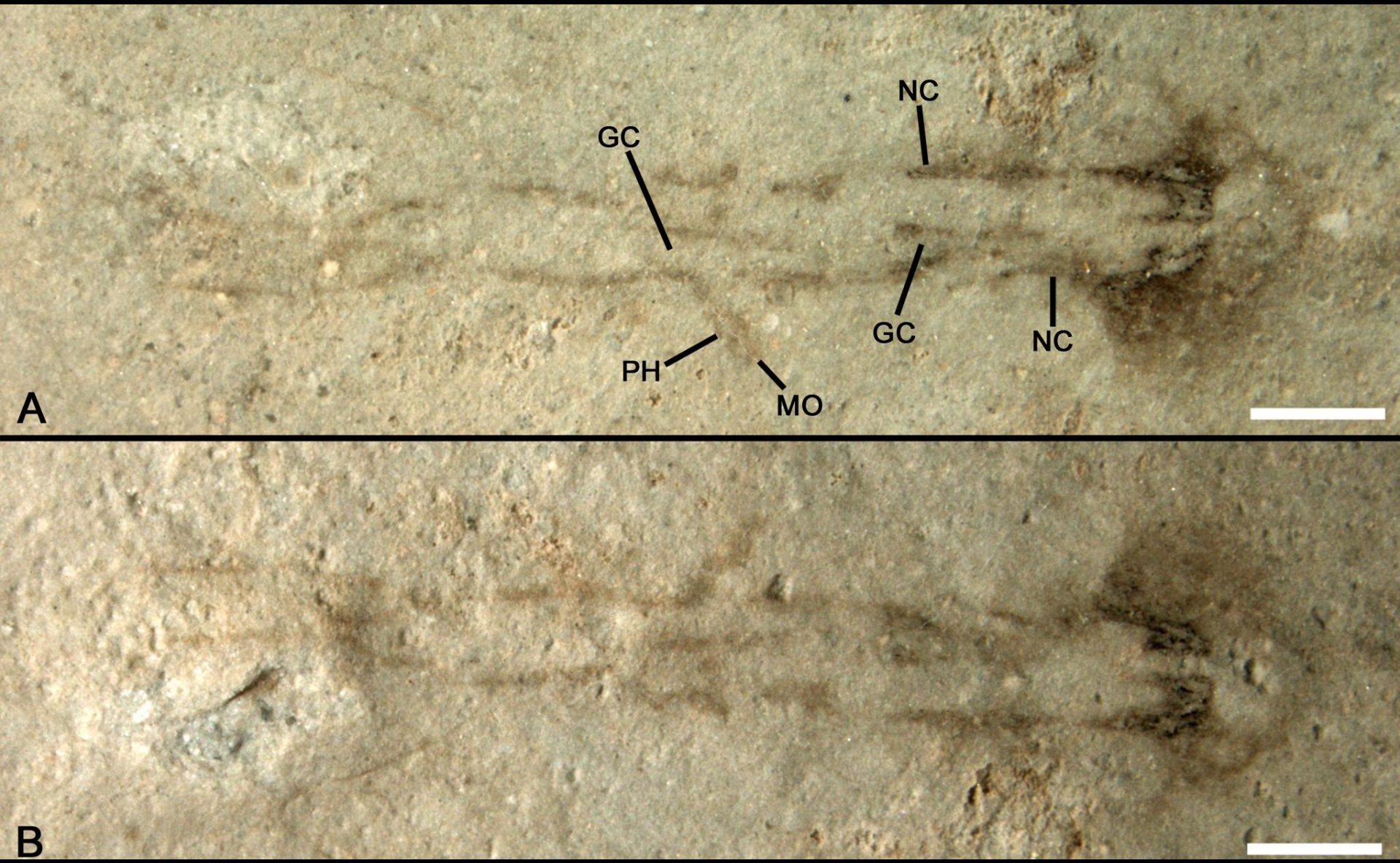
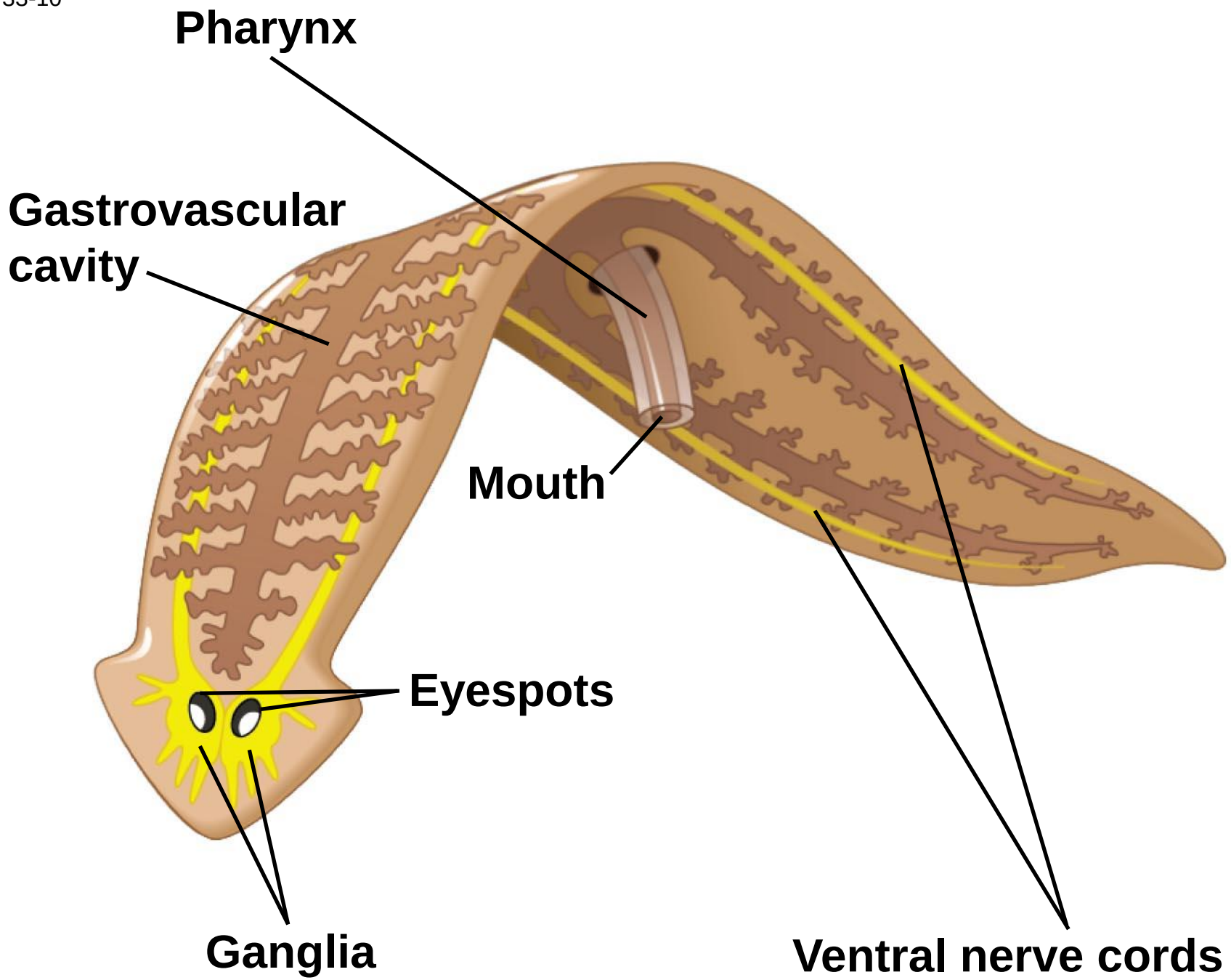
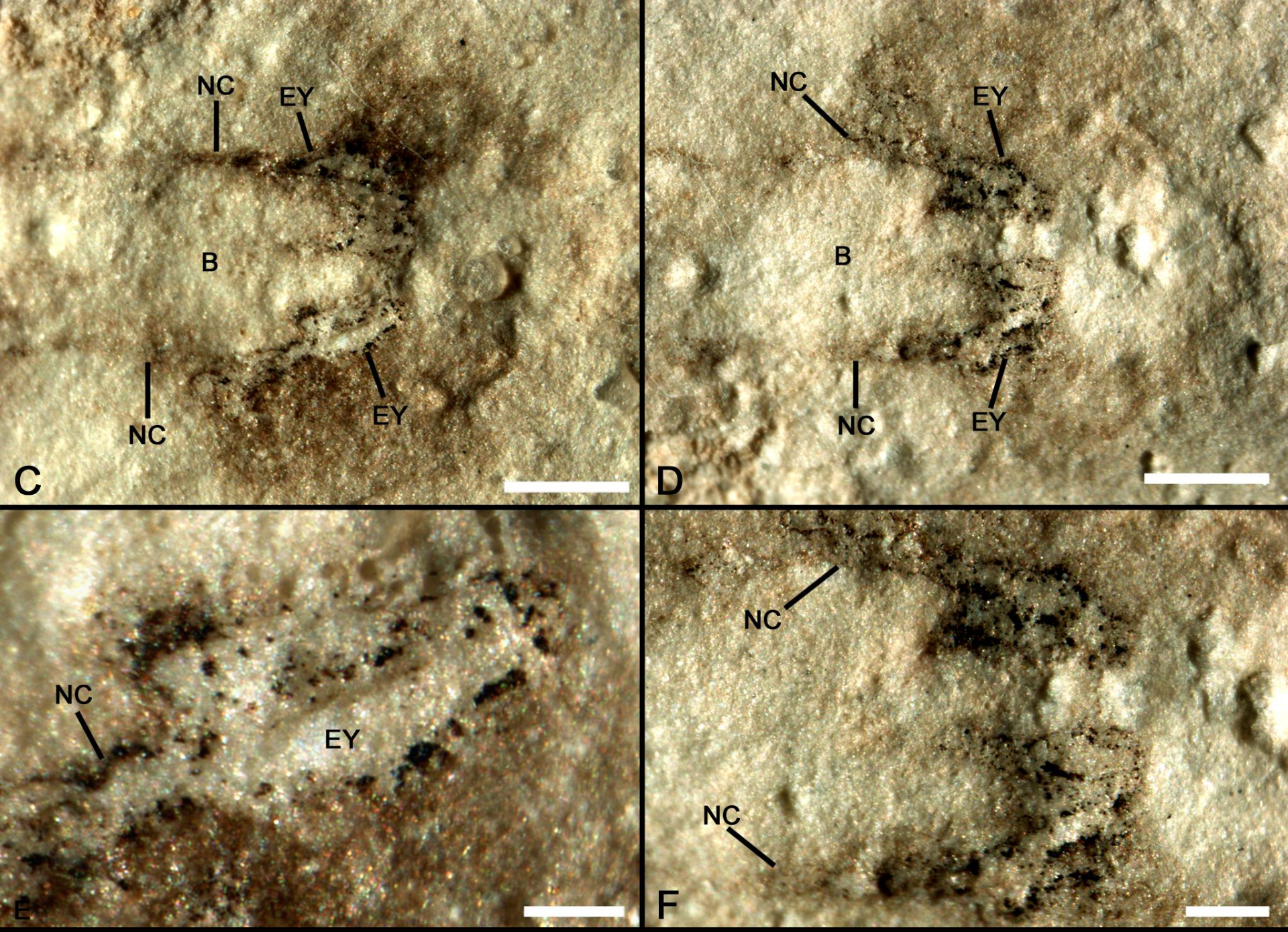

NC
GC
GC
NC
PH
MO
A
B

Fig. 33-10

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Paleozoic Era (542–251 Million Years Ago)

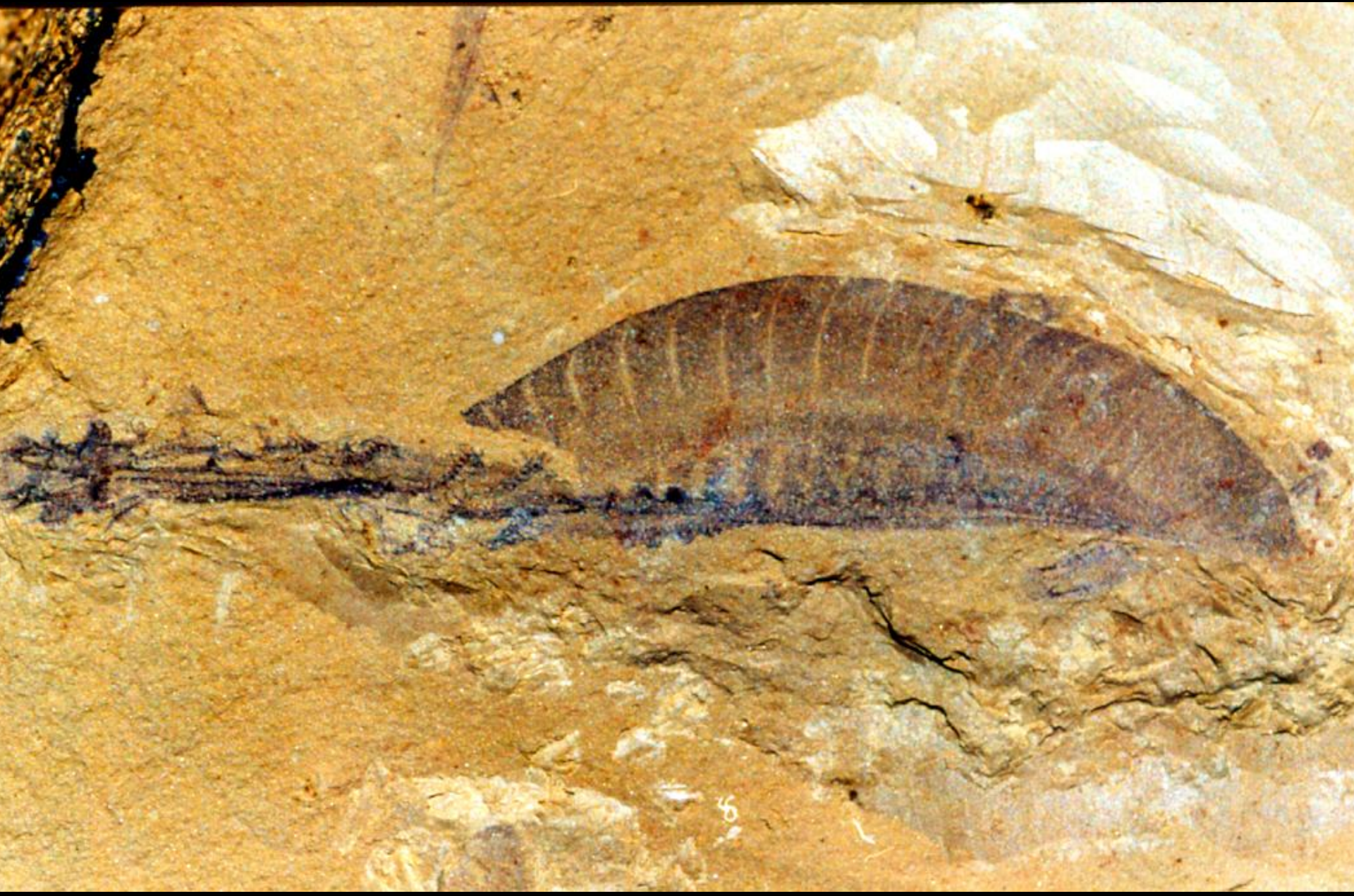
- The **Cambrian explosion** (535 to 525 million years ago) marks the earliest fossil appearance of many major groups of living animals
- There are several hypotheses regarding the cause of the Cambrian explosion
  - New predator-prey relationships
  - A rise in atmospheric oxygen
  - The evolution of the *Hox* gene complex

澄江生物群

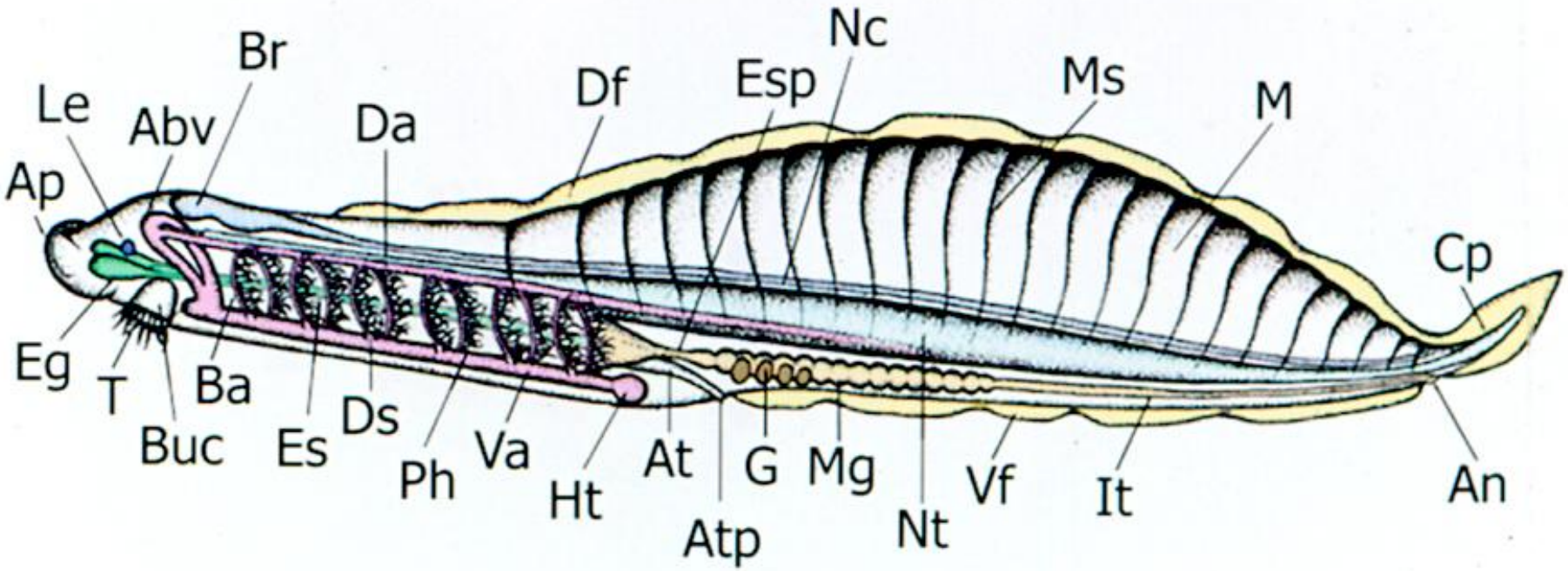
寒武紀大爆發的見證

陳均遠　周桂琴　朱茂炎　葉貴玉


历群
1996.1

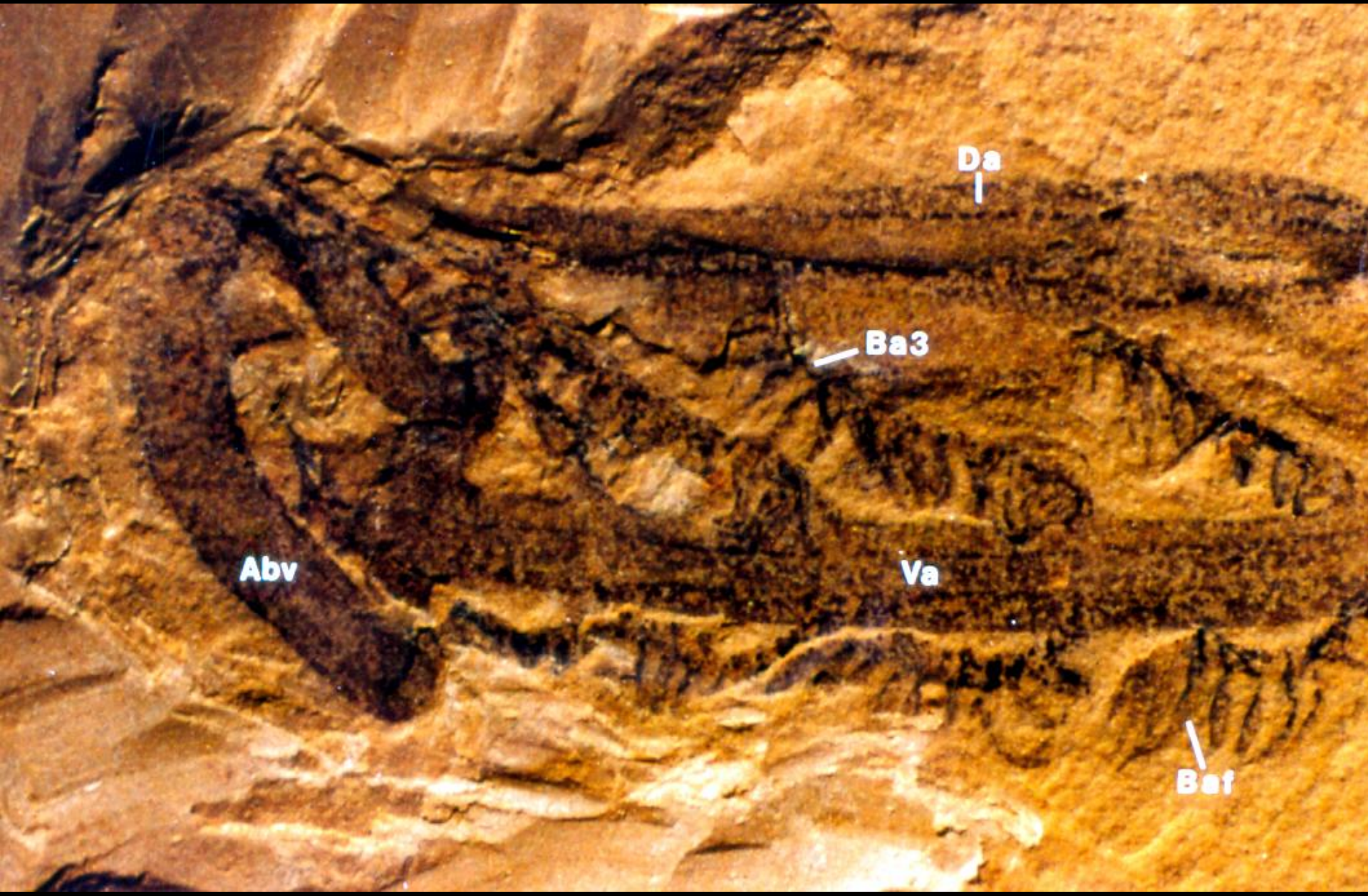


Haikouella lanceolata



海口虫

雲南　海口


Da
Ba3
Abv
Va
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E
T


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NC
VA

- Animal diversity continued to increase through the Paleozoic, but was punctuated by mass extinctions
- Animals began to make an impact on land by 460 million years ago
- Vertebrates made the transition to land around 360 million years ago


5
5
1
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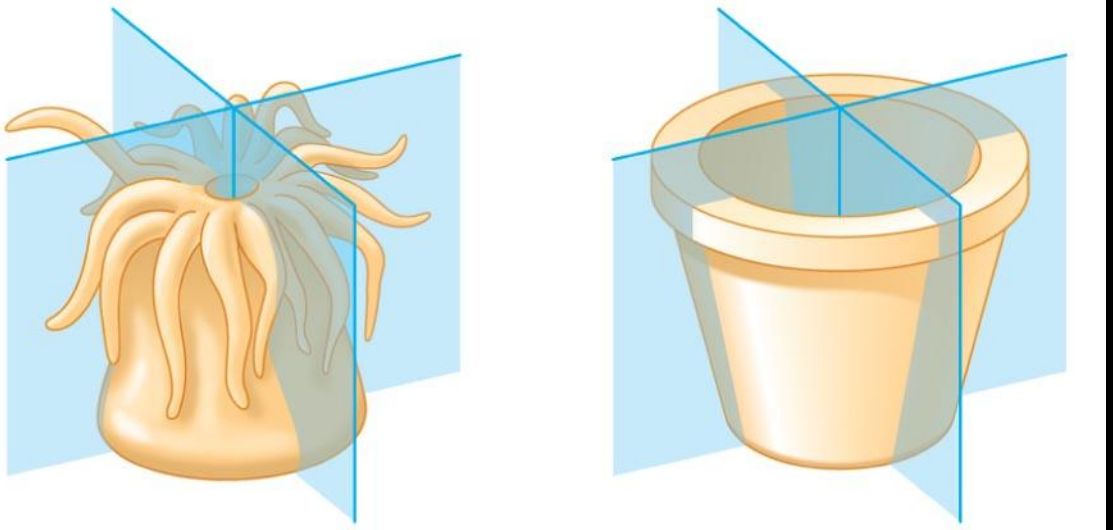
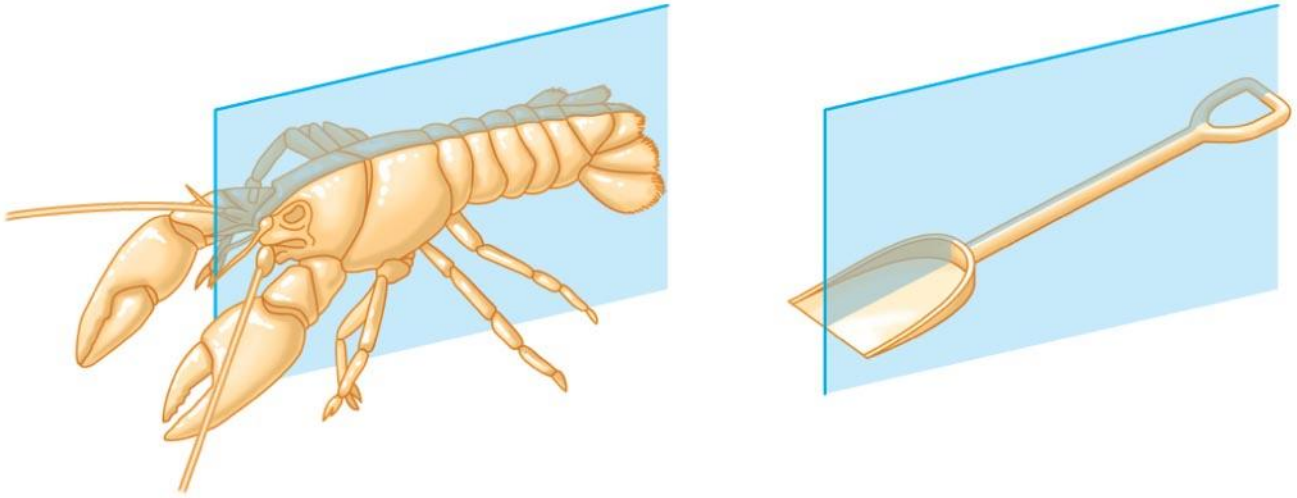


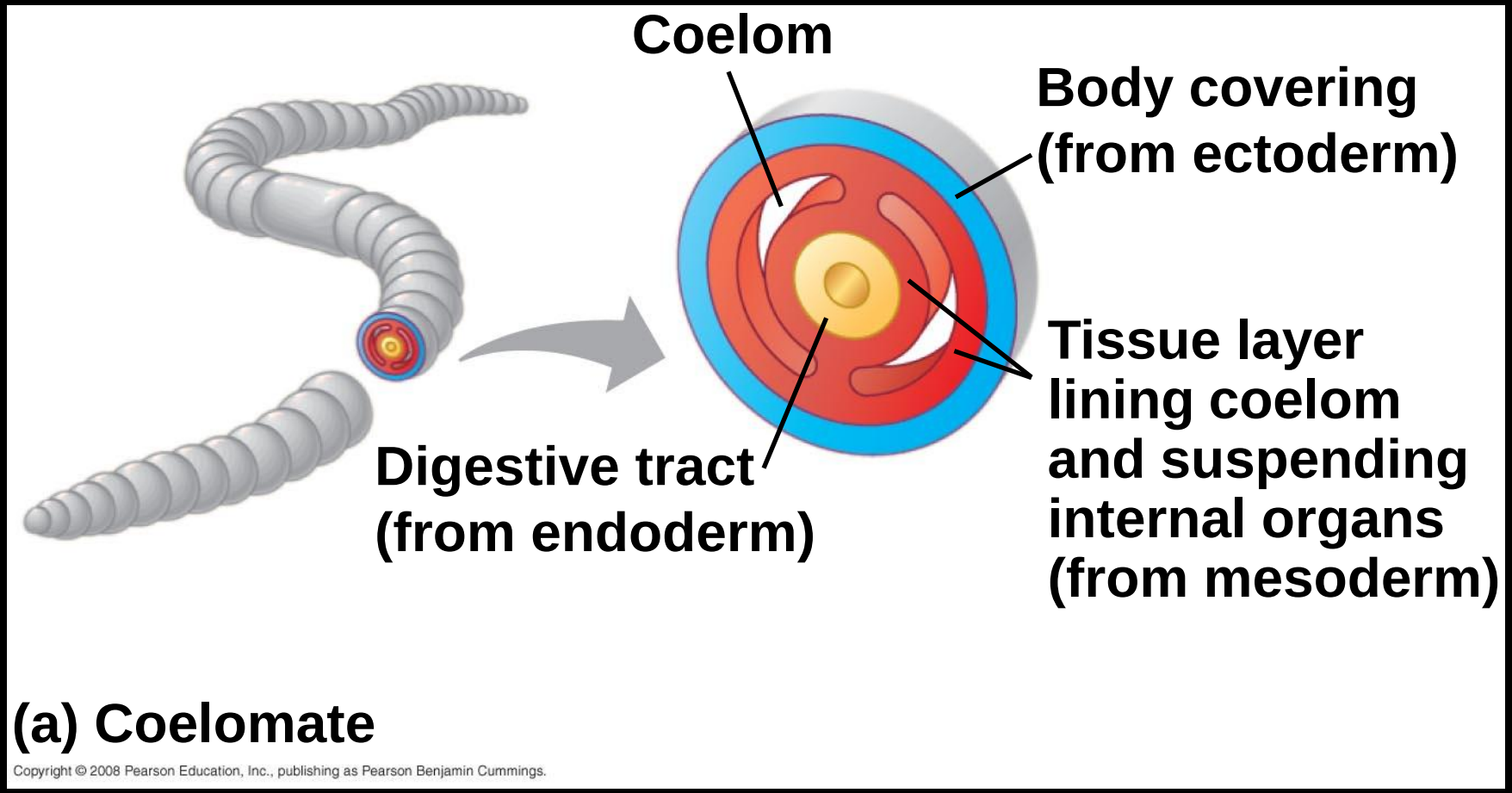
(a) Radial symmetry

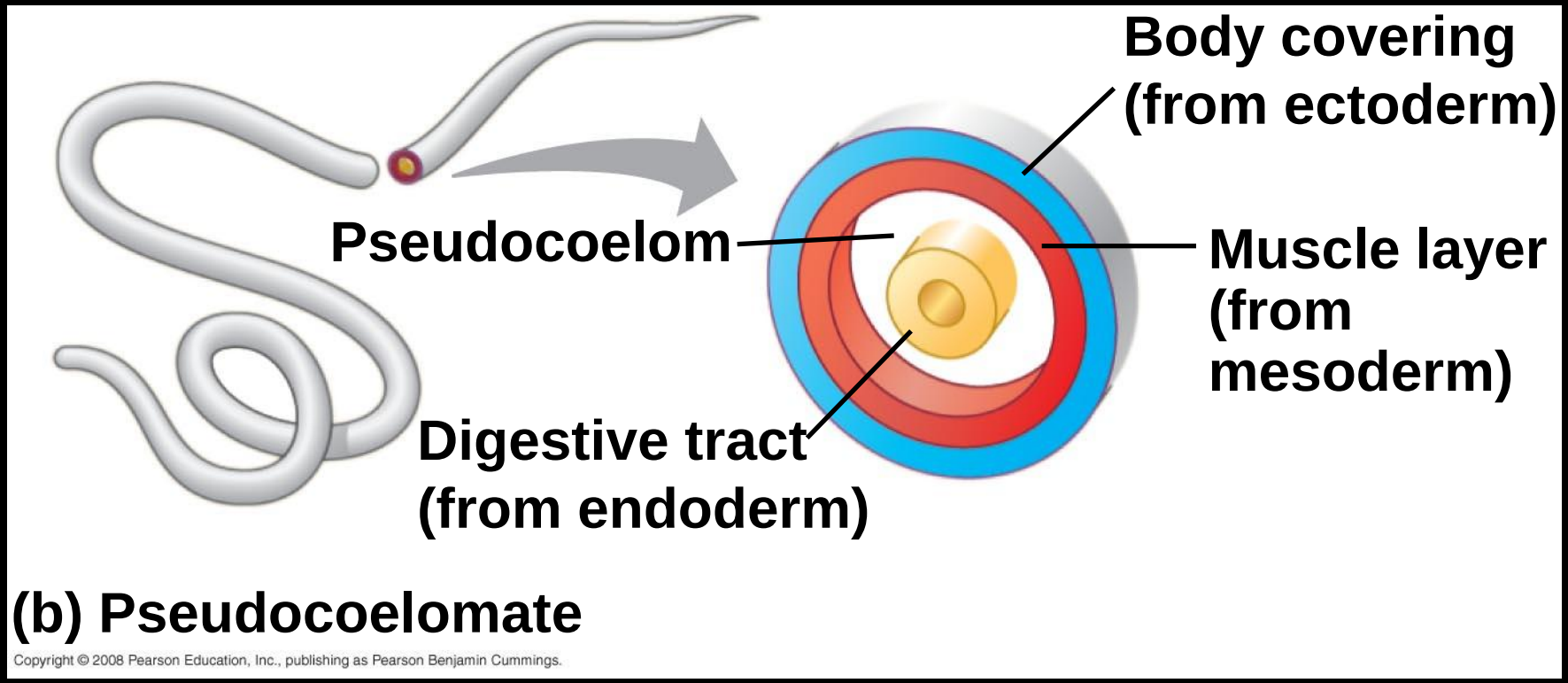


(b) Bilateral symmetry

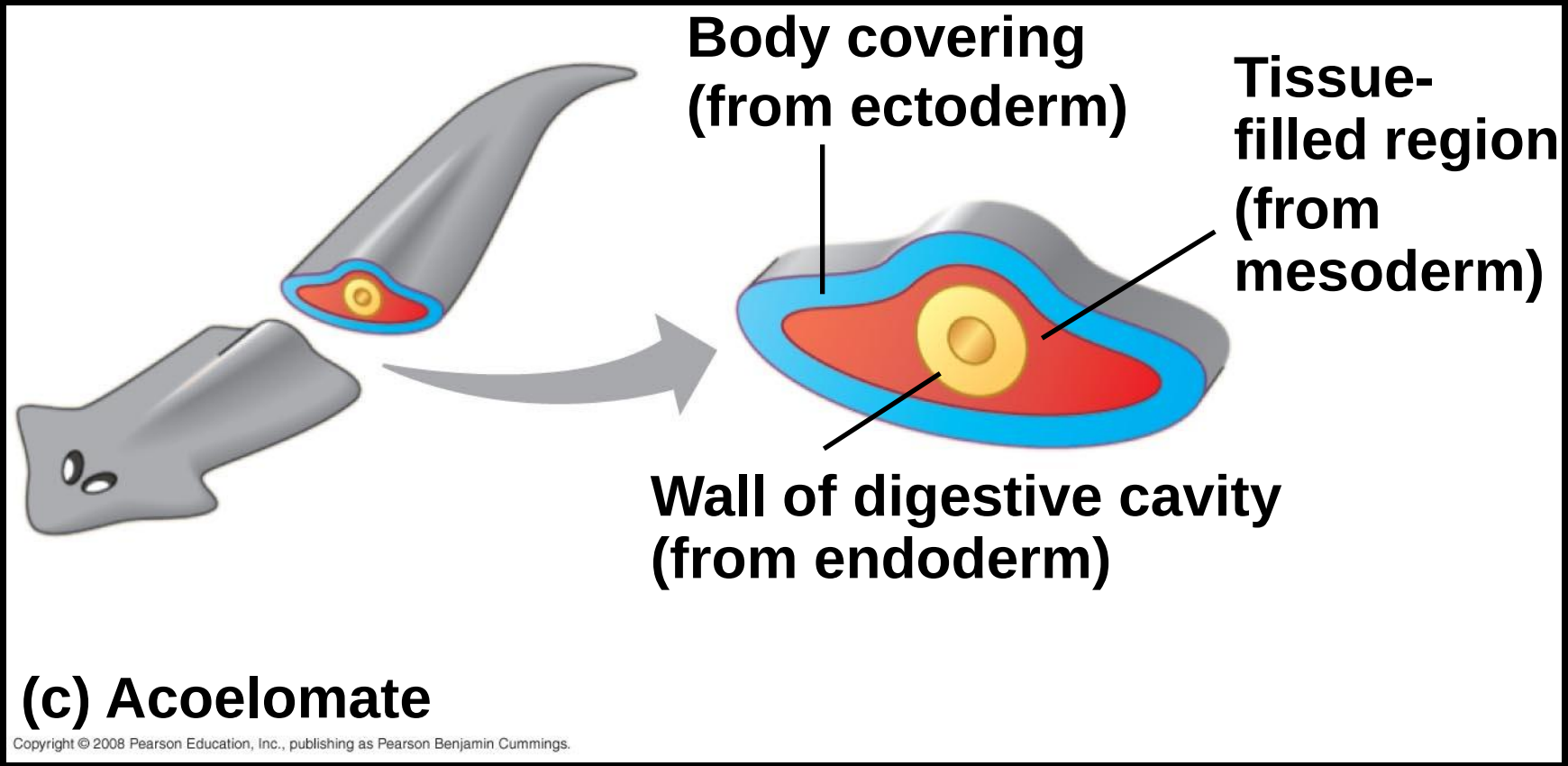
- Two-sided symmetry is called **bilateral symmetry**
- Bilaterally symmetrical animals have:
  - A **dorsal** (top) side and a **ventral** (bottom) side
  - A right and left side
  - **Anterior** (head) and **posterior** (tail) ends
  - **Cephalization**, the development of a head

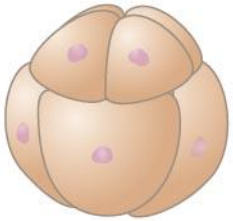
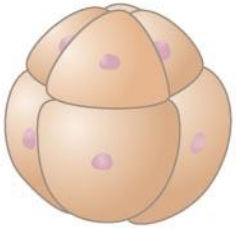
- **Ectoderm** is the germ layer covering the embryo's surface
- **Endoderm** is the innermost germ layer and lines the developing digestive tube, called the **archenteron**
- **Diploblastic** animals have ectoderm and endoderm
- **Triploblastic** animals also have an intervening **mesoderm** layer; these include all bilaterians



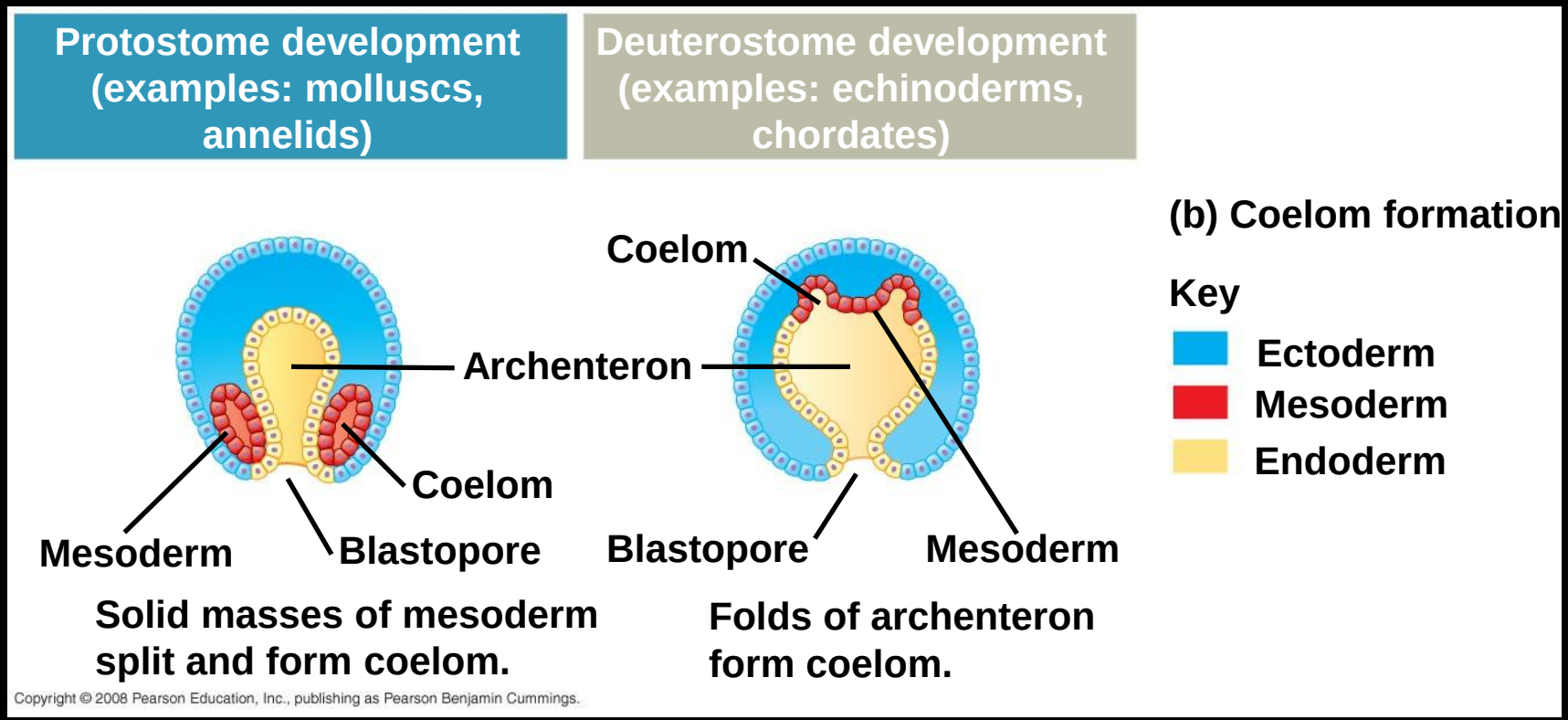


(b) Pseudocoelomate



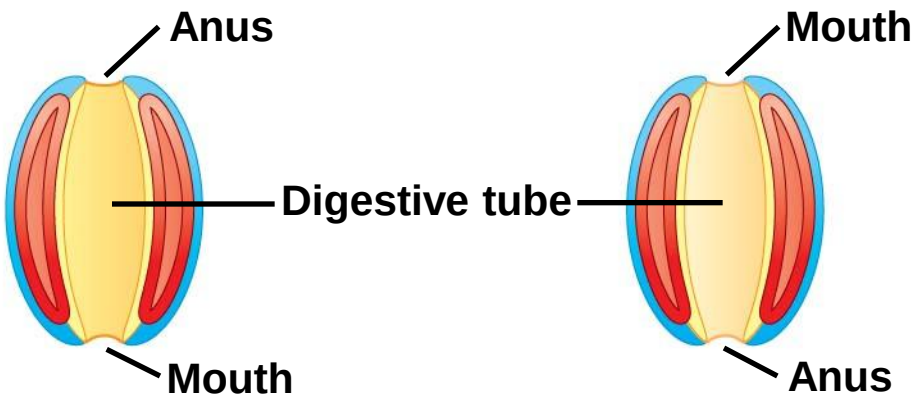
Protostome development (examples: molluscs, annelids)	Deuterostome development (examples: echinoderms, chordates)
Eight-cell stage	Eight-cell stage
	
Spiral and determinate	Radial and indeterminate

(a) Cleavage



Protostome development (examples: molluscs, annelids)

Deuterostome development (examples: echinoderms, chordates)



(c) Fate of the blastopore

Key

- Ectoderm
- Mesoderm
- Endoderm

Mouth develops from blastopore. **Anus develops from blastopore.**

Fig. 32-10

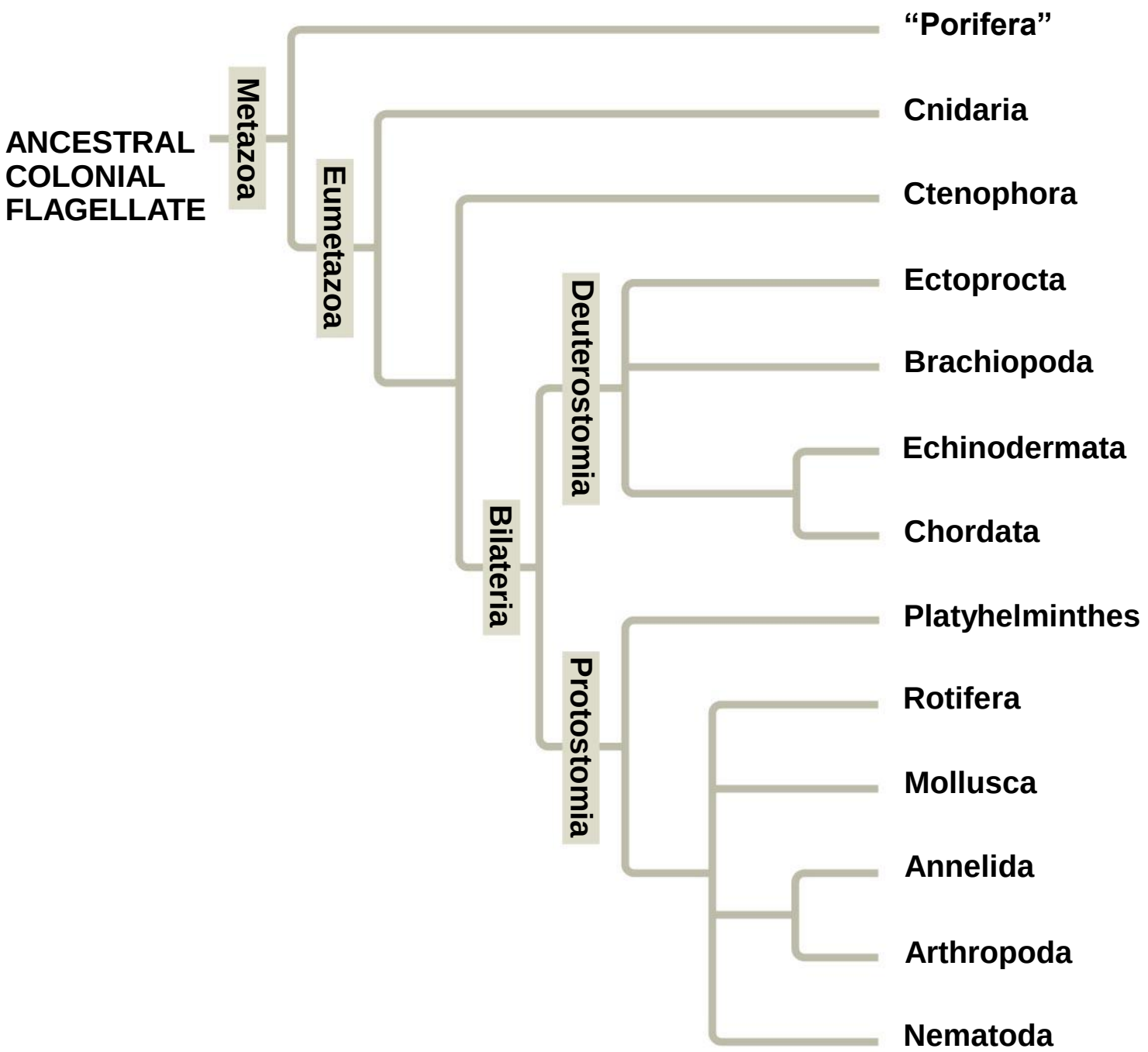
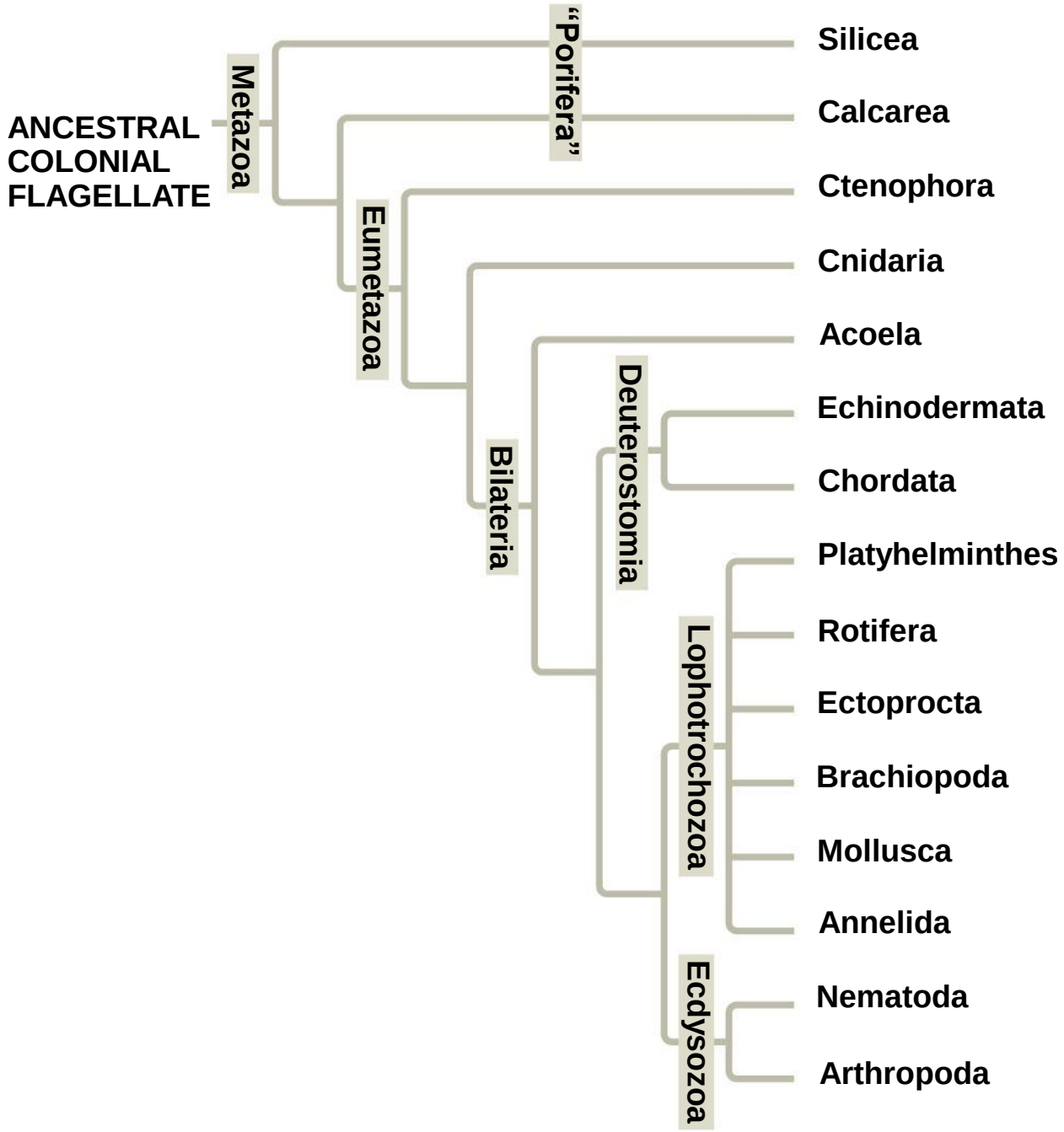


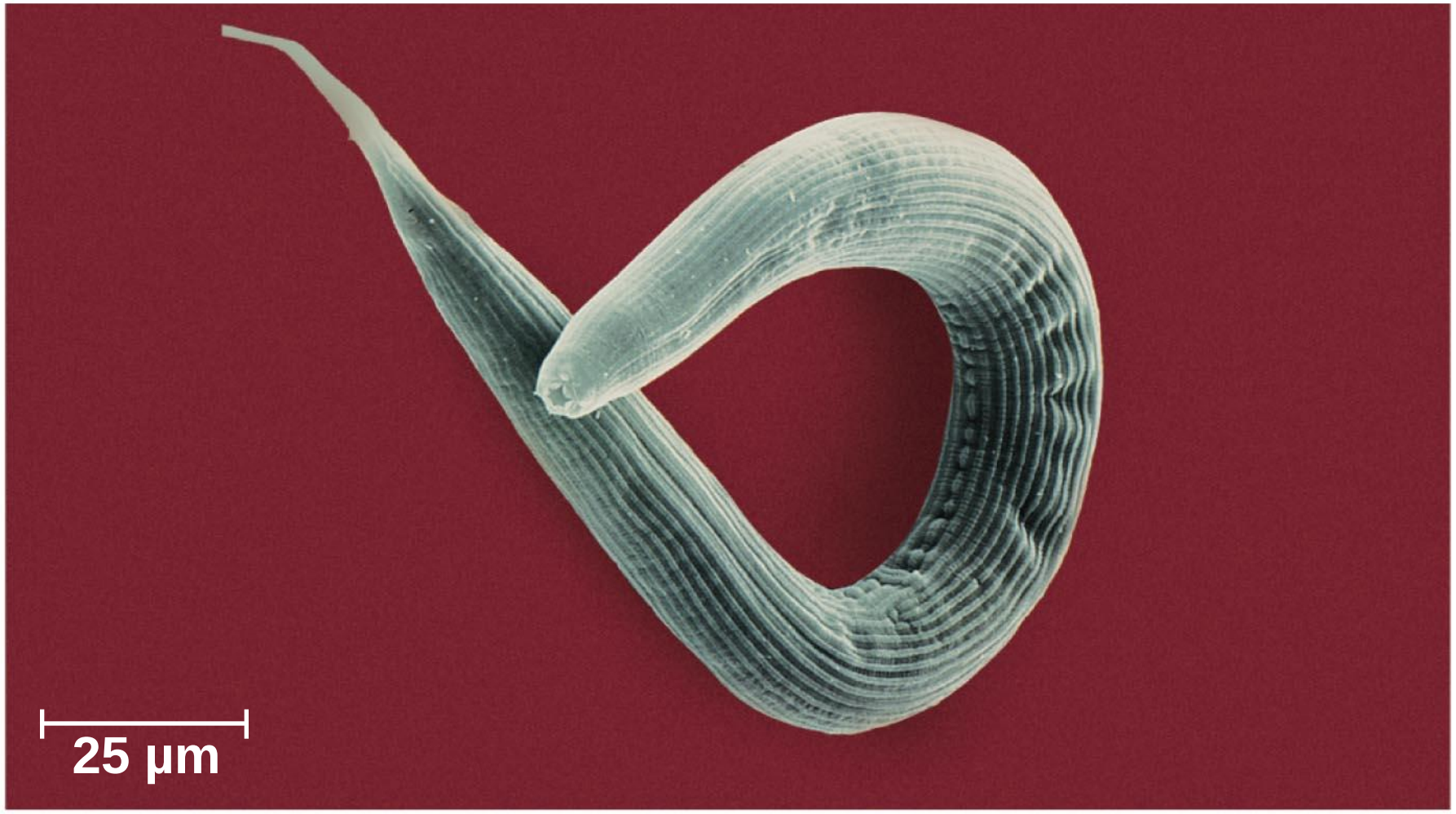
Fig. 32-11



Progress in Resolving Bilaterian Relationships

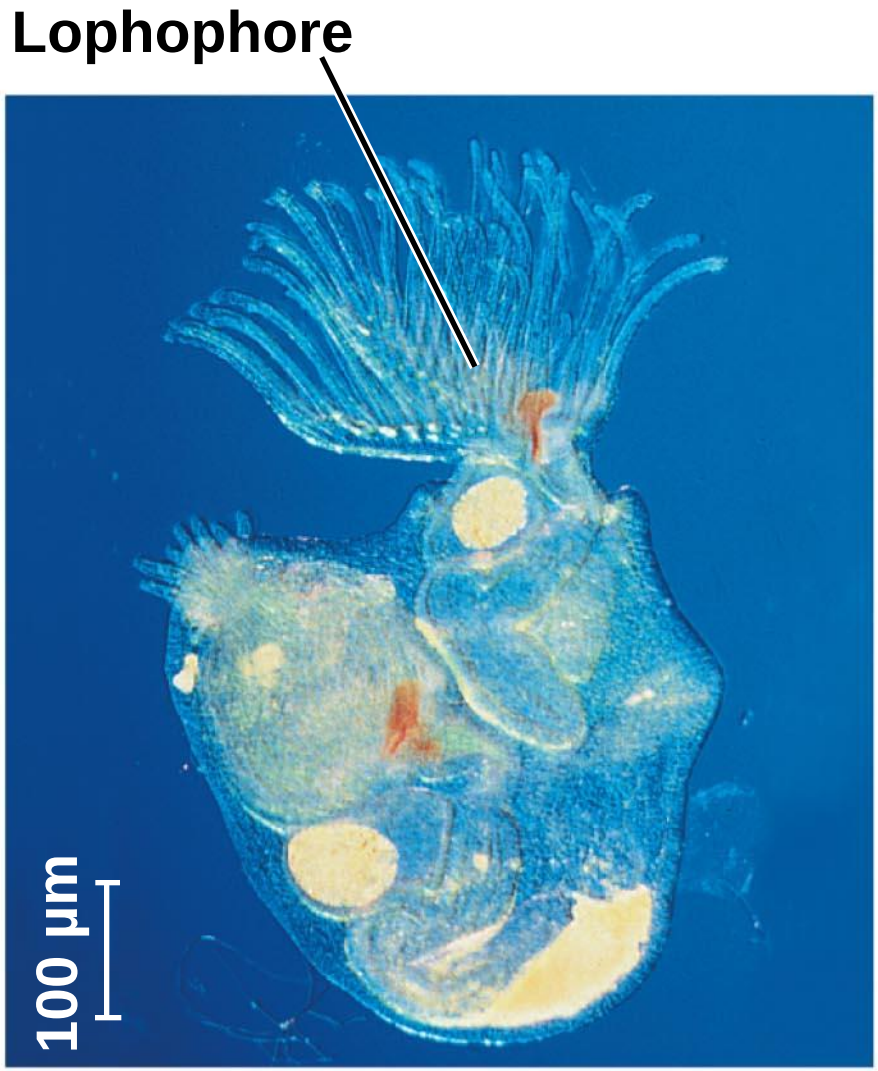
- The morphology-based tree divides bilaterians into two clades: deuterostomes and protostomes
- In contrast, recent molecular studies indicate three bilaterian clades: Deuterostomia, Ecdysozoa, and Lophotrochozoa
- **Ecdysozoans** shed their exoskeletons through a process called *ecdysis*

Fig. 33-38a

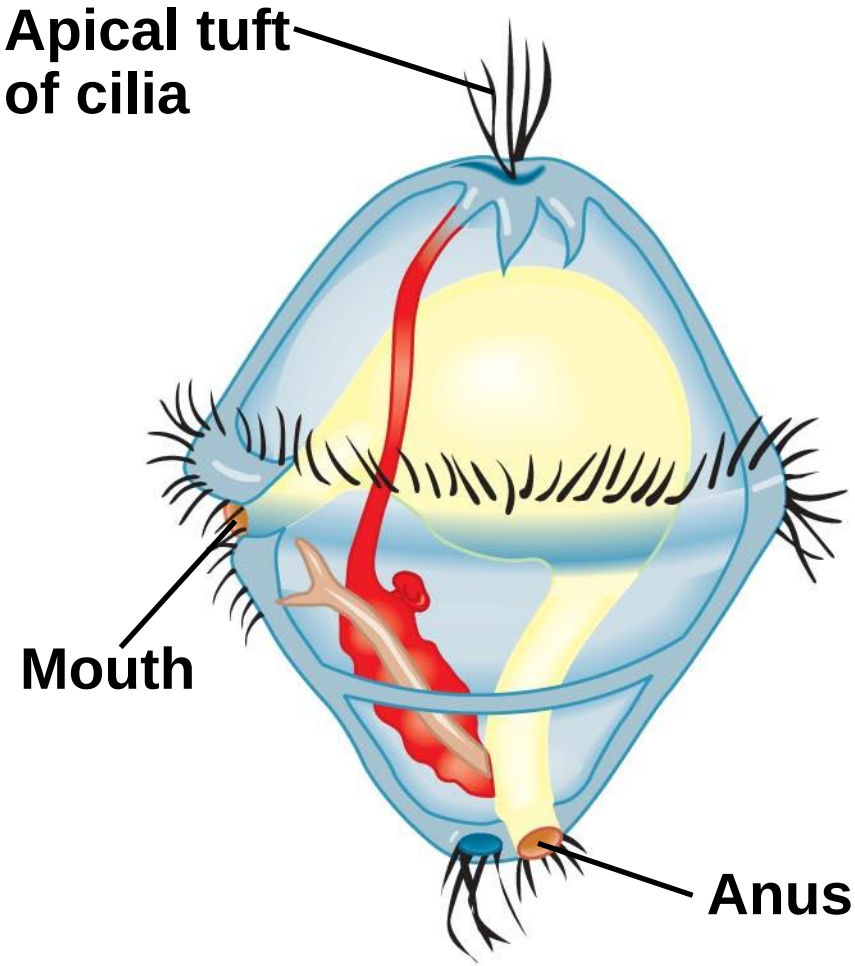


- Some **lophotrochozoans** have a feeding structure called a **lophophore**
- Other phyla go through a distinct developmental stage called the **trochophore larva**

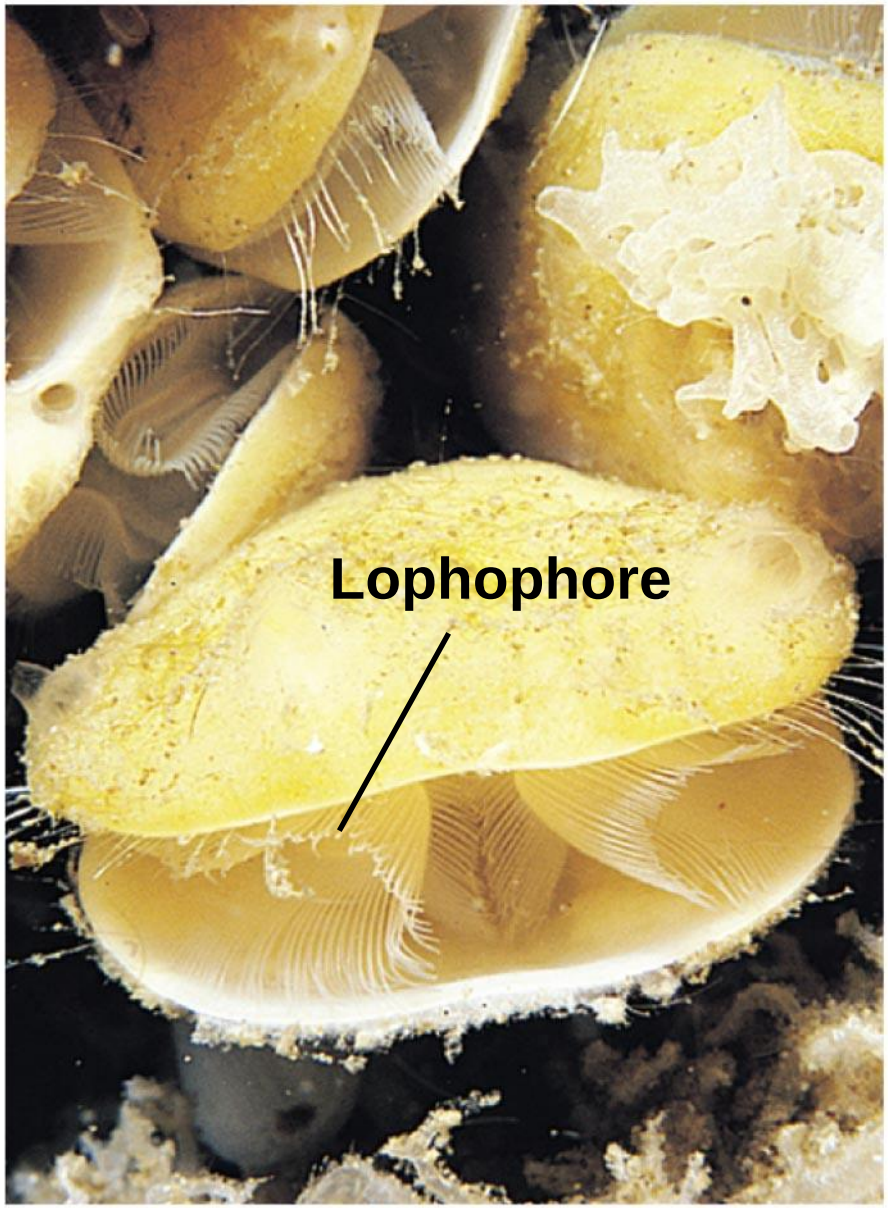
Fig. 32-13



(a) An ectoproct



(b) Structure of a trochophore larva



(b) Brachiopods

Fig. 32-UN1