

# 大洋中的鲨鱼-资源与保护



李云凯

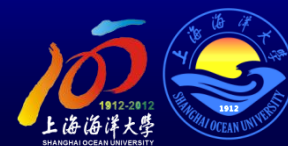
# Content overview



1. What is a shark? – Week 1
2. Where sharks live? – Week 1 and 2
3. How sharks works? – Week 3
4. Life in the water – Week 4
5. Shark families – Week 5 and 6
6. Shark relatives – Week 6
7. Sharks and people – Week 6
8. Studying sharks – Week 7
9. Sharks in China's Sea – Week 8



# 考试形式



成绩评定	总成绩比 %		平时成绩比 %						
	期末	平时	出勤	作业	实验	实习	讨论	测验	其它
	50	50	80				20		

# Schedule



PPT下载: <http://www.liyunkai.net>



# SHARKS

## What is a Shark?

College of Marine Sciences Shanghai Ocean University

2020

# What is a shark?



- The king of sharks  
-----the Great White



**PORBEAGLE SHARK**  
(*Lamna nasus*)  
Tier 1, Maximum size 3 meters



**GOBLIN SHARK**  
(*Mitsukurina owstoni*)  
Tier 2, Maximum size 5,5 meters



**BLACK TIP REEF SHARK**  
(*carcharhinus melanopterus*)  
Tier 1, Maximum size 2 meters



**MEGAMOUTH SHARK**  
(*Megachasma pelagios*)  
Tier 3, Maximum size 6 meters



**THRESHER SHARK**  
(*Alopius vulpinus*)  
Tier 1, Maximum size 4 meters



**SAND SHARK**  
(*Carcharias taurus*)  
Tier 2, Maximum size 3,2 meters



**BLUE FIN SHARK**  
(*Prionace glauca*)  
Tier 2, Maximum size 3,8 meters



**BULL SHARK**  
(*Carcharhinus leucas*)  
Tier 3, Maximum size 4 meters



**BASKING SHARK**  
(*Cetorhinus maximus*)  
Tier 4, Maximum size 10 meters



**WHITE TIP REEF SHARK**  
(*Triakodon obesus*)  
Tier 1, Maximum size 3 meters



**GREAT WHITE SHARK**  
(*Carcharodon carcharias*)  
Tier 4, Maximum size 7 meters



**MAKO SHARK**  
(*Isurus paucus*)  
Tier 2, Maximum size 4,4 meters



**SMOOTH HAMMERHEAD SHARK**  
(*Sphyrna lewini*)  
Tier 2, Maximum size 3,5 meters



**MEGALODON**  
(*Carcharodon Megalodon*)  
Tier 4, Maximum size 14 meters



# TONS OF SHARKS!

# Fishes



- **Hagfish** and **lampreys** are jawless fishes that lack both paired appendages and scales.





# Fishes



- The name **Chondrichthyes** is formed from the Greek prefix *khondros* meaning “cartilage” and suffix *ikhthus* for “fish.”

**Chondrichthyes** = **Holocephali** + **Elasmobranchii**

- *Holos* meaning “whole” and *kephale* meaning “head”
- *elasmo* meaning “plate” and *branch* for “gill.”



# All about sharks



- **Sharks are a type of fish**

They live and breathe underwater and most of them are brilliant swimmers.

- **Most fish have a skeleton**

Made from bone, but a shark's skeleton is made of a lightweight, rubbery material, called cartilage.

- **Almost sharks are carnivores**

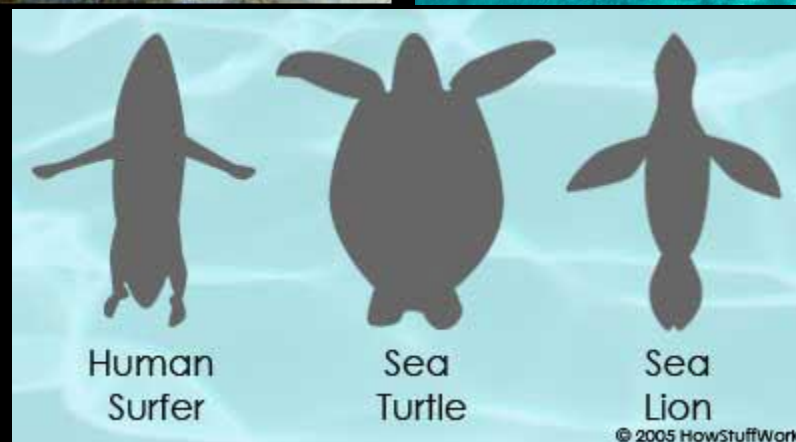
This means that they eat meat. Many kinds are fierce hunters and chase after their prey.

# 鲨鱼危险吗？

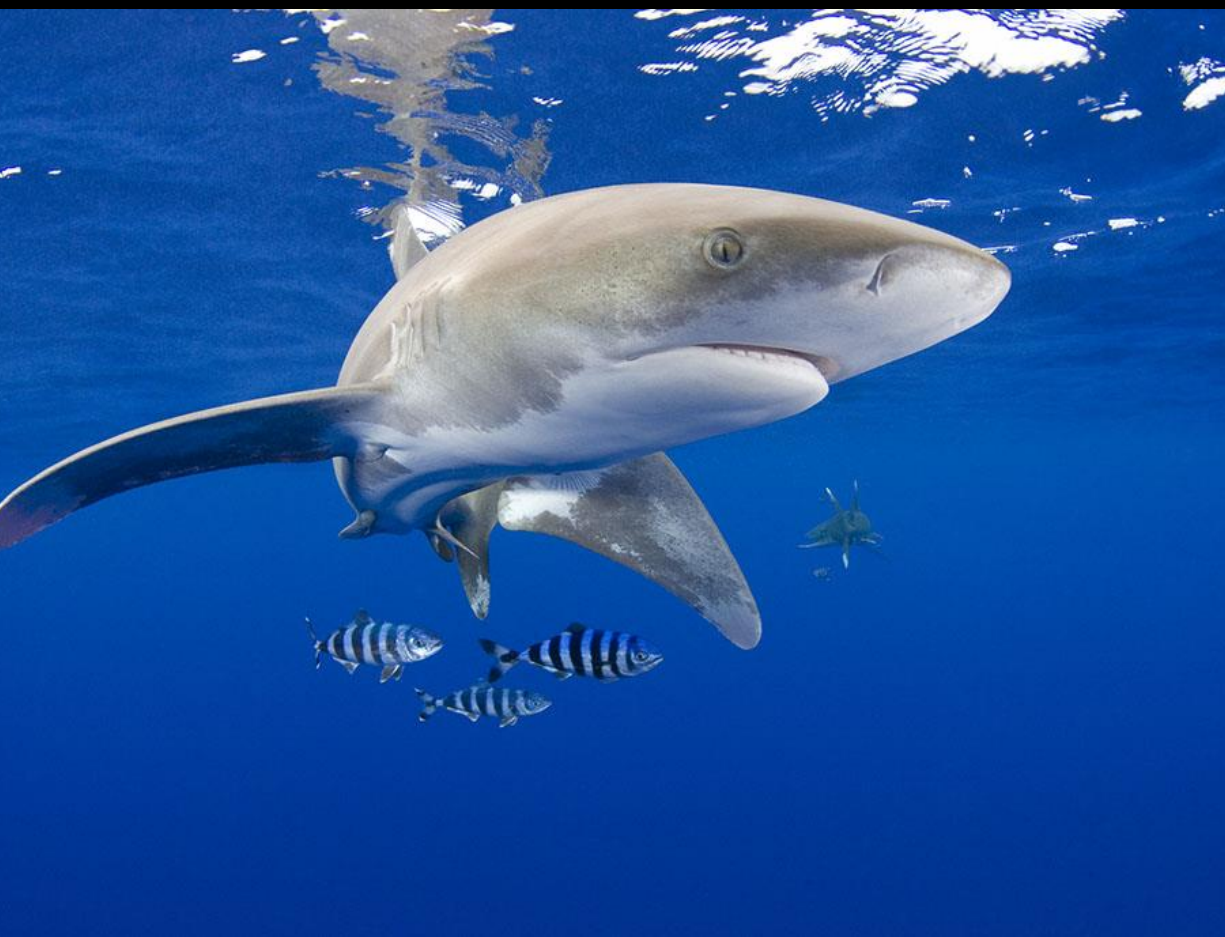
- 大白鲨 (The great white, 噬人鲨 *Carcharodon carcharias*)
- 虎鲨 (Tiger shark, 居氏鼬鲨 *Galeocerdo cuvier*)
- 牛鲨 (Bull Shark, 低鳍真鲨 *Carcharhinus leucas*)



# Shark Attack



# 长鳍真鲨 Oceanic Whitetip



# Glyphis Sharks



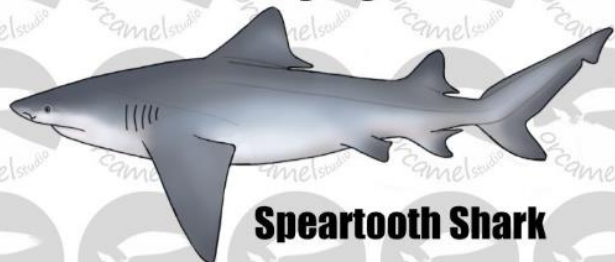
**Ganges Shark**

*G. gangeticus*



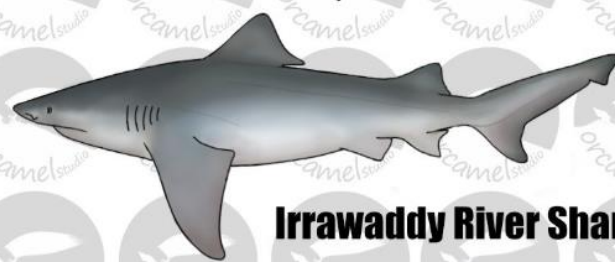
**Borneo River Shark**

*G. sp. B (G. fowlerae?)*



**Speartooth Shark**

*G. glyphis*



**Irrawaddy River Shark**

*G. siamensis*



**Northern River Shark**

*G. sp. C (G. garrick)*



**Bizant River Shark**

*G. sp. A*



Orcamel Studio 2018



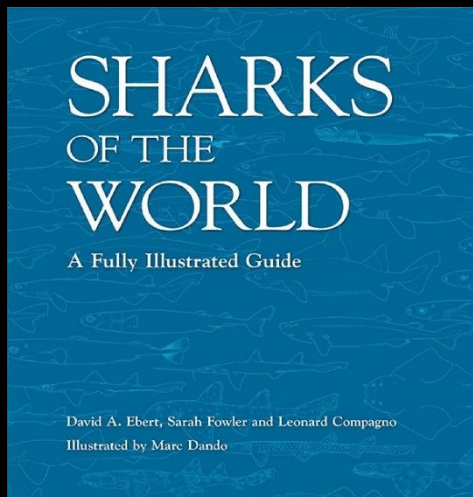
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# All about sharks



- There are more than 500 different species of sharks and more than 550 types of batoids (rays, skates, sawfish and guitarfish) which are their close relatives.
- Many shark species look similar, with long bodies, triangular fins and lots of sharp teeth. They can range greatly in size—from about the length of a banana to bigger than a bus.

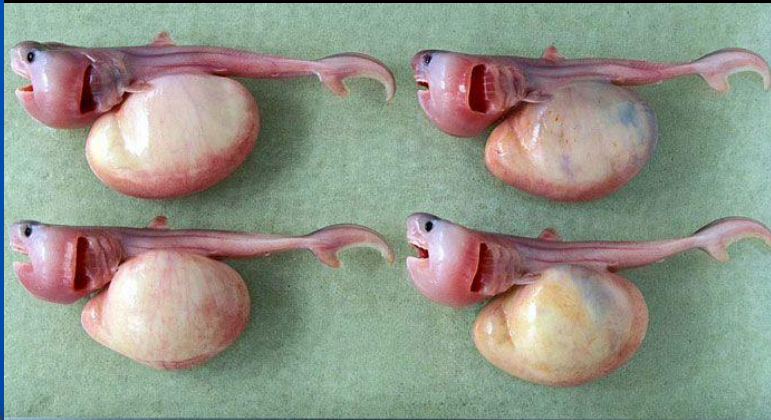






# All about sharks

- Some sharks lay eggs, but many give birth to live young, which are called pups.



Porbeagle shark

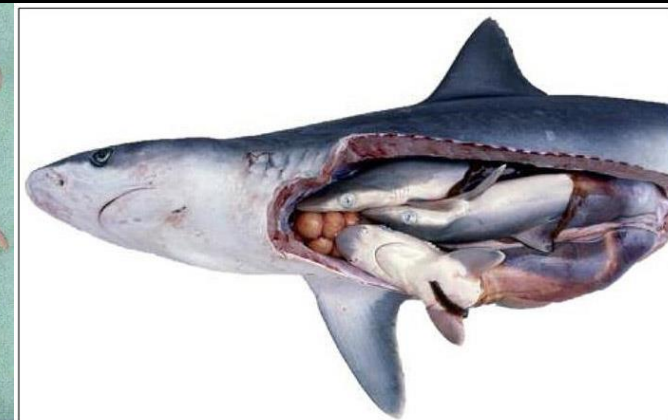
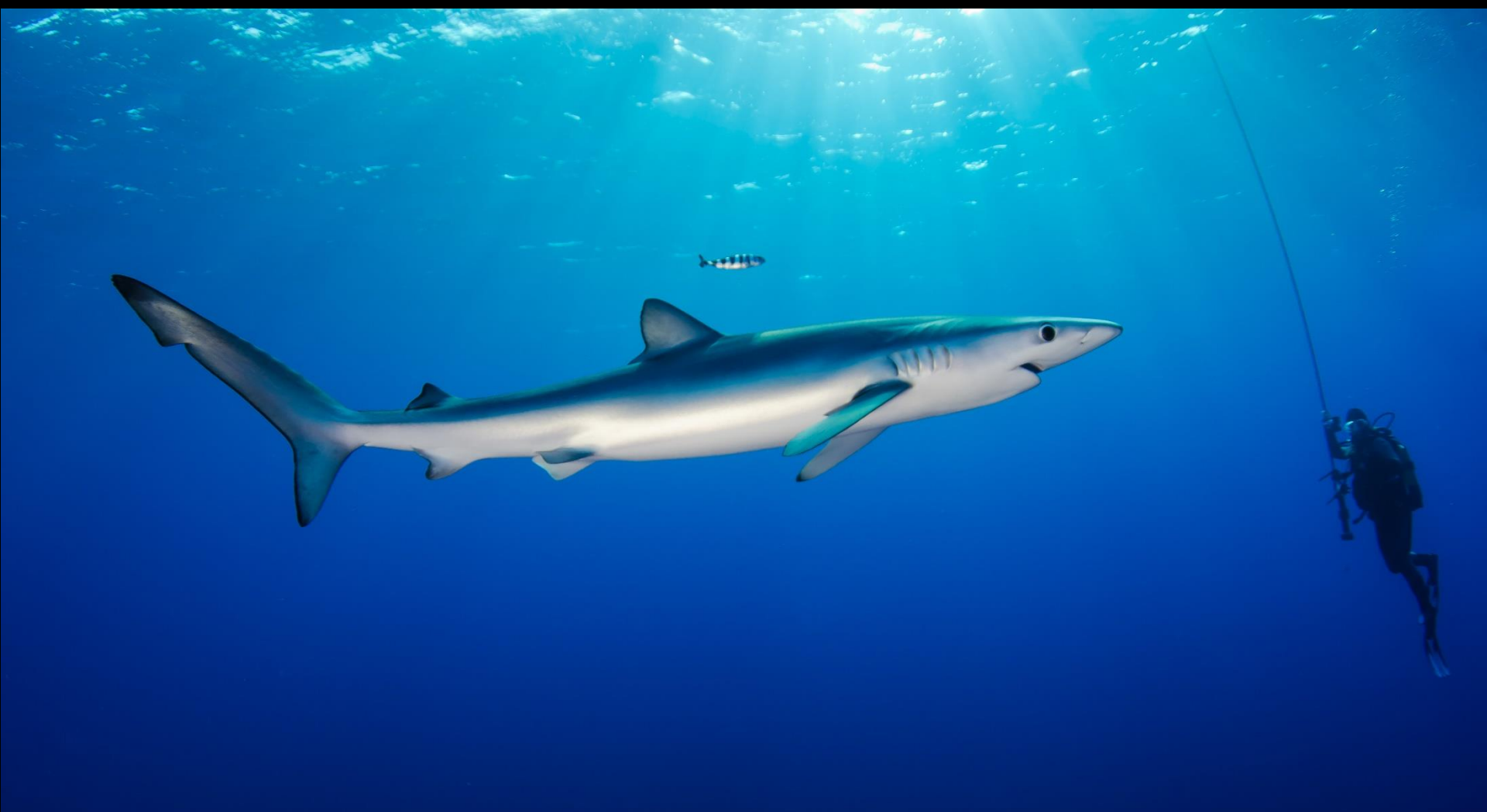


Fig. 5. *Rhizoprionodon terraenovae*, gravid female carrying term young and ripe oocytes. Photo by J. I. Castro.

Atlantic sharpnose shark

# Records and statistics



# Records and statistics



- The most widespread shark is the blue shark, found in most of



Wobbegong shark  
斑纹须鲨 (*Orectolobus maculatus*)



Angel shark  
扁鲨 (*Squatina* sp.)

# Records and statistics



- The most widespread shark is the blue shark, found in most of the world's oceans.
- The smallest shark is the dwarf lanternshark, found in the deep sea.
- The largest shark is the whale shark, which can reach a length of over 30 meters.
- Shortfin mako sharks can reach a length of over 3 meters.



# Records and statistics

- The most common shark in the world
- The shark with the largest gape, the angel shark
- The biggest shark, the whale shark, by body size.
- **Shortfin mako** is the fastest shark, reaching more than 5m per second.



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# Maturity



- Age and size at maturity differs among species.
- Can range from 5 to 150 years to reach breeding age.
- Sharks are usually about 75% of their maximum size at maturity
- Males are on average about 10% smaller than females at maturity
- Females reach maturity about 34% faster than males



**Max length:** 3.9 metres

**Speed:** >30 mph

**Maturity:** ♀ 18 years

**Life span:** 32 years

**Gestation:** 15 - 18 months

**Number of pups:** 4 - 25

## SHORTFIN MAKO

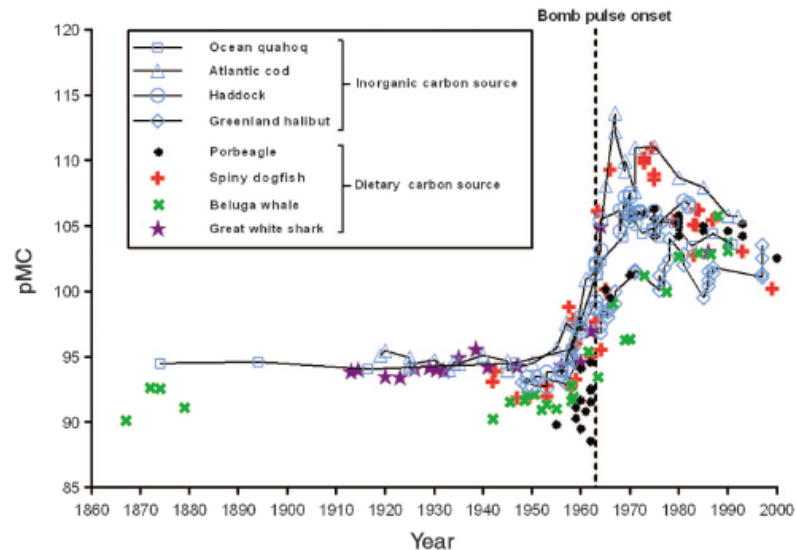
© wildestanimal 尖吻鯖鲨 (*Isurus oxyrinchus*)

**Main threat:** overfishing

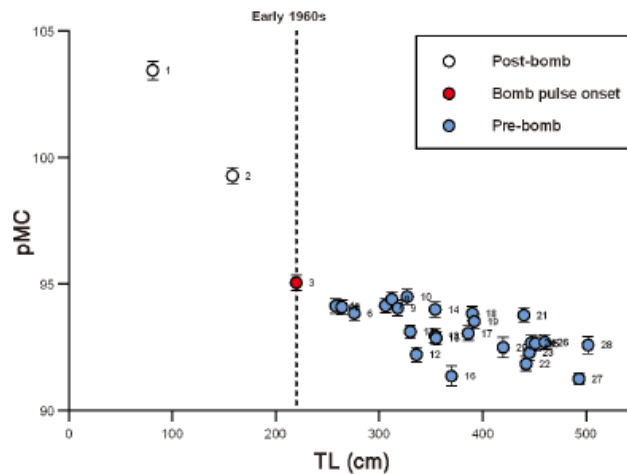
#NoLimits

# Records

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**Fig. 1. Radiocarbon chronologies of the North Atlantic Ocean.** Radiocarbon levels (pMC) of different origin (inorganic and dietary) over the past 150 years are shown. Open symbols (connected) reflect radiocarbon in marine carbonates (inorganic carbon source) of surface mixed and deeper waters (26, 36–38). Solid symbols reflect radiocarbon in biogenic archives of dietary origin (11, 14, 22, 24). The dashed vertical line indicates the bomb pulse onset in the marine food web in the early 1960s.

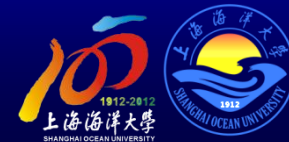


**Fig. 2. Radiocarbon in eye lens nuclei of Greenland sharks.** Radiocarbon levels (pMC  $\pm$  SD, table S1) from 28 females plotted against total length (TL) are shown. Individual animals are identified by the numbers next to the symbols. Nos. 1 and 2 are of postbomb origin, and nos. 4 to 28 are of prebomb origin. We consider shark no. 3 to be from the early 1960s, which is the latest timing of the bomb pulse onset (dashed vertical line).

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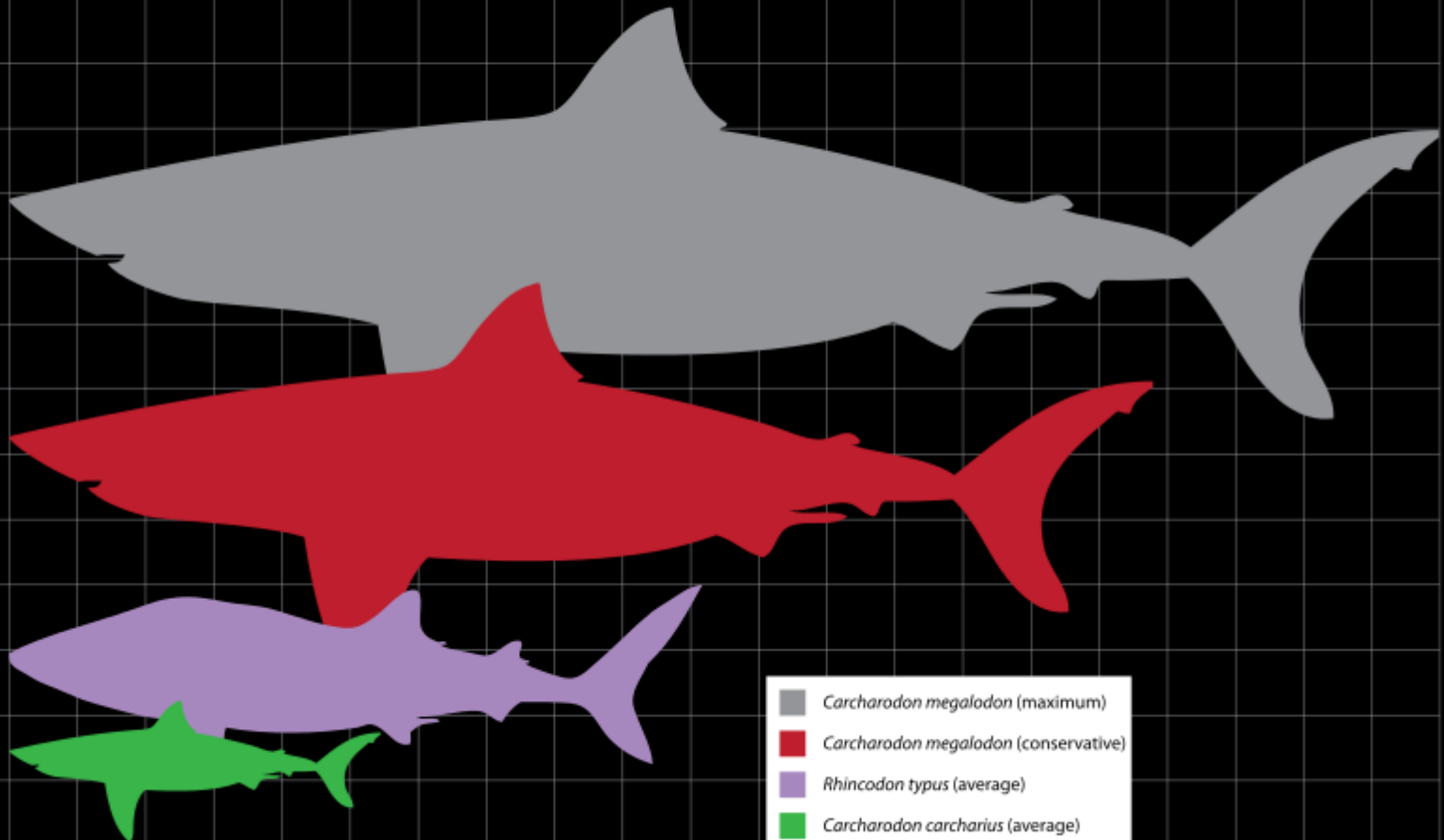
# Big and small

- The biggest shark ever, Megalodon, is now extinct. Scientists think Megalodon may have weighed almost twice as much as a whale shark.

Megalodon vs. Great White Shark Teeth



# Big and small





The whale shark is the biggest living shark. It can measure over 15m in length- that's as long as two buses end to end.

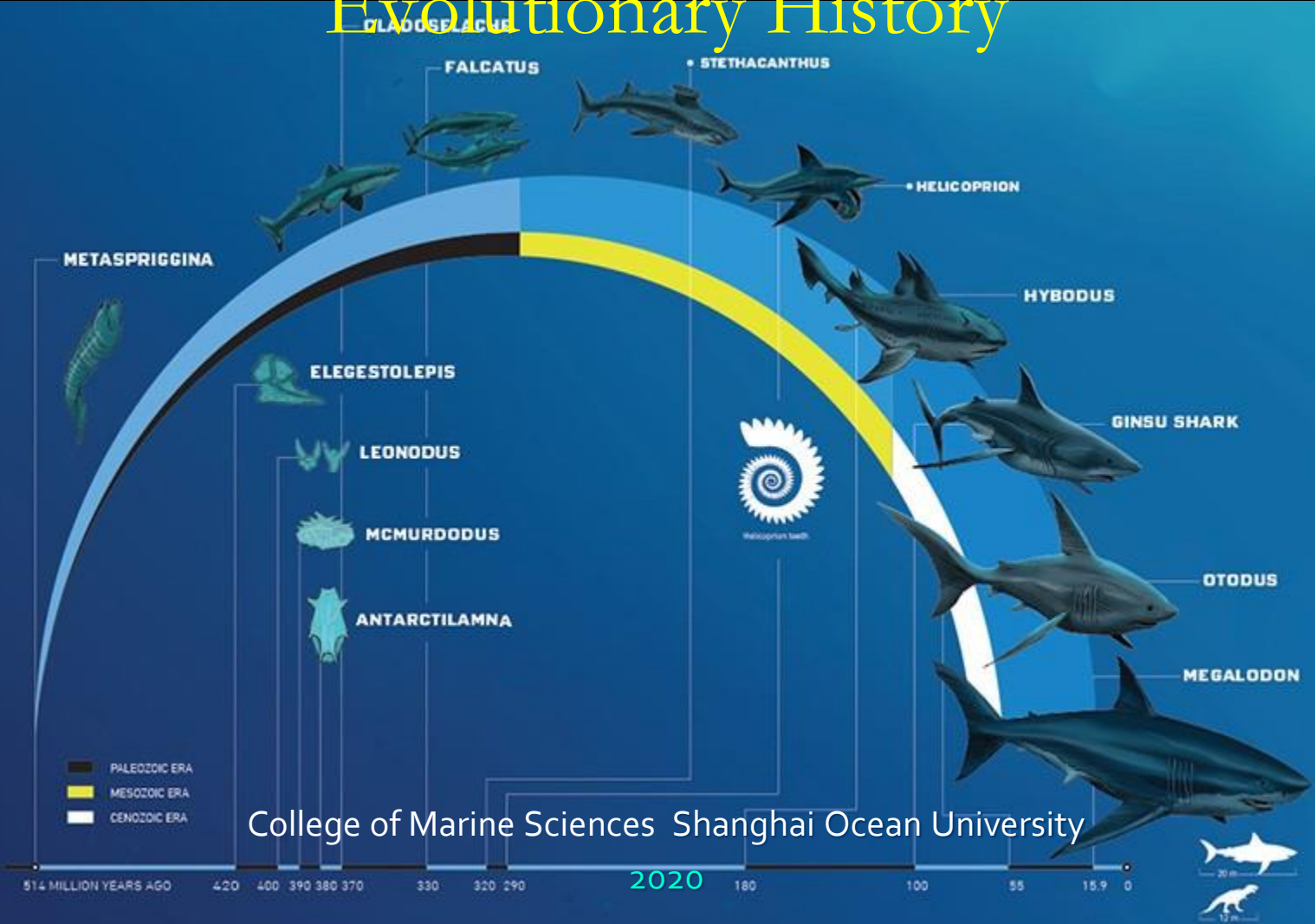
- Whale sharks are gentle fish that feed by filtering tiny food particles from the water.
- The biggest hunting shark measure up to 1.2m wide
- The smallest sharks are the lantern shark (*Lychnothorax*) and the dwarf lantern shark (*Etmopterus perryi*).
- The fussiest eaters of shark world are bullhead sharks.





# 鲨鱼进化史

## Evolutionary History



College of Marine Sciences Shanghai Ocean University

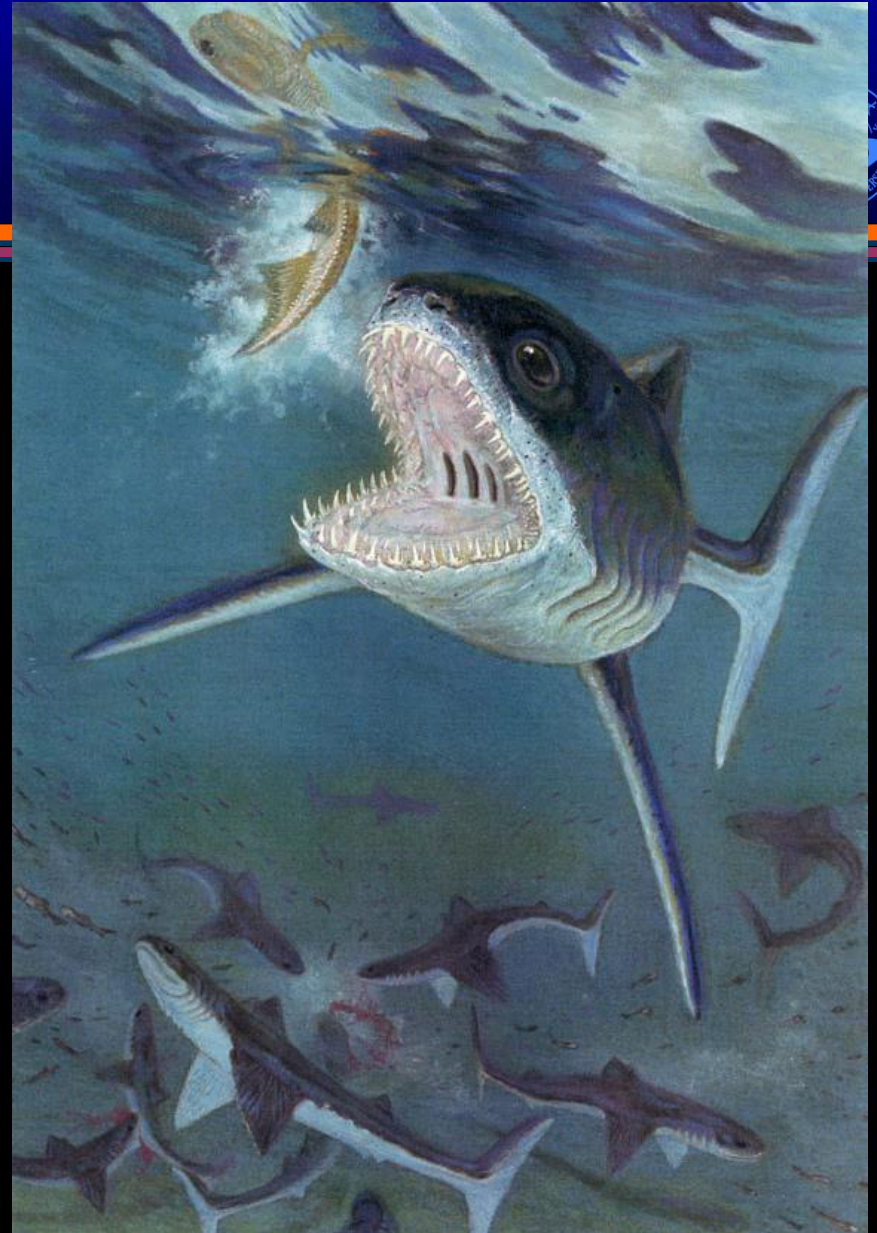
# *Metaspriggina walcottii*

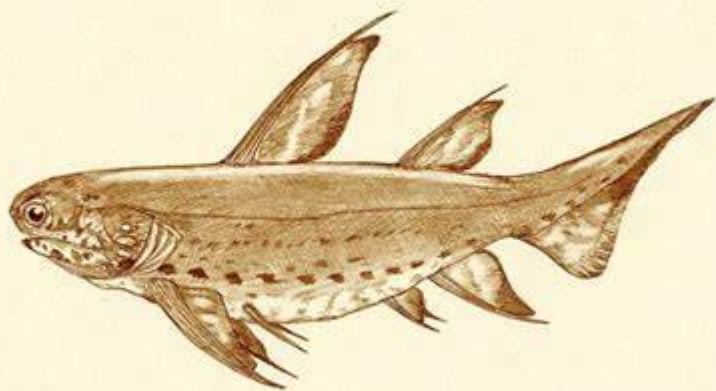
- 古生物学家2014年在加拿大落基山脉寻获了两个生活在5亿年前的原始鱼类化石，这也是迄今已知最古老的鱼种。



# *Cladoselache*

- The first common shark in the Paleozoic Era.
- The first cartilaginous fishes is from fossil deposits over 455 million years ago (mya).





Acanthodians (棘鱼)



Placoderms (盾皮鱼)



*Dunkleosteus terrella* (邓氏鱼)



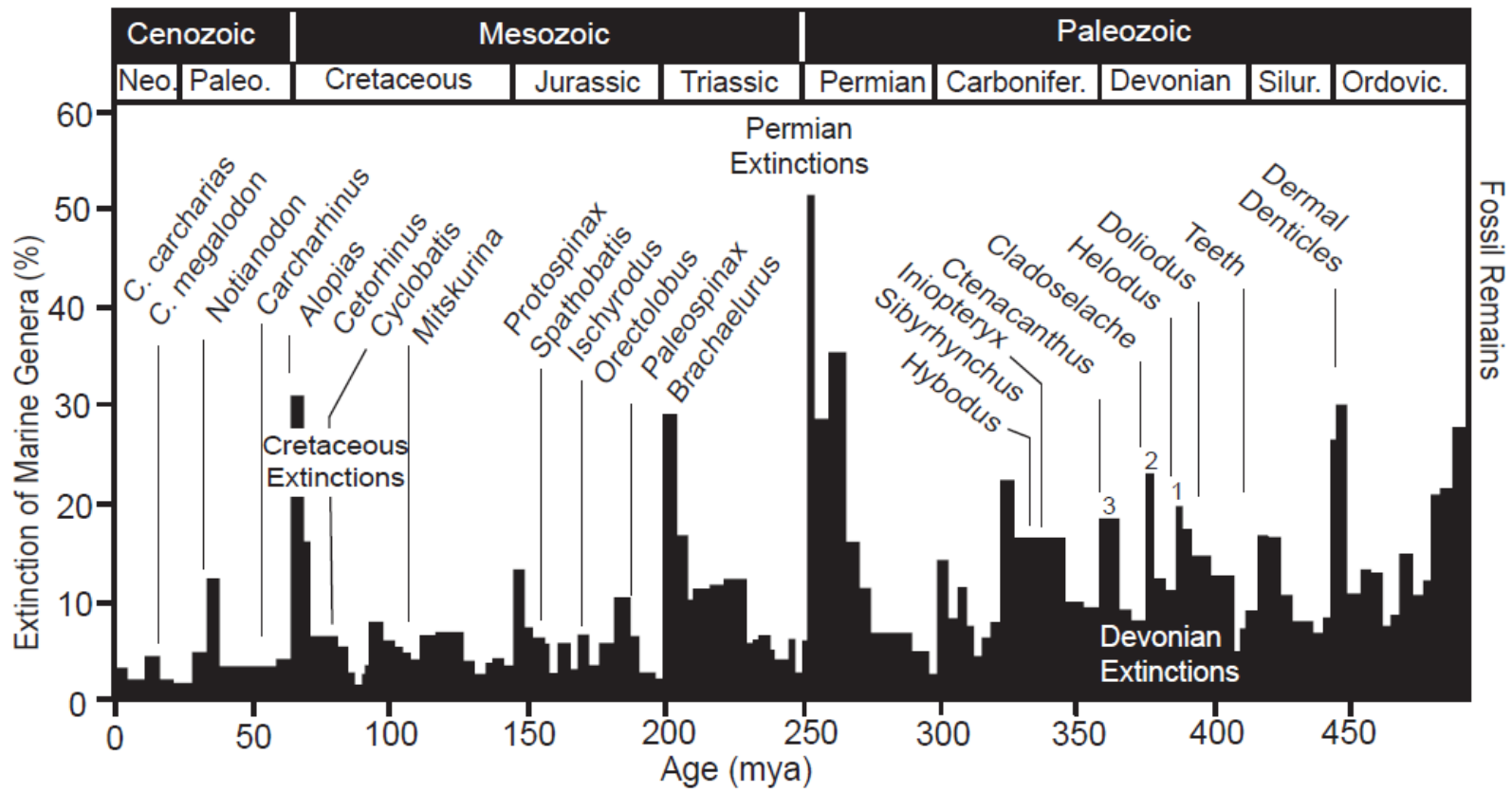
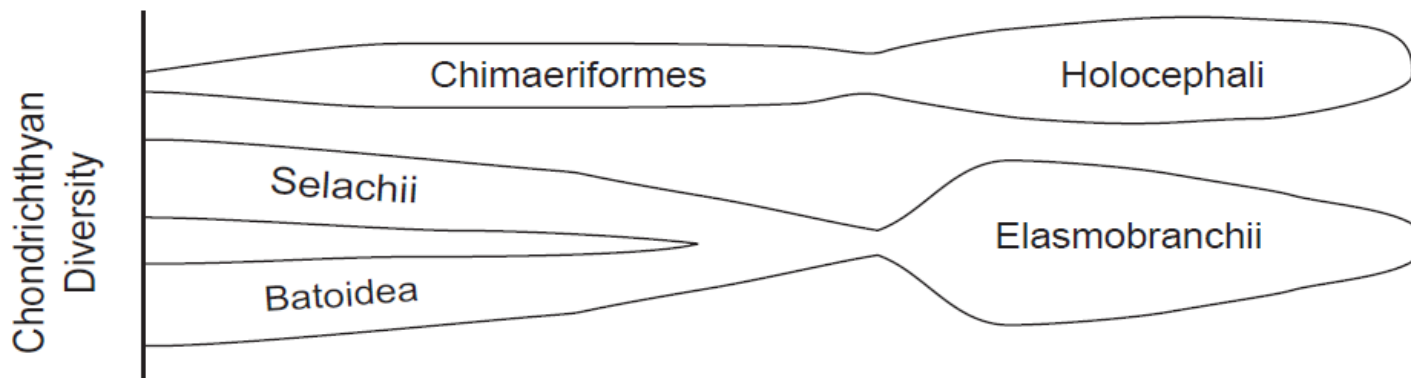
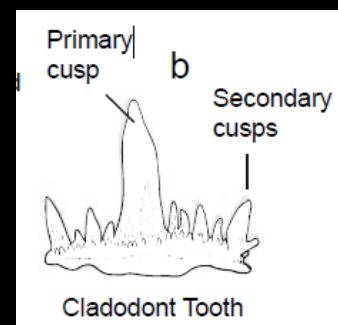


Fig. 2.1 The relative diversity and abundance of holocephalans and elasmobranchs indicated over geological time. The relative rates of extinction of marine genera with a scale of geological time below and the geological eras and periods indicated above. Denoted on the time record is when dermal denticles, teeth, or skeletal remains of the different genera of chondrichthyan fishes have been found in fossil deposits worldwide.



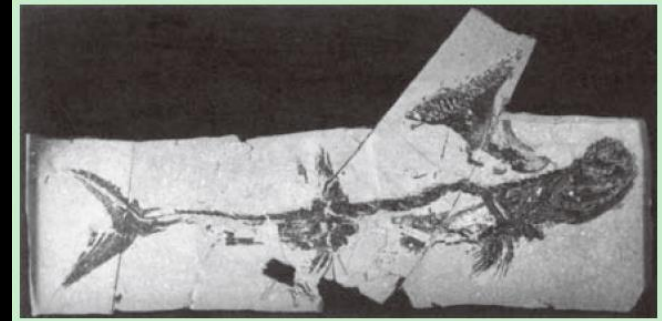
- 无颌类和原始的有颌鱼类在4.43-4.17亿年前的志留纪十分兴盛。
- 盾皮鱼类在泥盆纪基本就灭绝了。
- 泥盆纪一共有三次物种灭绝，很多捕食性鱼类灭绝，也正是这样，使得软骨鱼类的多样性开始大大增加。软骨鱼类开始繁荣起来。
- 软骨鱼类最早的楯鳞发现在4.55亿年前的奥陶纪，鲨鱼牙齿最早发现在4.18亿年前的泥盆纪开始时期。
- 这类牙齿在泥盆纪中期数量极大。

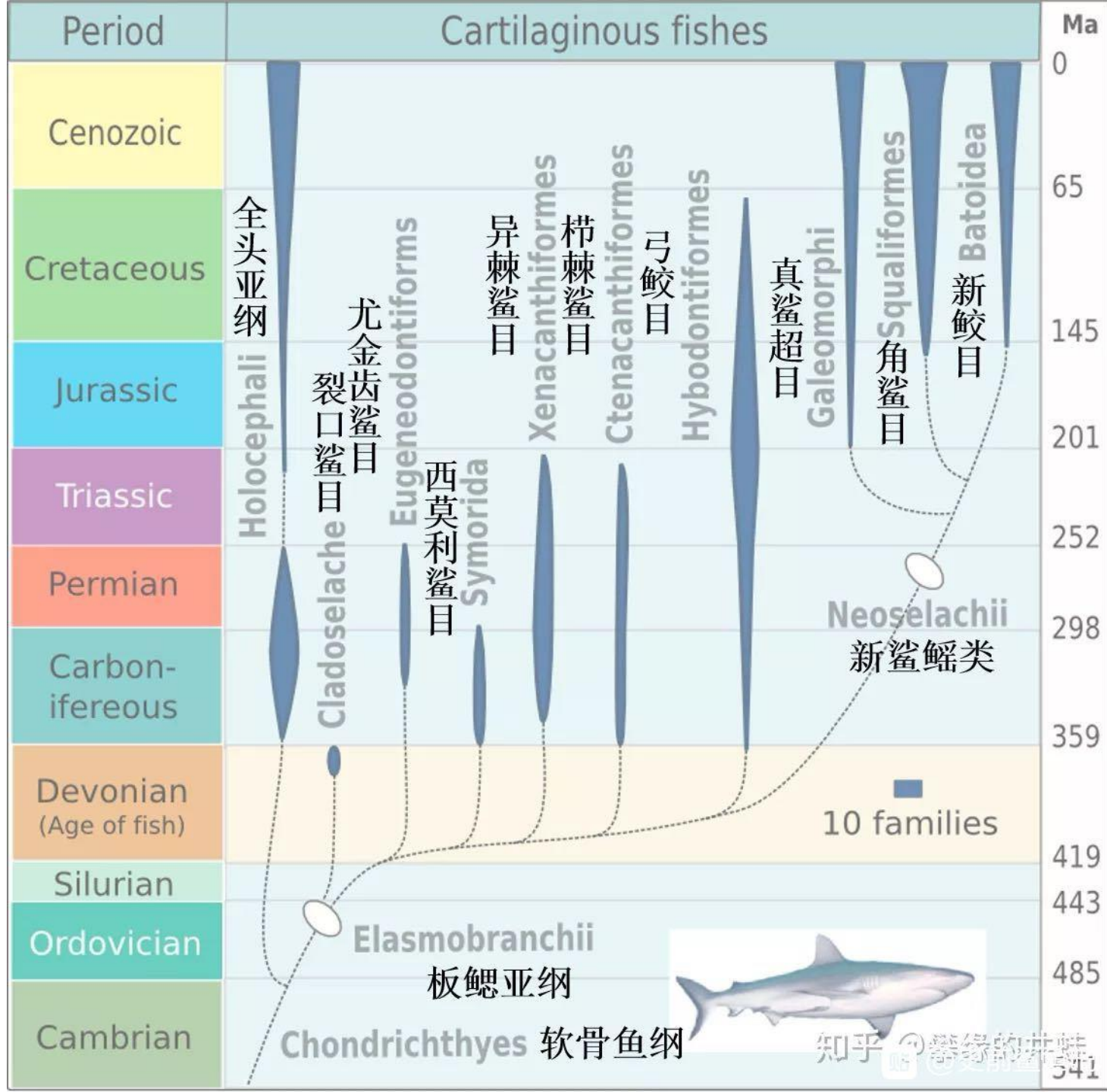


# The oldest chondrichthyan fossil



- 最古老的软骨鱼类化石是多里阿鲨 *Doliodus problematicus*，在4.08亿年前的泥盆纪早期，但鲨鱼在3.8亿年前的泥盆纪中期才开始兴盛起来。
- 裂口鲨同现生鲨鱼相比脊椎比较僵硬，尾鳍的上下叶等面积，类似于鼠鲨目鲨鱼，但尾鳍上下叶内部结构并不一致





新生界 (0.6亿年前-)

白垩纪 (1.4-0.6亿年前)

侏罗纪 (2.0-1.4亿年前)

三叠纪 (2.5-2.0亿年前)

二叠纪 (2.9-2.5亿年前)

石炭纪 (3.5-2.9亿年前)

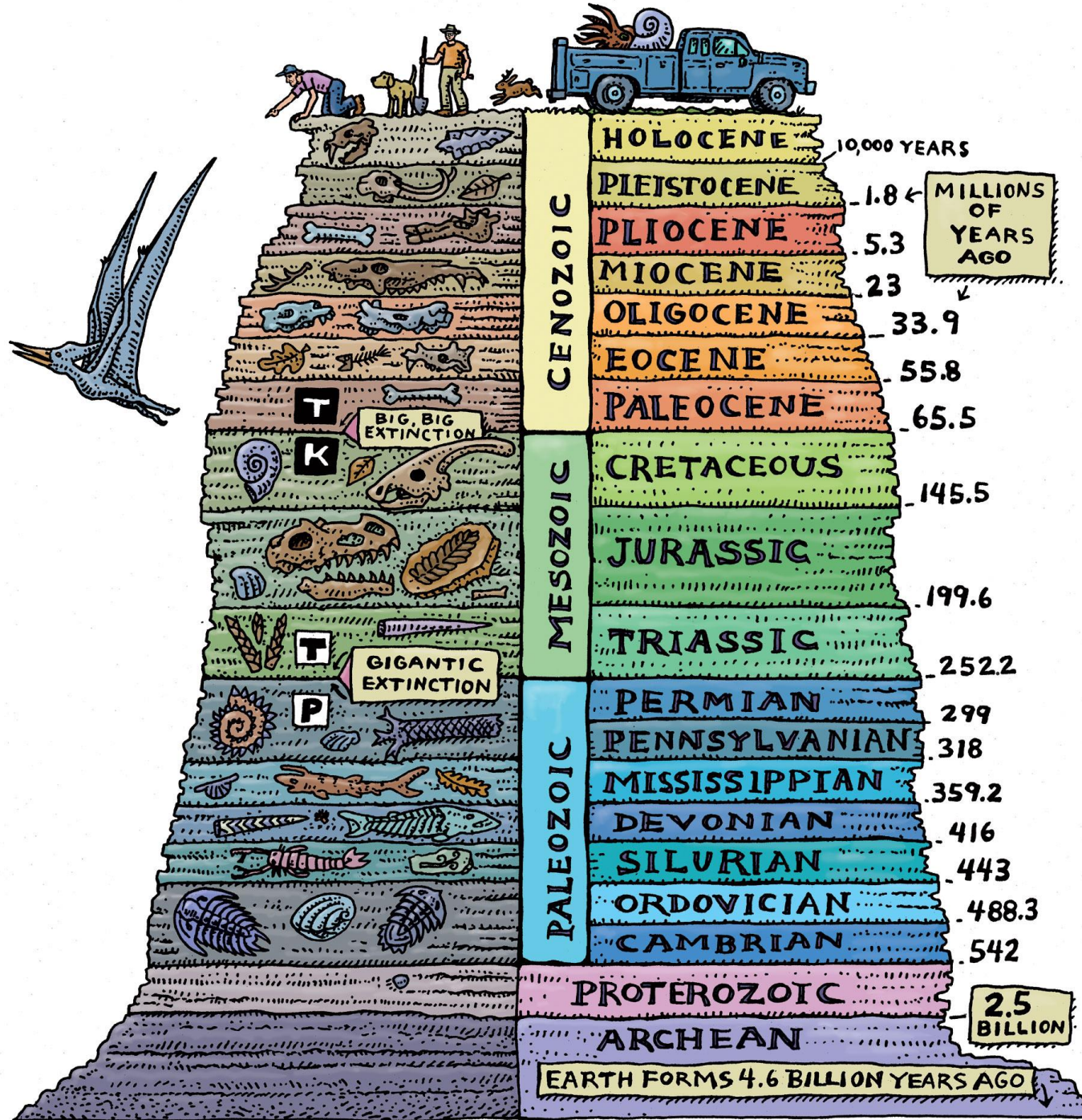
泥盆纪 (4.1-3.5亿年前)

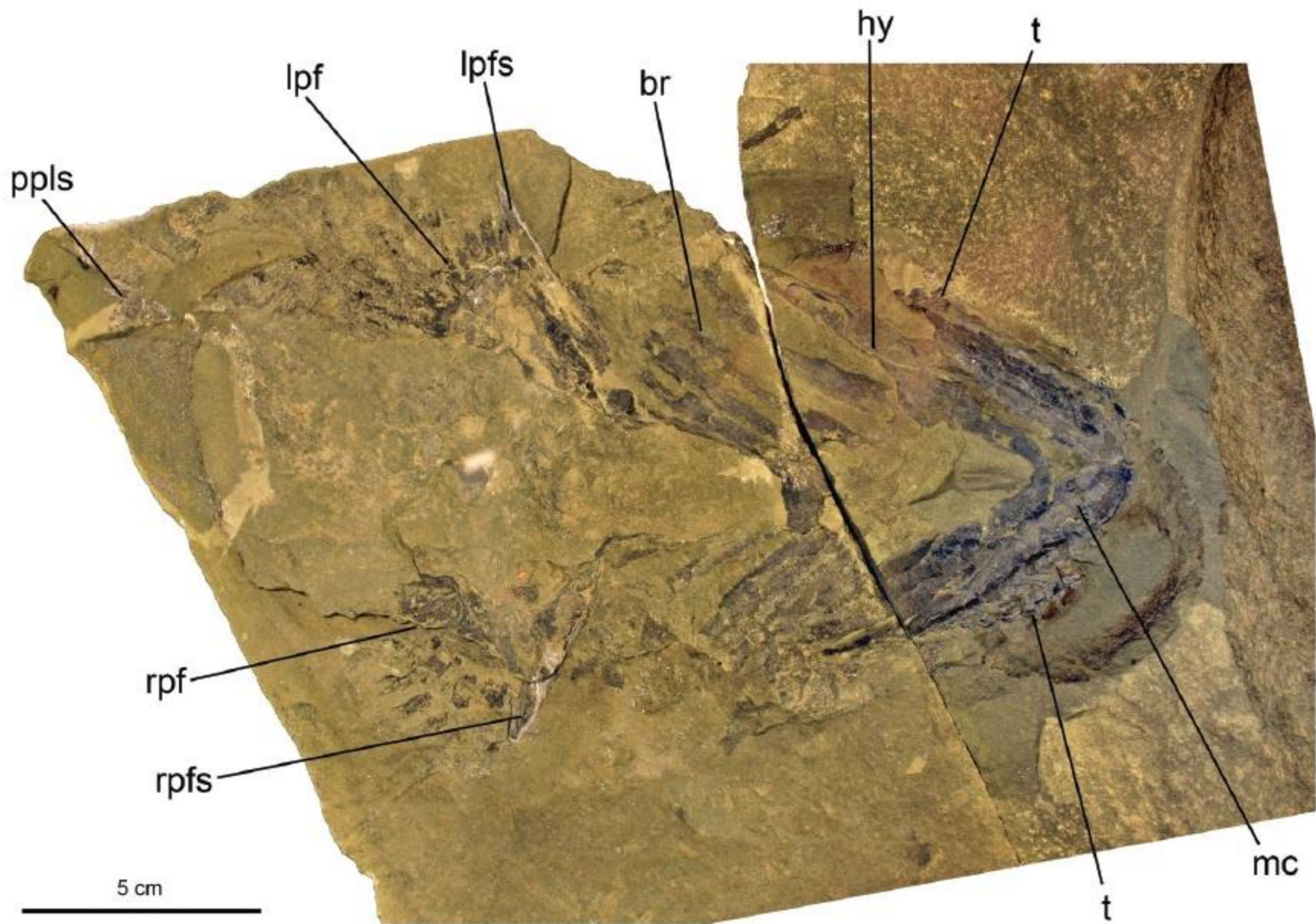
志留纪 (4.4-4.1亿年前)

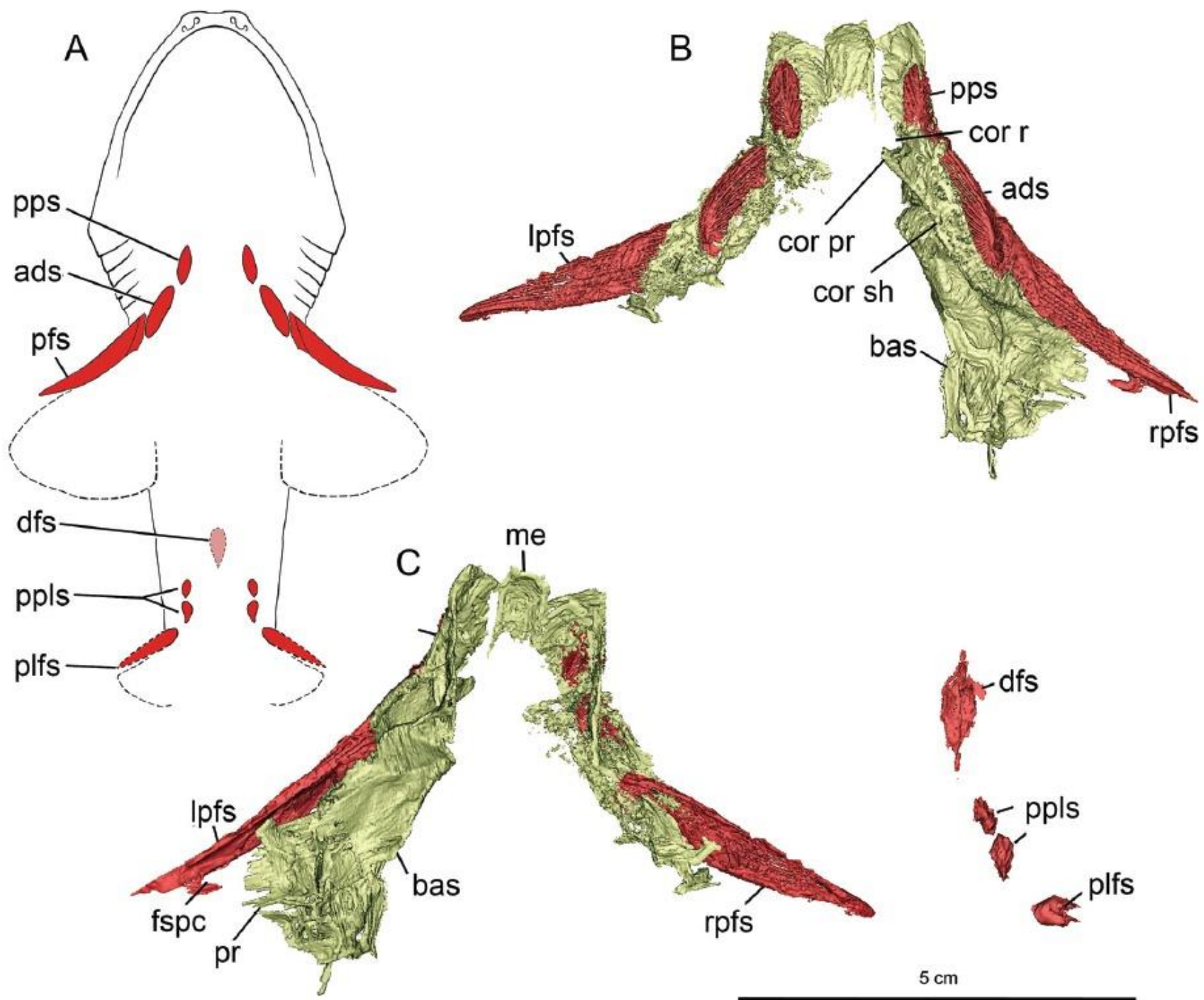
奥陶纪 (4.8-4.4亿年前)

寒武纪 (5.4-4.8亿年前)



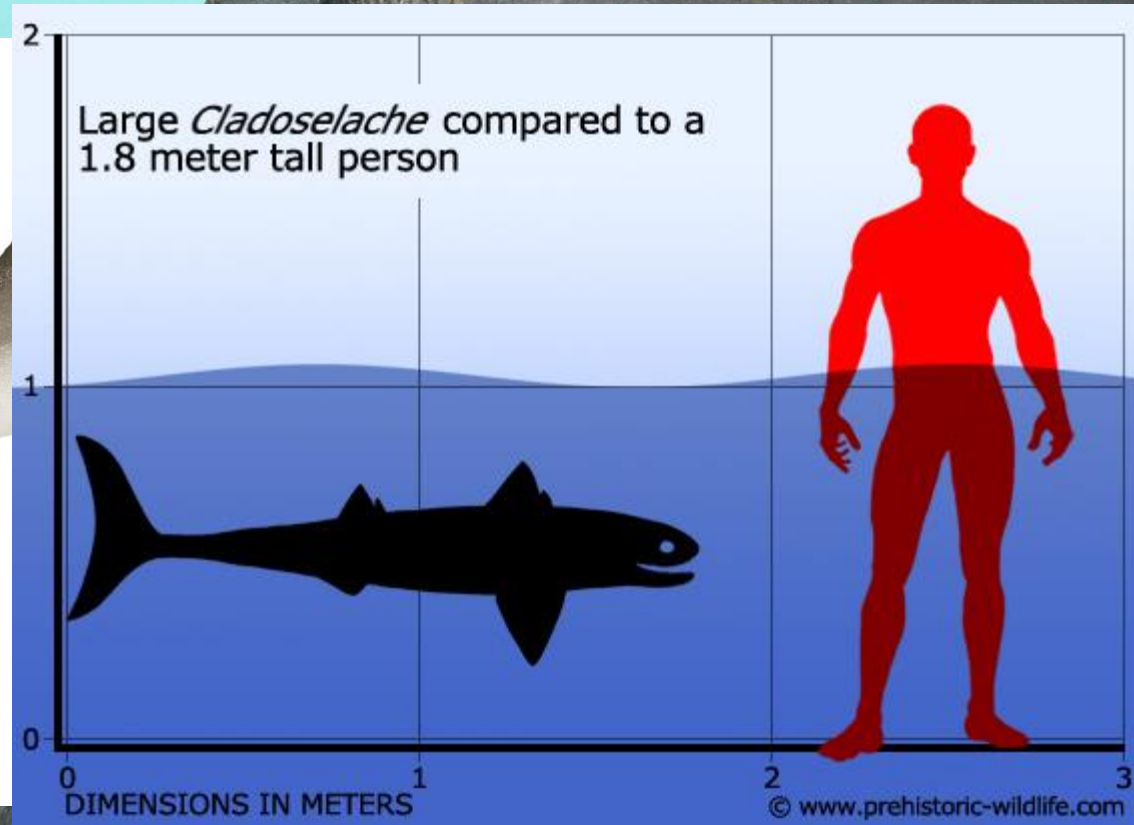






# Cladoselache

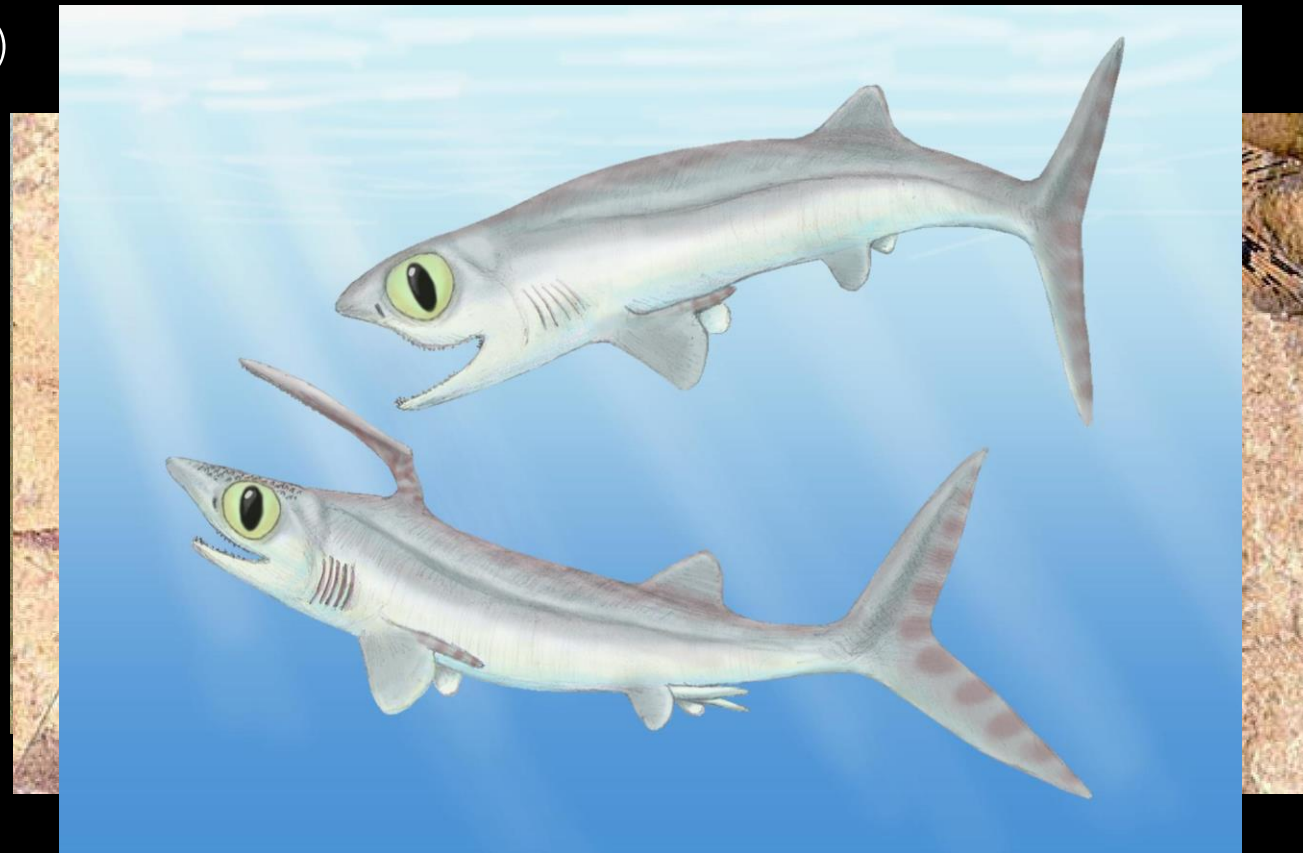
## 裂口鲨





# *Falcatus*

- 镰鳍鲨(胸脊鲨)



*Falcatus falcatus*

# *Stethacanthus*

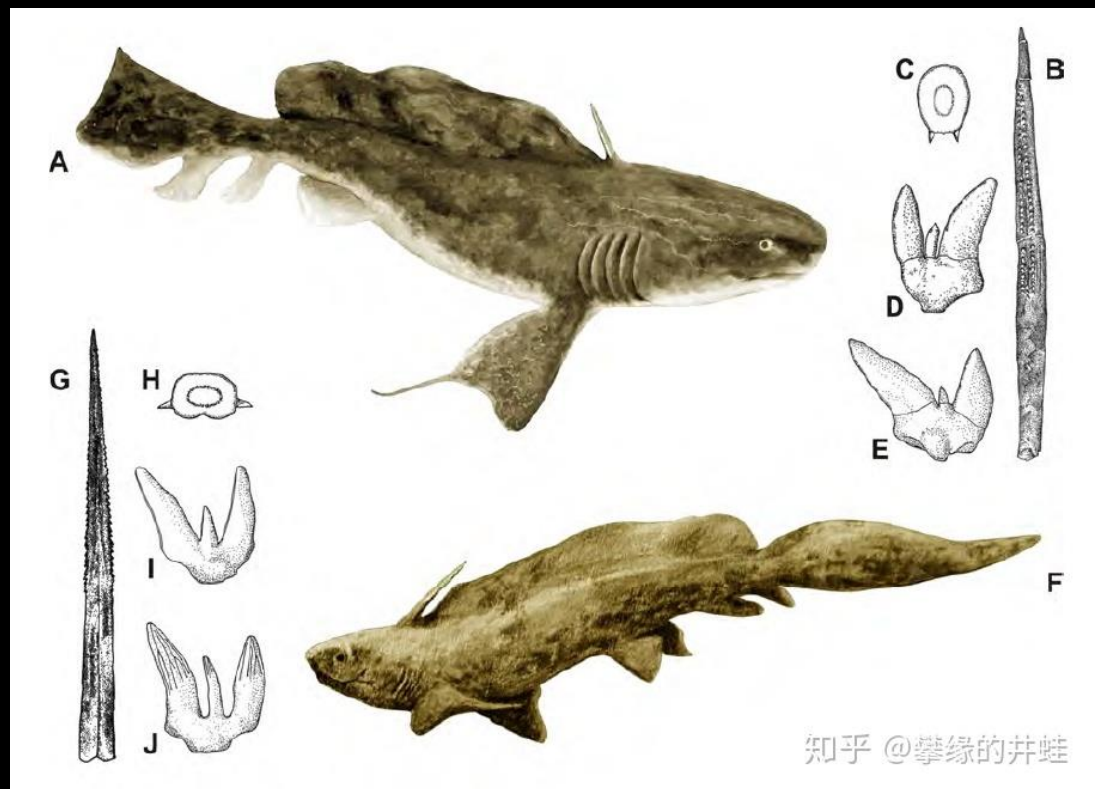
## ■ 胸脊鲨



*Stethacanthus altonensis*

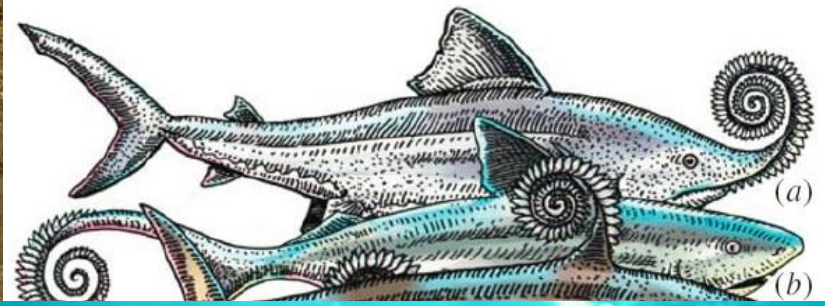
# Xenacanthida

## ■ 异棘鲨



知乎 @攀缘的井蛙

# *Edestus*

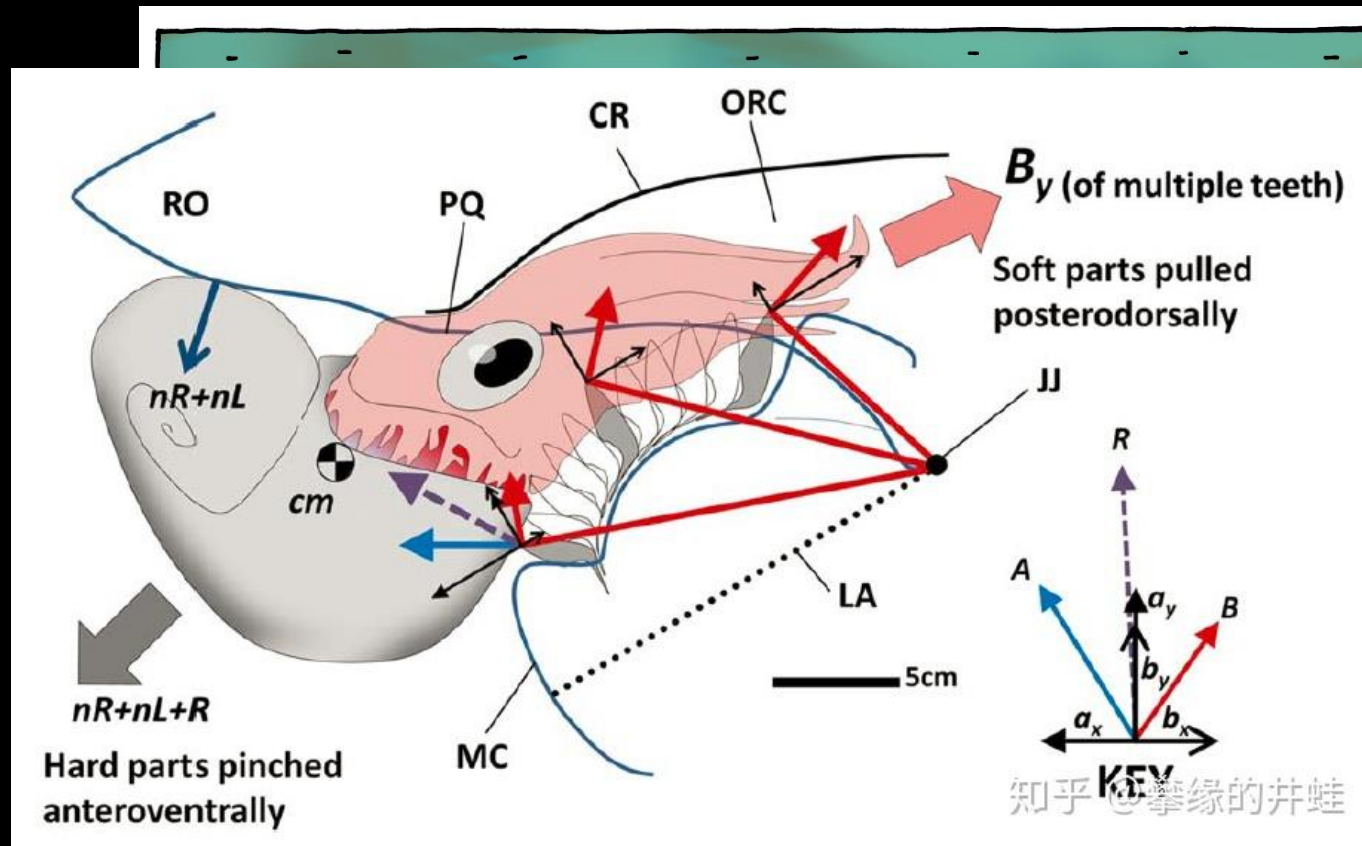


## ■ 剪齿鲨



# Helicoprion

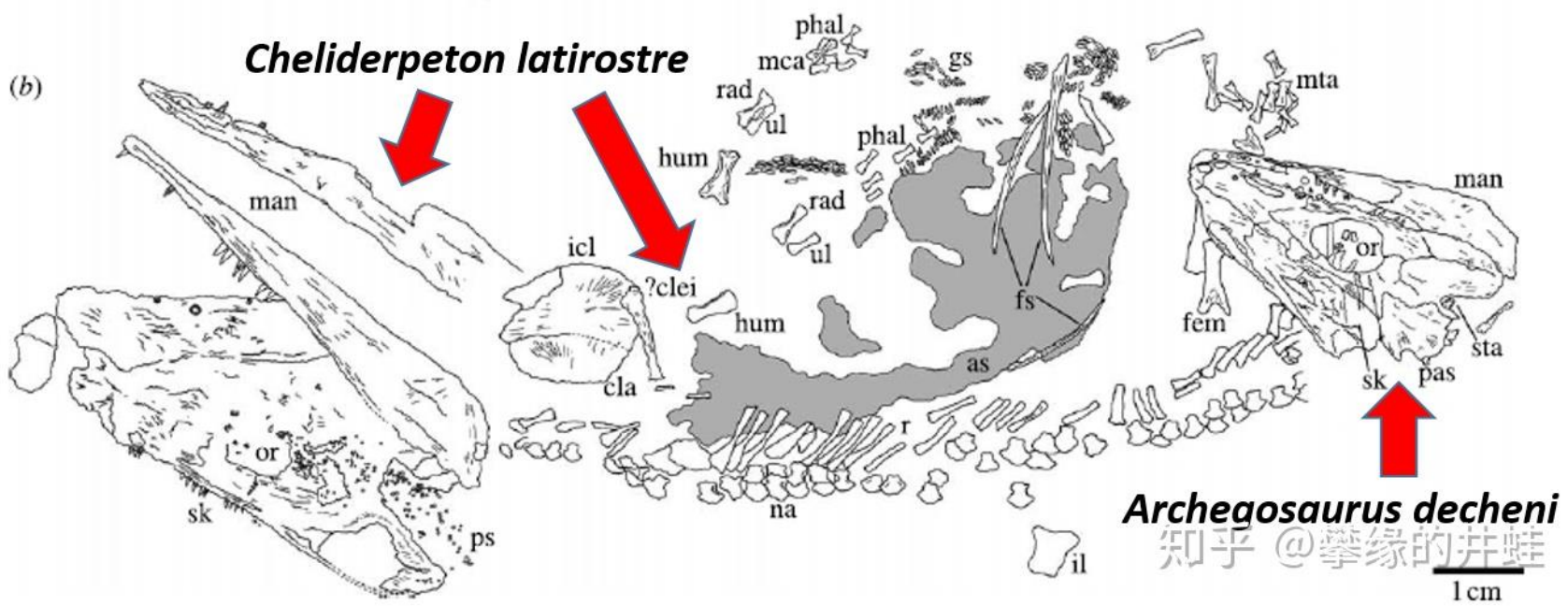
## ■ 旋齿鲨

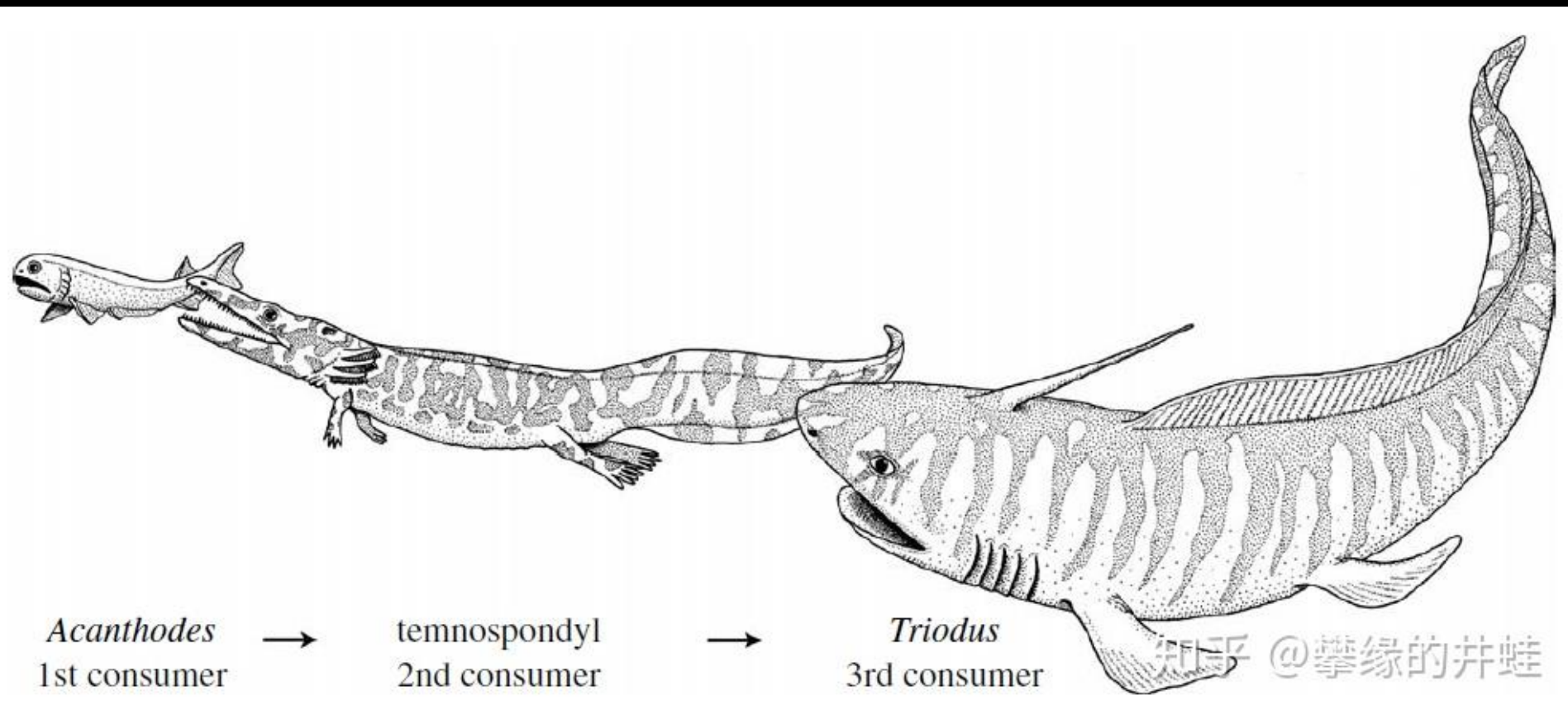


(a)



(b)





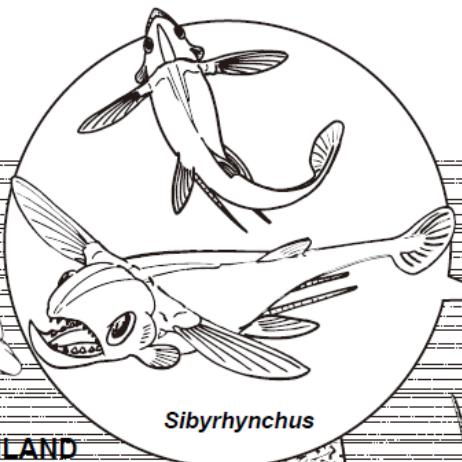
# *Hybodus*

## ■ 弓鲛

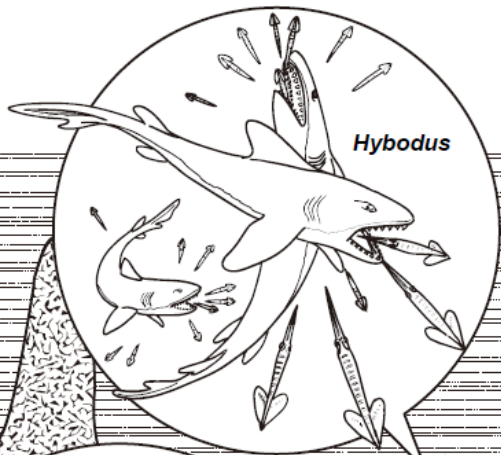




SWAMPS

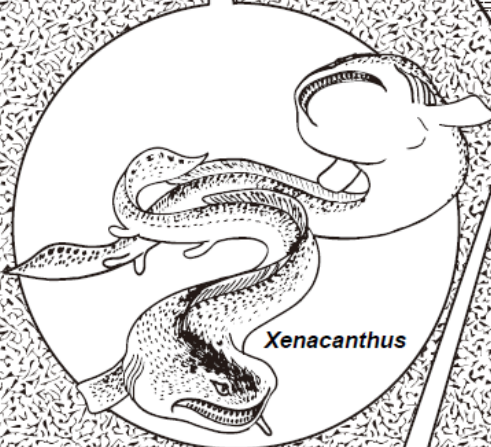


Sibirhynchus

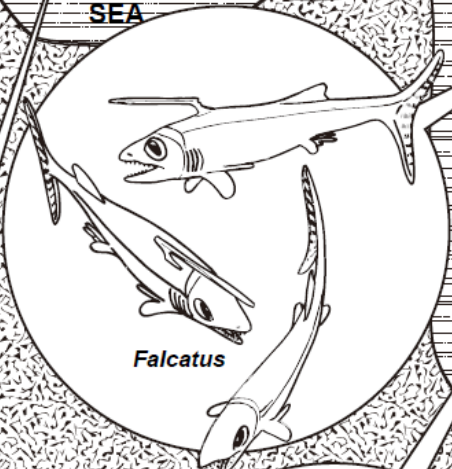


Hybodius

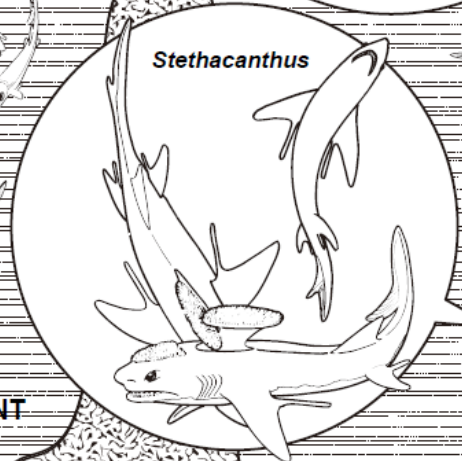
INLAND SEA



Xenacanthus

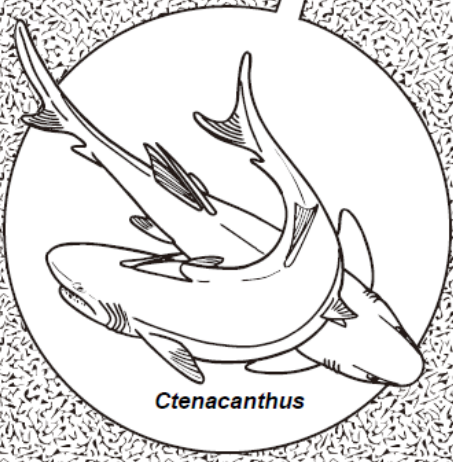


Falcatus

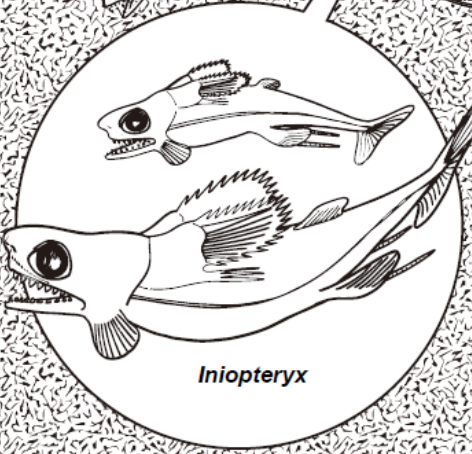


Stethacanthus

SEAMOUNT

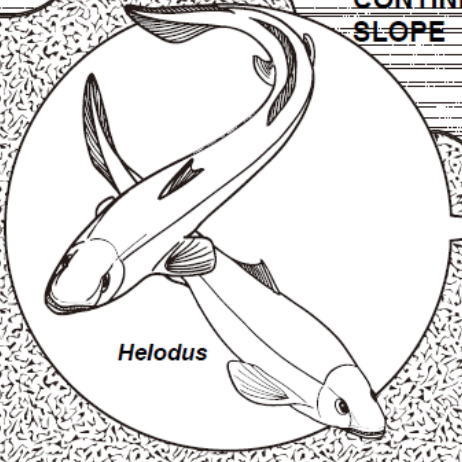


Ctenacanthus



Iniopteryx

CONTINENTAL SLOPE



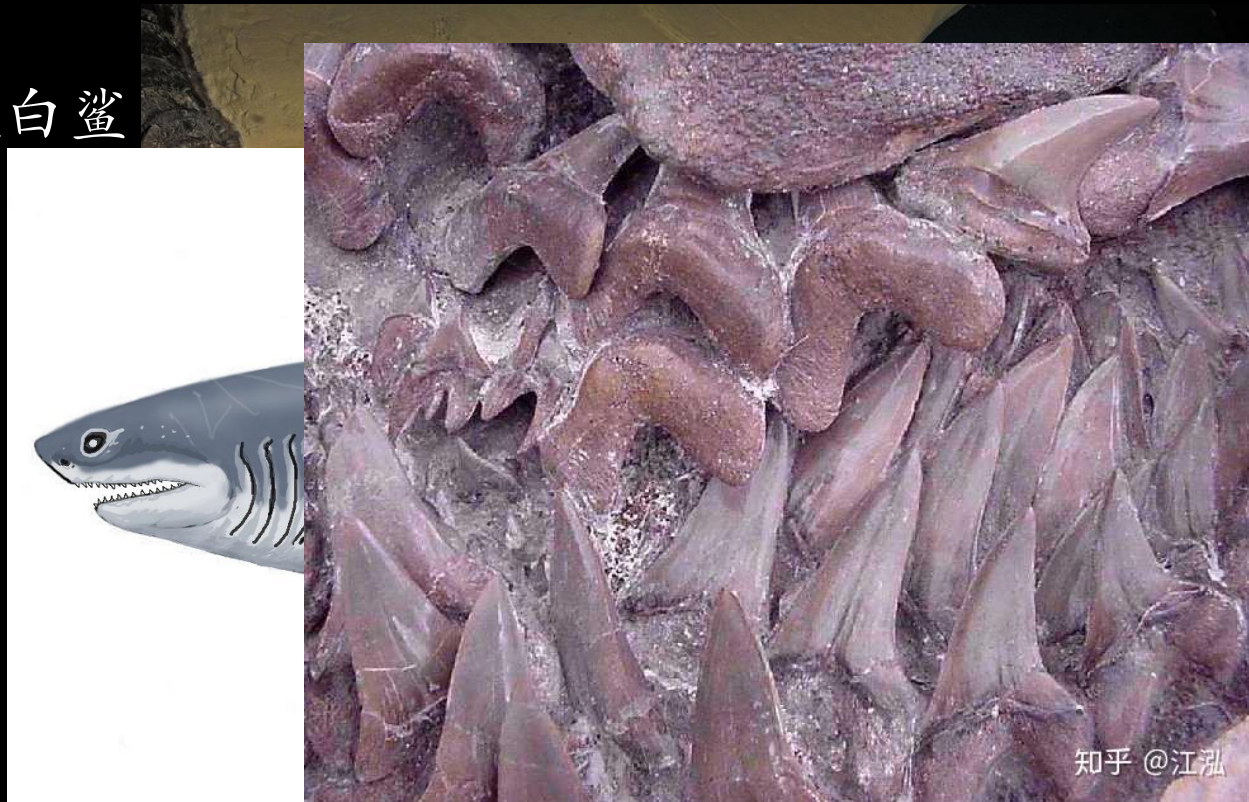
Helodus



DEEP SEA

# Cretoxyrhina

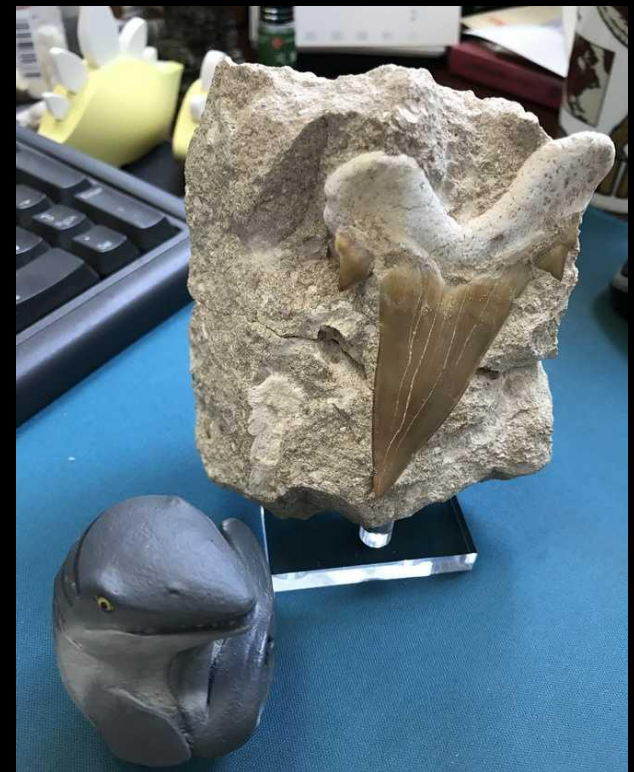
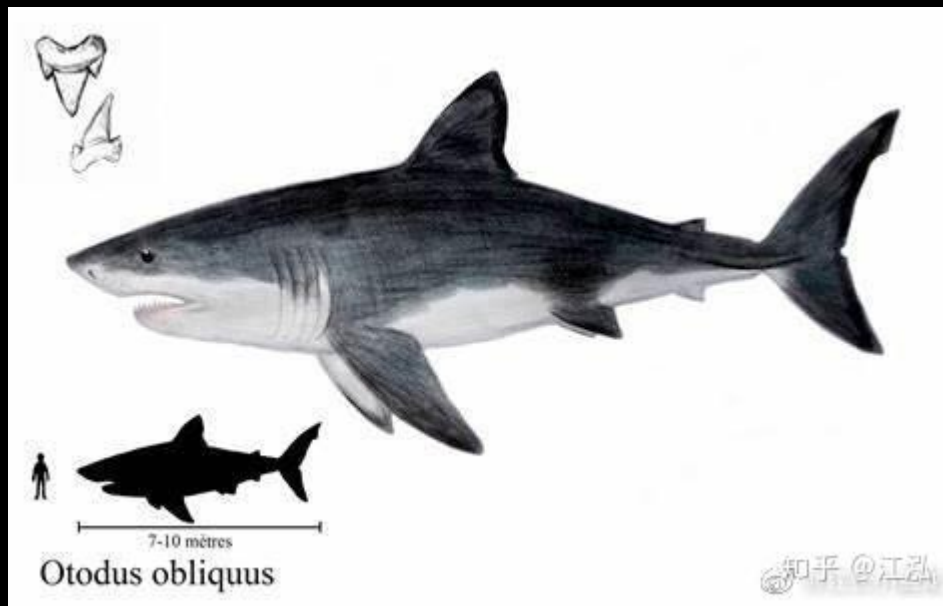
- 白垩刺甲鲨
- 白垩纪的大白鲨
- Ginsu shark
- 金厨鲨



*Cretoxyrhina Mantelli*

# Otodus

## ■ 耳齿鲨



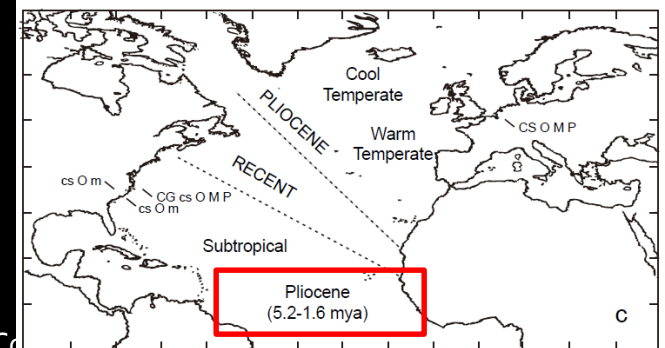
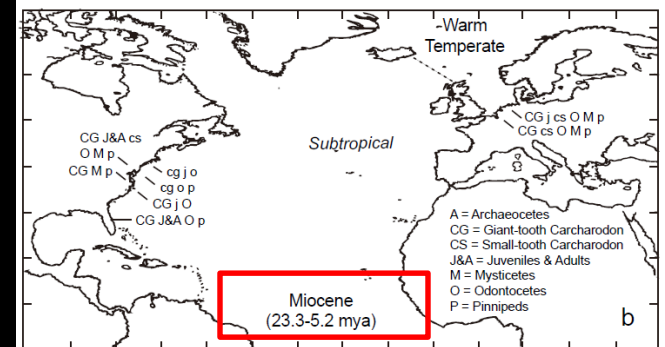
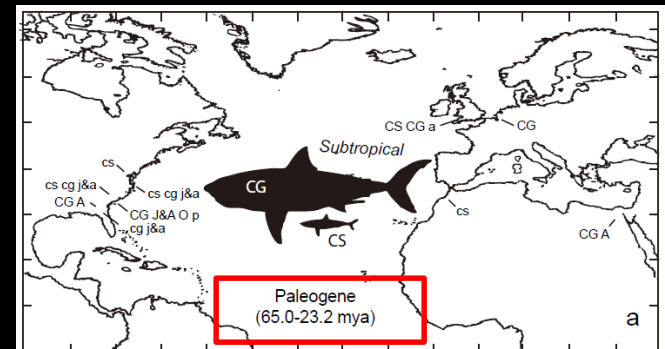
*Carcharocles Me*

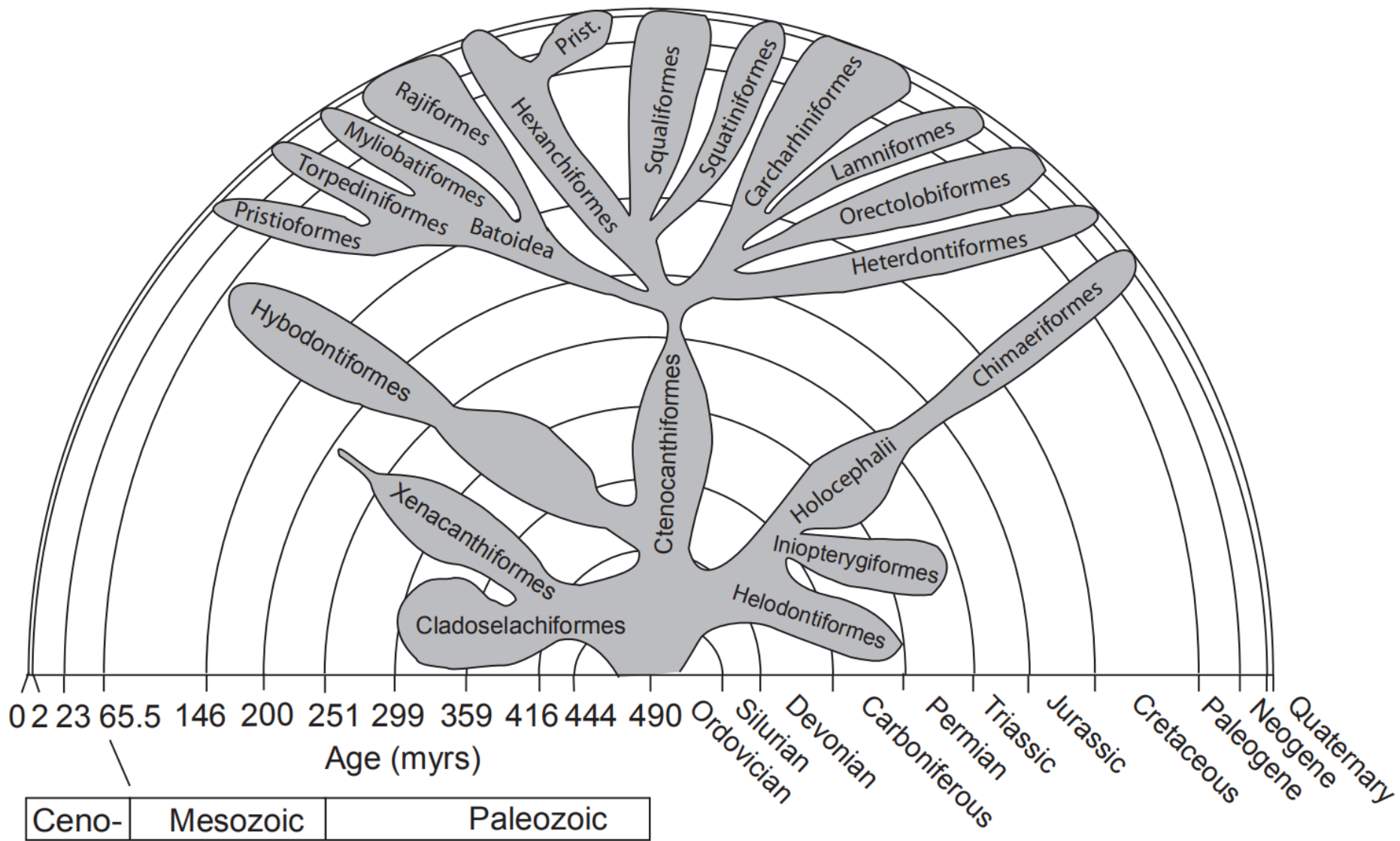
■ 巨齿鲨

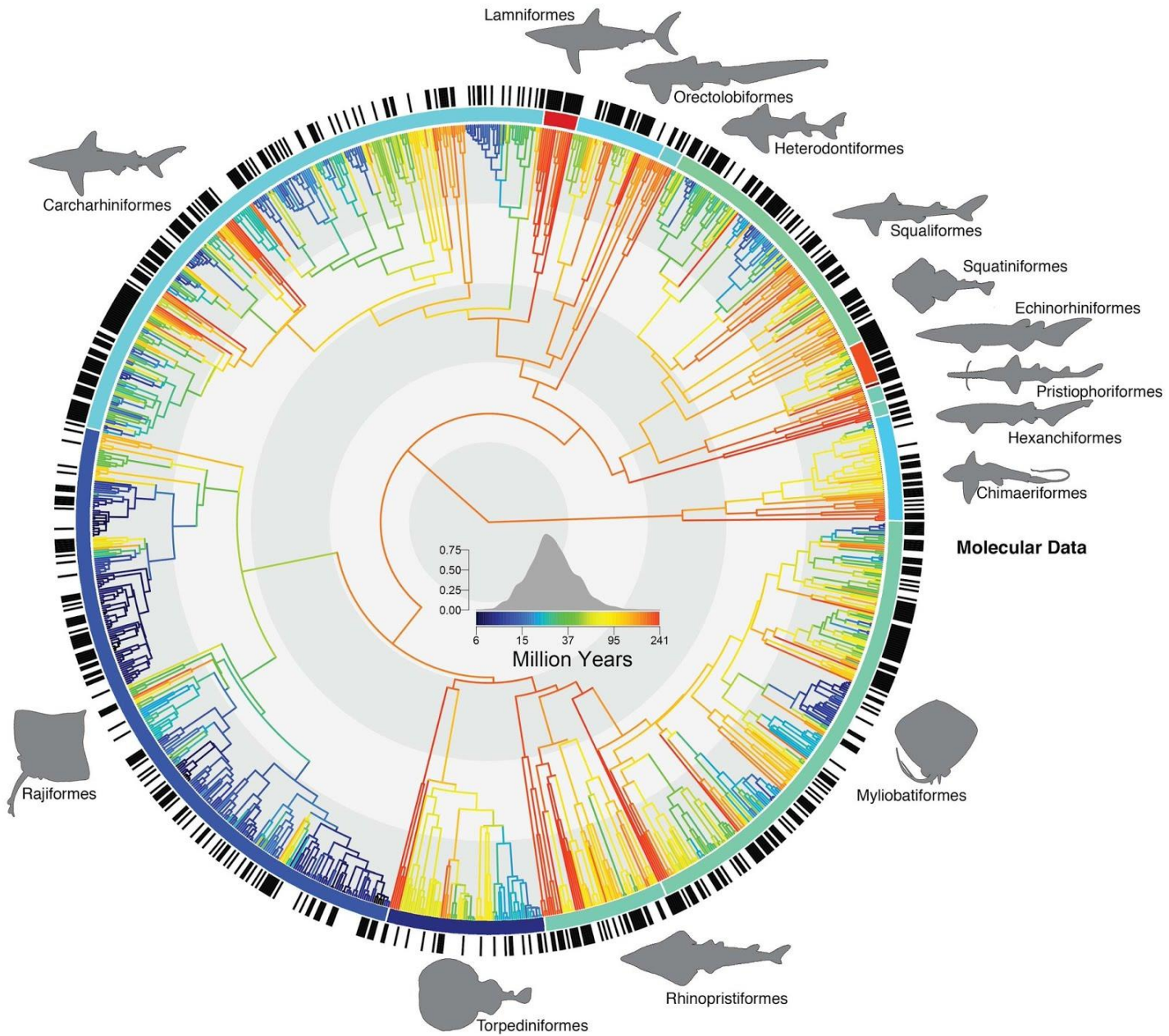


# *Carcharodon megalodon*

- *Megalodon* (23 to 3.6 million years ago)
- White shark (3.6 million years ago -)







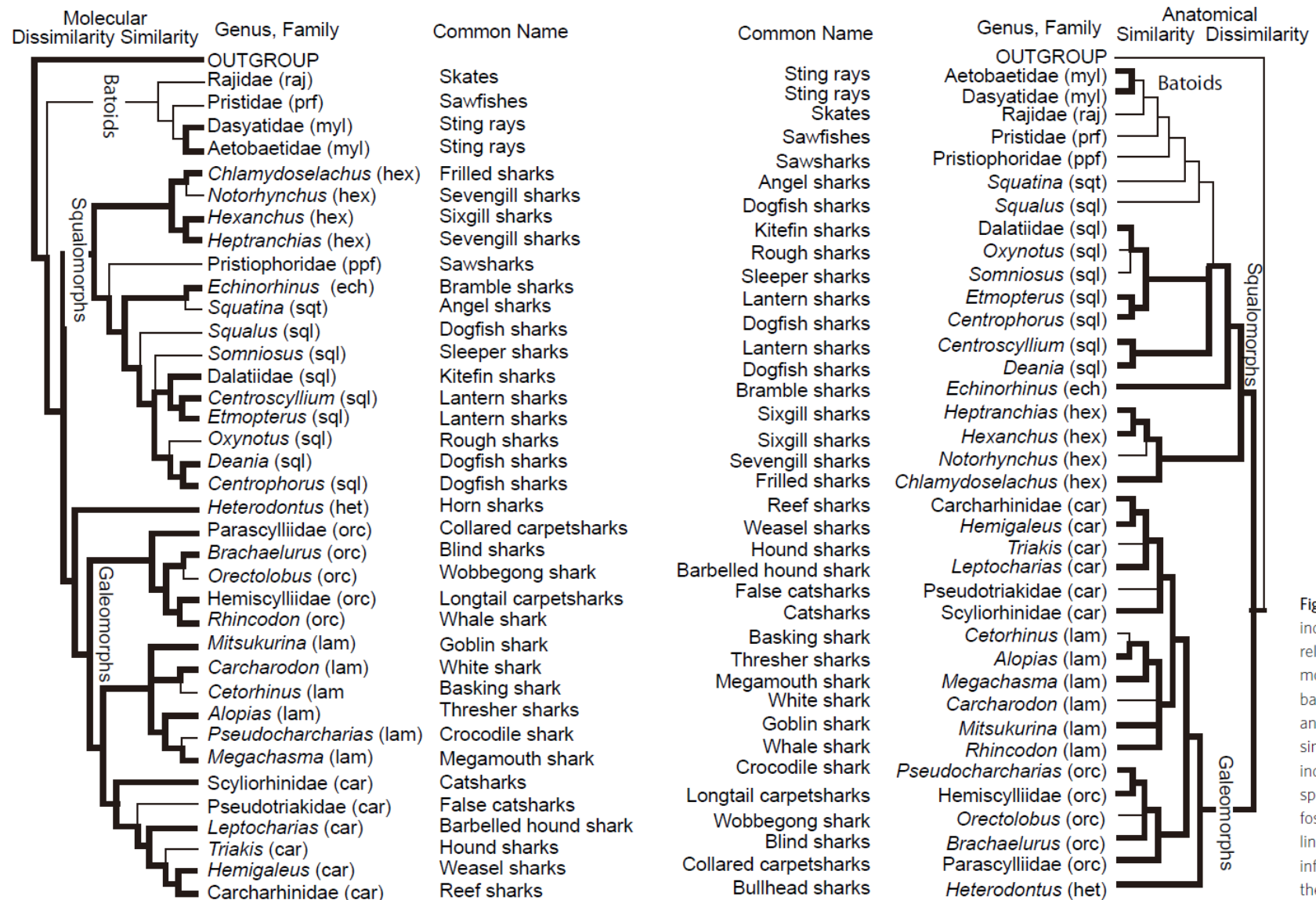


Fig. 2.13 Evolutionary trees indicating the phylogenetic relationships among the modern sharks and rays based on molecular (left) and anatomical (right) similarity. The bold lines indicate the presence of species preserved in the fossil record and the thin lines the relationships inferred only on the basis of the two types of similarity.

Orders: Carchariformes (car); Echinorhiniformes (ech); Heterodontiformes (het); Hexanchiformes (hex); Lamniformes (lam); Myliobatiformes (myl); Orectolobiformes (orc); Pristiformes (prf); Pristiophoriformes (ppf); Rajiformes (raj); Squaliformes (sql); Squatiformes (sqt).



- The Squalomorphi are considered more primitive in their anatomy, possessing smaller brains, and having evolved in deepwater environments, where they are currently more abundant.
- The Galeomorphi are more advanced in their anatomy, have larger brains, and are likely to have evolved in shallow water tropical environments, where they are currently most abundant.

# CREATURES OF THE CLASS CHONDRICHTHYES



1 COOKCUTTER SHARK 2 THRISHER SHARK 3 STARRY SMOOTH-NOSED SHARK 4 NARROWNOSE CHIMAERA 5 DWARF SANDSHARK 6 PORT JACKSON SHARK 7 AUSTRALIAN GHOSTSHARK 8 GIANT OCEANIC MANTA RAY 9 LESTER ELECTRIC RAY 10 BULL SHARK 11 COMMON RAY 12 LEOPARD SHARK 13 ATLANTIC GUITARFISH 14 COMMON STINGRAY 15 ZEBRA SHARK 16 WHITE SHARK 17 PACIFIC SPINNOCK 18 SPOTTED NOBBLING 19 THORNBACK SKATE 20 BLUESPOTTED RIBBONTAIL RAY 21 GREAT WHITE SHARK 22 WHALE SHARK 23 SPOTTED TIGER RAY 24 AUSTRALIAN ANGLESHARK 25 SPINY DOGFISH 26 GREAT HAMMERHEAD 27 BLACKTIP SHARK 28 PYGMAE SHARK 29 LONGNOSE TINTINNACK 30 TALLEST SHARK 31 JAPANESE BULLHEAD SHARK