LIFE OF THE EARLY AND MIDDLE PALEOZOIC

Phylogeny of the Vertebrates

PHYLUM CHORDATA

- Gill slits
- Chevron-folded muscles
- Dorsal nerve cord
- Dorsal central stiffening structure just ventral to the nerve cord - Notochord
- Tail (Caudal) fin

Chordates and Echinoderms

1

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Vertebrata / Craniata

- Cephalization (brain with eyes, olfactory & ear capsules)
- Bony plating around head
- Bony scales
- Segmented structures around the notochord (Vertebrae)
- Fin for control during swimming

Agnatha - jawless fish - Ordovician to Recent

Sacahamaspis
Oldest known vertebrate - Ordovician
Agnatha

Diversified through the Silurian and into the Devonian.

After the Devonian we lose their fossil record because they lost their boney skeletons.

Cephalaspid Agnathan head

Electrical field

Electrical nares

Pineal eye

Orbit

A few more agnathans

The only surviving agnathans are lampreys and hagfish. Lampreys are parasitic on living fish and hagfish only eat rotting flesh.
Agnathans only have 2 semicircular canals.

**Phylogeny of the Vertebrates**

- Agnathans
- Gnathostomes have jaws

**Placoderms** - appear at the end of the Silurian, become very diverse in the Devonian and go extinct in Mississippian

- Jaws (not earliest)
- 3 semicircular canals
- Internal skeleton cartilage
- Head and shoulders covered with boney armor
- No ‘true’ teeth
- Ball and socket joint between head and shoulder armor

Carnivorous

Scavengers
CHONDRICTHYES

Appear in Devonian and continue to diversify today.
- Sharks, rays and skates
- Cartilaginous skeletons
- ‘True teeth’ - enamel & dentine - teeth derived from scales.
- Teeth are ‘ever growing’
Steno's original illustration of a modern shark, from a 1667 woodcut.

“Ever growing” teeth.

Cladoselache
Devonian
3 feet long

Various Paleozoic Sharks

More Paleozoic Sharks

Helicoprism
Modern Chondrichyians

- Thresher
- Hammerhead
- Great White

Hammerhead

Chondrichthians

- First jawed fishes, fin spines from the Lower Silurian: extinct in Permian
- Greatest diversity in Devonian
- Mixture of osteichthian and chondrichthian characters
- Fin Spines

Phylogeny of the Vertebrates

Teleostomi
- Verte. with single gill opening

ACANTHODIA

- Osteichthyes
- Boney internal skeleton

Phylogeny of the Vertebrates
(Actinopterygii) (Ray-finned fish) Appear in the Devonian and make up over 90% of all modern fish

Cheirolepis (Devonian) - up to 20 cm long

Osteichthyes

Xiphactinus (Devonian) - Age of Fish

Acanthodians

Osteichthyes

Placoderms

Agnathans

DEVO NIAN - AGE OF FISH
Sarcopterygia

(Fleshy finned fish)

Appear in Devonian and are still around today.

Coelacanth

Actinopterygian

Sarcopterygian

Phylogeny of the Vertebrates
Choanata

The Dipnoi (lung fish) are surviving, little-changed, examples of primitive choanates and are the sister group of all vertebrates with true legs (tetrapods). As choanates they have external nostrils that pass into the mouth, and lungs.

Eusthenopteron is an extinct early choanate that is closer to the primitive group that gave rise to the first tetrapods than are the lung fish.
Vascular plants diversified in the Devonian, though they first appeared in the Silurian. The first arborescent forms appear by the end of the Devonian.

As the vascular plants began to invade the land so did the first terrestrial animals, scorpions, spiders and millipedes—all arthropods.
We will finish the Devonian in the next lecture.