16 - Paleozoic Invertebrates

Continents

- Six major continents (before Pangaea)

Epeiric Seas

- Formed on the shelves during episodes of transgressions

Avalon Explosion

- The Ediacaran Fauna were the first wide-spread group of animals that were complex and diverse
- This population boom occurred rather quickly at the end of the Precambrian
- May be first multicellular fauna
- Peaked around 570-580 MYA but began earlier

Invertebrates

Dickinsonia

- Wide slug
- Possibly first animal

Spriggina

- Trilobite-like animal
- Early prototype of an arthopod

Charnia

- Flexible blade like structure that would capture bits of organic nutrients floating by
- It was sessile (attached to the seafloor)
- Similar to coral

Kimberella

- Slug like creature
- Wavy corrugated fringe along the side

Cambrian Explosion

- We start to see organic mineralization (shells, teeth, skeletons)

Why?

- More predation, predators developed traits to help them capture prey
- Prey needed traits to help them defend themselves (exoskeletons, shells, vision, speed, ability to burrow)
- Many were both predator and prey
- Chemistry changes in ocean
- Lots of shoreline = lots of reefs

Advantages of Shells and Exoskeletons

- Protection from predators
- Protection from UV light (most reefs in photic zone)
- When the tide goes out, shelled organisms don't dry out
- Promotes growth, like snails

Creatures

Ottoia

- Predatory, carnivorous worm
- Creature that burrowed and had a probiscis that stuck out

Wiwaxia

- Scaly, armored, slug-like

Hallucigenia

- Worm like thing with many legs and spikes

Pelagic

- Live in the water column
    - Water from bottom to top
    - Not including the Benthos

Planktonic

- Microorganisms
- some macro organisms (some jellyfish)

Nektonic

- Fish
- Cephalopods (octopus, squid)
- Most jellyfish

Benthic

Epifauna

- Live on top of the ocean floor
- Some sessile (they don't move)
- Some mobile (they move)
- Some are a combination of sessile and mobile

Infauna

- Buried/burrowed into the mud

Phyla

Arthropoda

- "Jointed foot"
- Jointed exoskeleton made of chitin and sometimes calcite
- Bilateral
- Molts
- Complex, sensitive eyes and antennae

Echinodermata

- Five-fold symmetry
- Sea urchins, sand dollars, starfish, crinoids, sea cucumbers
- Regeneration of body parts
- Usually covered in hard plates
    - Name means spiny skin
- Variety of feeding habits

Cnidaria

- Also known as Coelenterates
- "Nettle-thingy"
- Coral
    - Polyps
        - Little animals that live on a branch of coral
    - Contains algae that gives it energy in exchange for shelter and CO_2

    - Also eats tiny plankton
- Anemone
    - Sting food with tentacles
    - Pulls food into mouth
    - Sessile
    - Like a large polyp
    - Finger trap
- Jellyfish
    - Like a large upside down polyp
    - Plankton and even larger prey
    - Mostly Nektonic
    - (Prey entangled and stung by tentacles)
- Stinging barbs called nematocysts

Mollusca

- Most have
    - A soft body
    - A mantle
    - No segments (ex. like arthropods or vertebrates)
    - Most have calcareous shell
        - Inner (cuttlebone, belemnite)
        - Outer (snail, ammonoids, nautilus, almost all bivalves)
            - clams, oysters, mussels, scallops

Cephalopoda (Class)

- Octopus, squid, cuttlefish
- Ceph = head, Poda = foot/leg $\Rightarrow$ headfoot
- Some of the most intelligent invertebrates
    - Jet propulsion
    - Mantle
        - Encloses their guts (visceral mass)
        - Like skin, but also like muscle, down and across their backs
        - Useful body parts are made from mantle
        - Capable of secreting calcium carbonate to make shells with
    - Camouflage (can be active camouflage)
    - Only example of cephalopod with a shell today is a nautilus
- Orthoceras
    - Straight Horn
    - Ancestor of modern squid

    - Straight, chambered shell with siphuncle
    - Tentacles used for collecting food
    - Used water at "jet propulsion"

Gastropoda (Class)

- Gastro = stomach, poda = foot/leg $\Rightarrow$ bellyfoot
- Only mollusca to have moved on land
- Snails, slugs
- Extremely diverse
- Marine, freshwater, terrestrial
- Radula (licks things)
    - Lickers made of hardest organic substance of any thing alive
    - Rough tongue

Bivalvia (Class)

- Two shells (valves) hinged together
- Some burrow, swim, or are sessile
- Clams, oysters, mussels, scallops
- Gills used for breathing and collecting food

Tardigrades

- Eight legs
- Can survive extreme environments
- Since about 530 million years ago

Ordovician Invertebrates

- Many pre-existing life from the Cambrian
- Reef systems now contain corals

Brachiopods

- Armfoot
- Not a bivalve
- One shell bigger than the other
- Leg thing sticks out between larger and smaller

Coral

- Breathe and gather food through internal gills
- Symbiotic algae

- Corals are called "polyps"
- Phylum Cnidaria
- Polyps live in the corallites

Rugose Coral

- Can be solitary

Tabulate Coral

- Long corallites
- Multiple tabula lines horizontally through the long corallites
- Always colonial

Bryozoans

- Breathe and gather food through external lophophores
- Zooids
- Phylum Bryozoa
  - It has its own phylum

Similarities between Coral and Bryozoans

- Both are colonial
- Both live in a calcite cup (theca)
- They both can form branching structures but other forms as well
- Both filter-feeders
- …

First Mass Extinction

- Occurs at the end of the Ordovician Period
- Ice Age
- When plants moved onto land, photosynthesis boomed, and more carbon dioxide …

Silurian and Devonian Invertebrates

Gastropods

- Stomach foot
- Snails and slugs
- Shells that coils in pointed spiral
- Shell is one hollow space, grows larger as the gastropod grows larger
- Toothy tongue (radula)

Eurypterids

- Arthropod
- Broad wing
- Swimmers (nektonic)
- Predators
- "Sea scorpions"
    - Likely the ancestors of today's scorpions

Bivalves

- Mollusks
- Clams, oysters, scallops, mussels
- Two shells hinged together (left and right valve)
- Filter feeds and breathes through a gill
- Internal gills (brachiopods have external lophophores)
- The shells are mirror images (unlike brachiopods)

Crinoids

- Echinoderms
- Related to starfish
- Long, skinny, noodle-like arms
- Feathery things to collect food
- Stalk/stem
- Holdfast

Ammonoids

- Extinct Cephalopods (mainly with coiled shells)
- Chambered shells
- Shells are planar in shape and are divided into multiple chambers
- Predatory, with tentacles to grab food
- They would bring with food to their beak, in the center of the tentacles

Carboniferous and Permian Invertebrates

- Slow decline in oceanic biodiversity

Fusulinids

- Looks like rice
- Type of Foraminifera Plankton

- Single-celled, appeared in Silurian
- Ubiquitous Carbonate Fossil

Insects and Arachnids

- Appear to have origins in the sea, from marine arthropods such as eurypterids and the ancestors of horseshoe crab
- Earliest land fossils date from the Silurian, such as ancient millipedes and centipedes
- Many insects including dragonflies by the Carboniferous