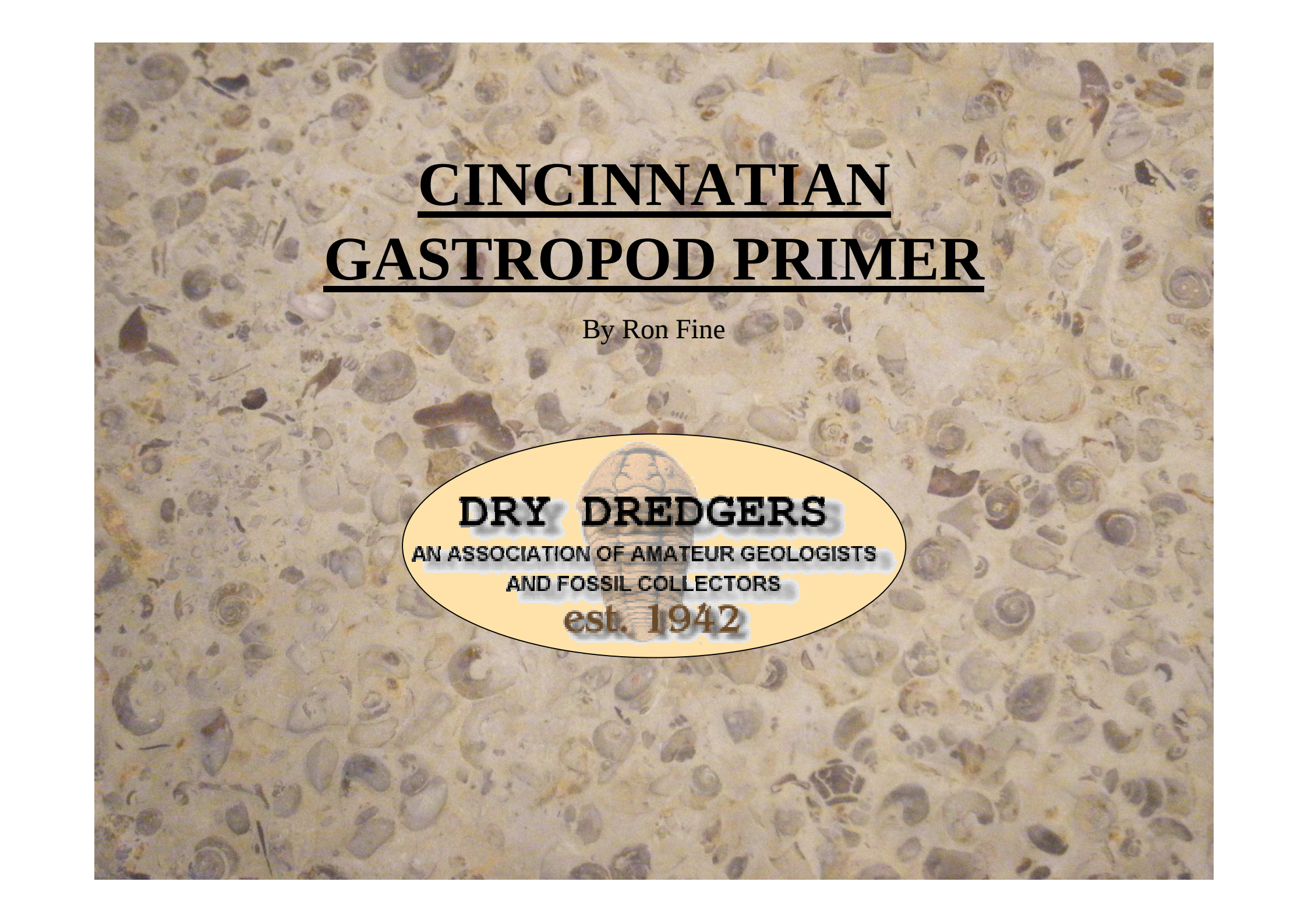




CINCINNATIAN **GASTROPOD PRIMER**

By Ron Fine

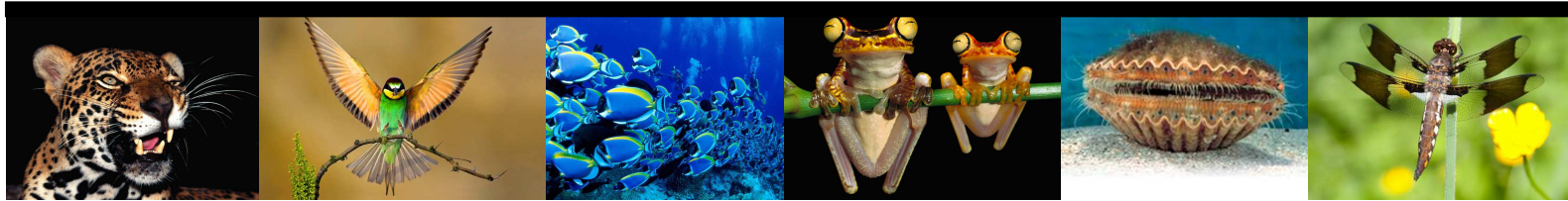
DRY DREDGERS

AN ASSOCIATION OF AMATEUR GEOLOGISTS
AND FOSSIL COLLECTORS

est. 1942

HOW DO SCIENTISTS CLASSIFY GASTROPODS?

KINGDOM: Animalia (Animals)



Mammals

Birds

Fish

Amphibians

Molluscs

Insects

PHYLUM: Mollusca (Molluscs)



Cephalopods

Gastropods

Bivalves

Monoplacophorans

Scaphopods

Aplacophorans

Polyplacophorans

CLASS: Gastropoda (Gastropods or Snails)



Gastropods

HOW MANY KINDS OF GASTROPODS ARE THERE?

There are 611 Families of gastropods, but 202 are now extinct



Slug



Land Snail



Limpet



Conch



Whelk



Periwinkle



Sea Butterfly



Oyster Borer



Cowrie



Nudibranch

A large collection of various seashells of different shapes, sizes, and colors arranged on a light background. The shells include large conch shells, small pebbles, spiral shells, and many others with intricate patterns and colors like orange, white, brown, and black.

**THERE ARE 60,000 TO 80,000
SPECIES!**

**IN ENDLESS SHAPES AND
PATTERNS!**

HABITAT-WHERE DO GASTROPODS LIVE?



Gardens



Deserts



Ocean Depths



Mountains



Ditches



Rivers



Lakes



Estuaries



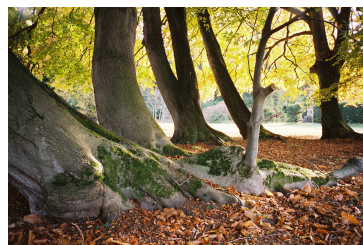
Mud Flats



Tropical Rain
Forests



Rocky Intertidal
Zones



Woodlands



Subtidal Zones



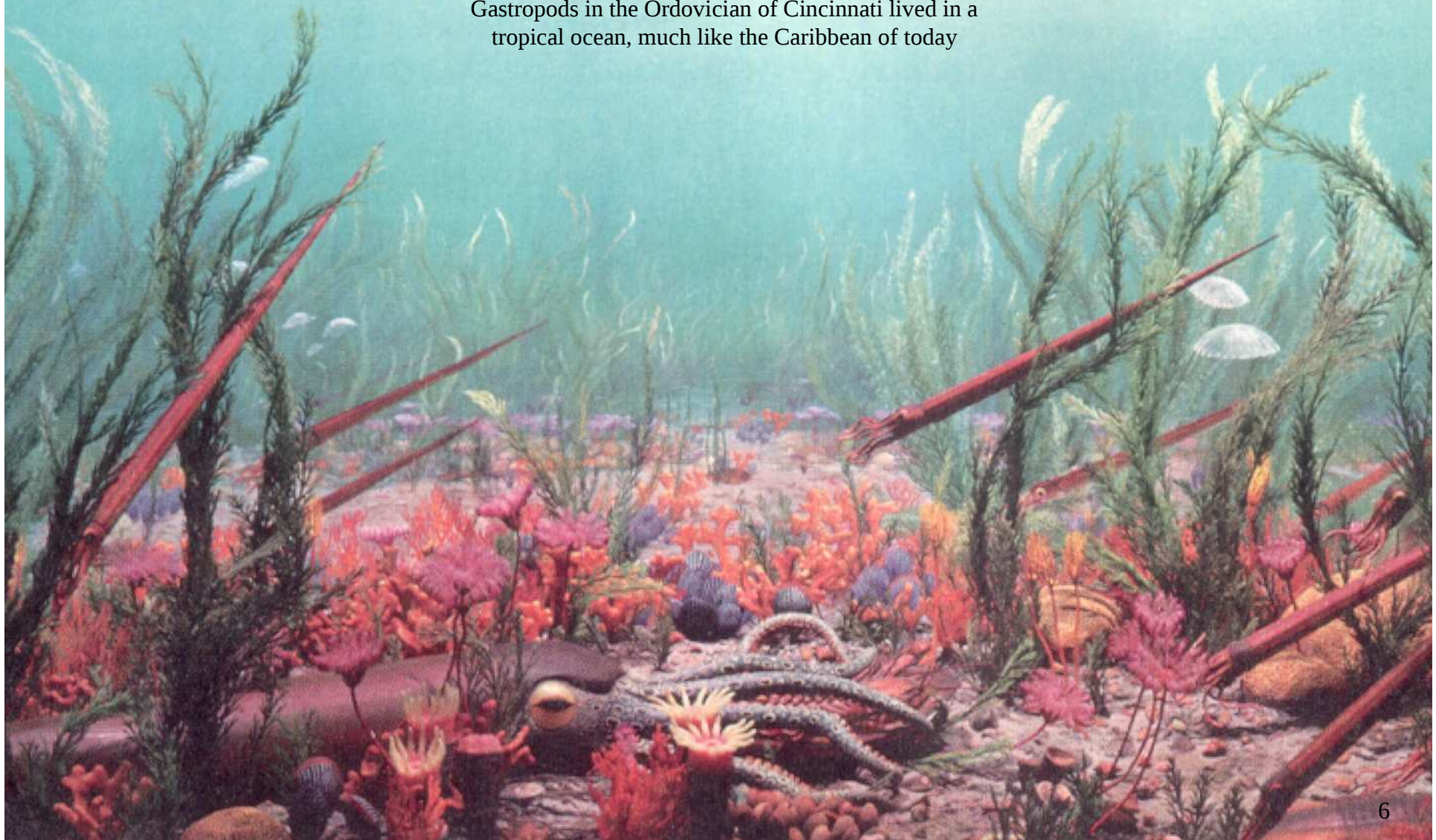
Hydrothermal Vents



Sub-Arctic/Antarctic

HABITAT-WHAT WAS IT LIKE IN THE ORDOVICIAN?

Gastropods in the Ordovician of Cincinnati lived in a tropical ocean, much like the Caribbean of today



DIET-WHAT DO GASTROPODS EAT?



Herbivores

Plant Eaters



Detritus

Mud Eaters



Parasites

Living on other animals



Scavengers

Eat dead animals



Ciliary

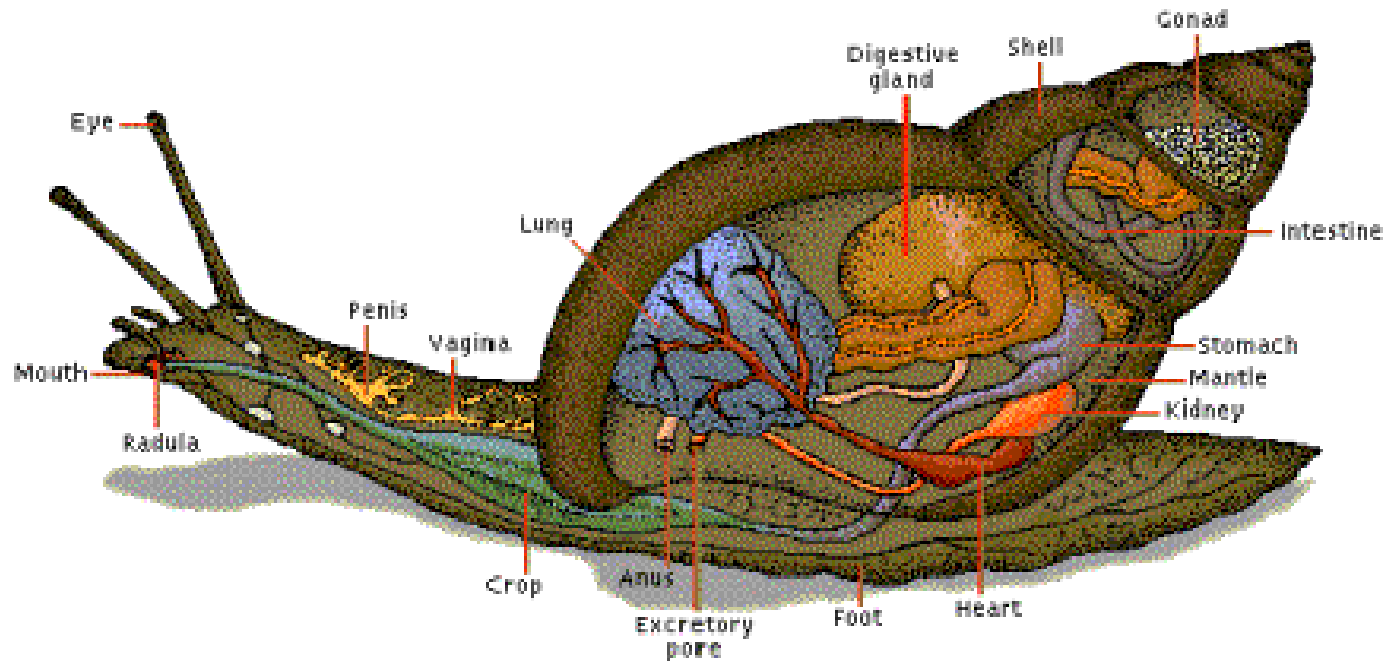
Filter feeding in the water



Carnivores

Meat Eaters

ANATOMY-HOW DO YOU IDENTIFY A GASTROPOD?



Gastropod is Greek, from “gaster” meaning ‘stomach’ and “poda” meaning ‘foot’

They are characterized by a head with antennae, a large foot, coiled shell, a radula and operculum

Torsion: all of a gastropod’s anatomy is twisted, not just the shell

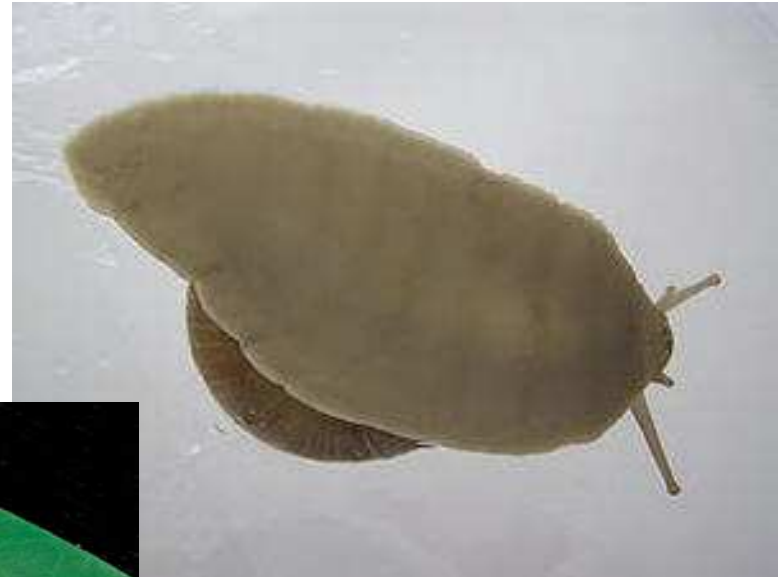
They are the largest group of molluscs, only insects are more diverse

Most are hermaphrodites

GASTROPOD ANATOMY-FOOT



Gastropods have a large “foot”, used for locomotion.



Undulating bands of muscles propel the gastropod forward, even on vertical surfaces.

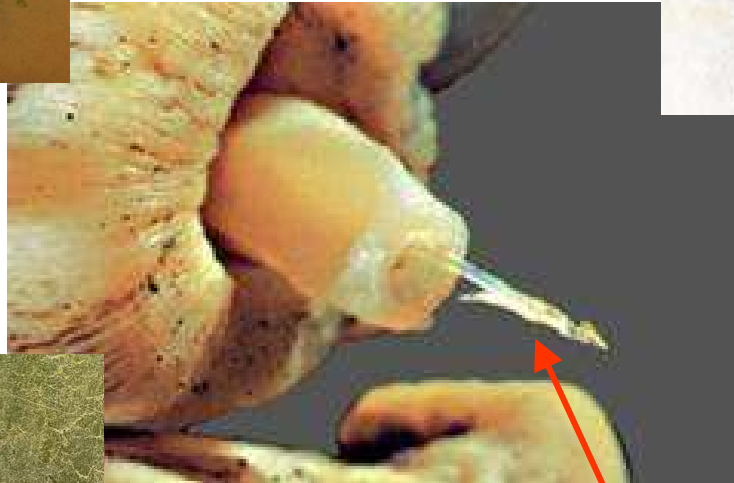


SLIME! Gastropods excrete slime to help their foot glide over almost any surface.

GASTROPOD ANATOMY-RADULA



All Molluscs, except for the bivalves, use a hard chitinous toothy structure, the radula, for gathering food.



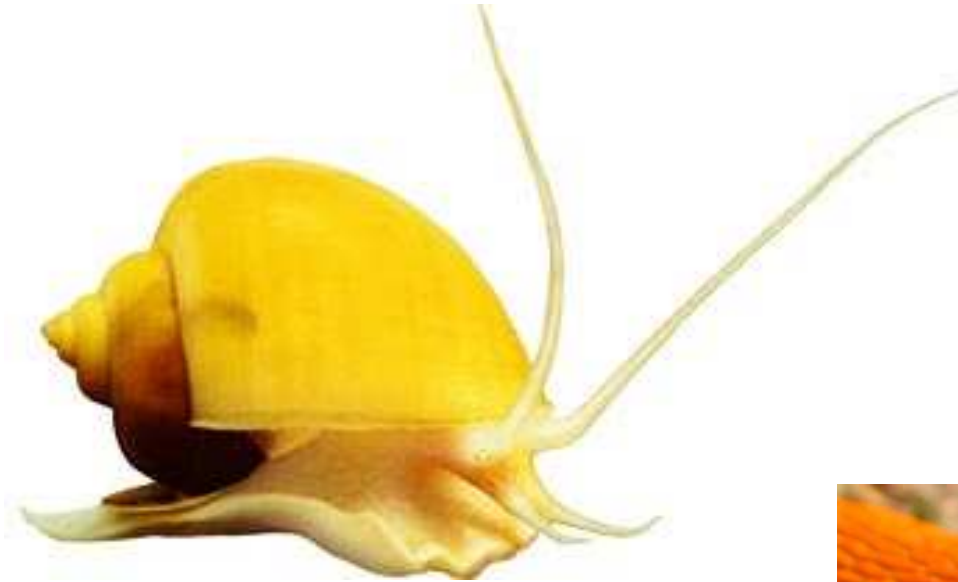
Some predatory snails use their radula to bore holes through shells, then suck out the soft parts. You can find tiny holes similar to this one on many brachiopods in the Cincinnati.



Most Gastropods are herbivores, using their radula to scrape algae and diatoms off the surface of rocks, or eat the lettuce in your garden.

The cone snails have a dart-shaped radula, fired like a harpoon, for capturing prey.

GASTROPOD ANATOMY-ANTENNA



Pomacea diffusa, the Spike Topped Apple Snail, has very long antennae.



Many gastropods, such as this Conch, have simple eyes on their antennae.



Gastropods have 2 or 4 antennae with sensory organs for feeling their way around, finding food, or detecting danger.

GASTROPOD ANATOMY-OPERCULUM

Most gastropods have a calcareous cover, or plate, attached to their foot. Terrestrial and tidal zone gastropods use the operculum to seal their shell to prevent drying out when water is scarce.



When a gastropod withdraws into its shell, as this Whelk has done, the operculum covers the opening to protect it from predators.

GASTROPOD ANATOMY-COILED SHELL



The most prominent feature of gastropods is the coiled shell. Its found in nearly all gastropods, except Slugs and Nudibranches. Its also the only part of the gastropod preserved in the Cincinnatian.



CONISPIRAL

The shell coils to one side, gradually tapering to a point.



Some shells have a twist all their own, *Tenagodus anguina*, Squamous Worm Snail



PLANISPIRAL

The shell coils in a single plane, overlapping itself.

NOT A GASTROPOD!



Nautilus pompilius , Chambered Nautilus

Not all coiled shells belong to gastropods. Many cephalopods, most now extinct, also possess them.



Cephalopod shells have chambers.
Gastropod shells do not.



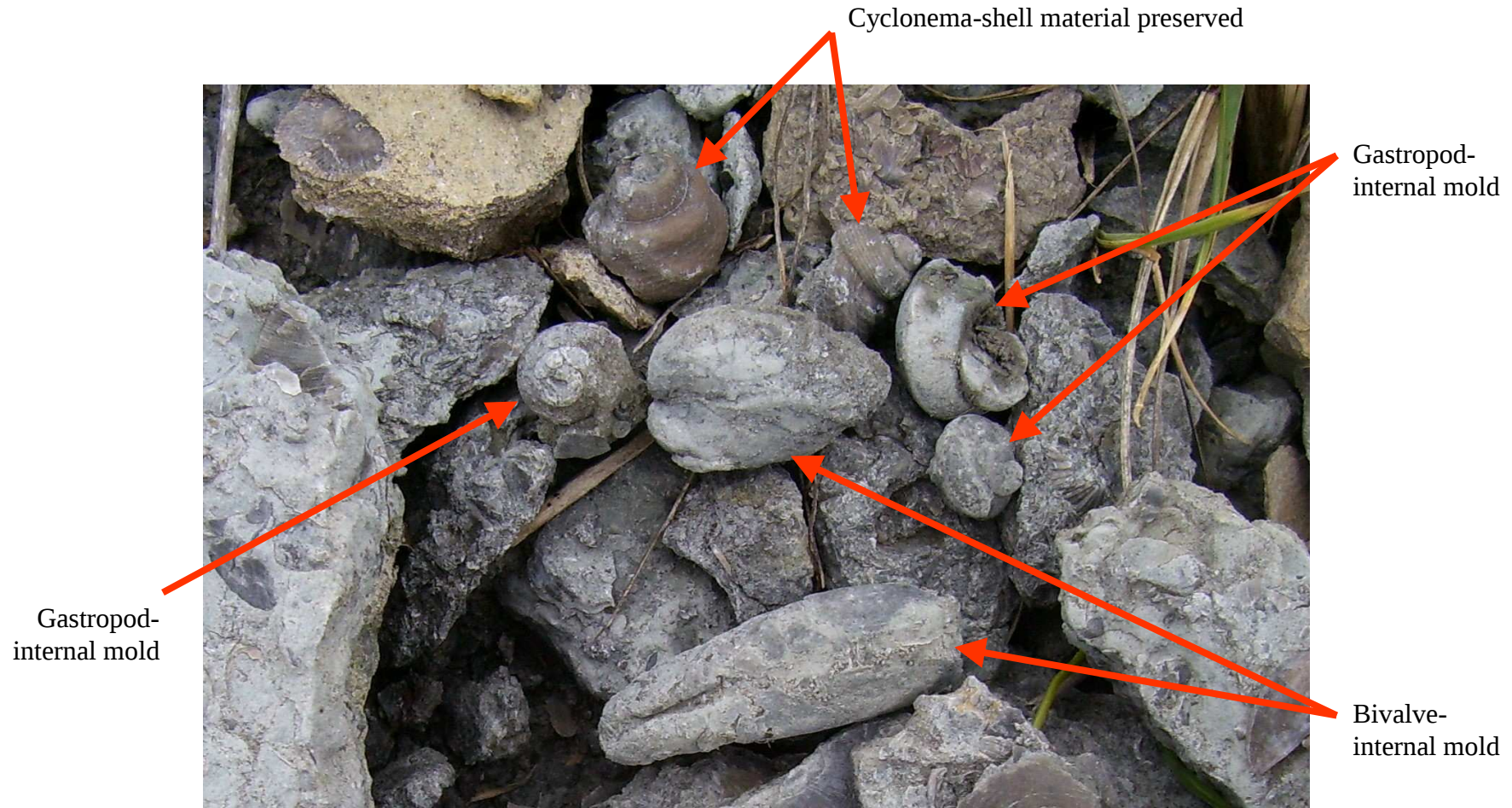
Ammonite with original shell material

WHAT KIND OF GASTROPODS CAN YOU FIND IN THE CINCINNATIAN?



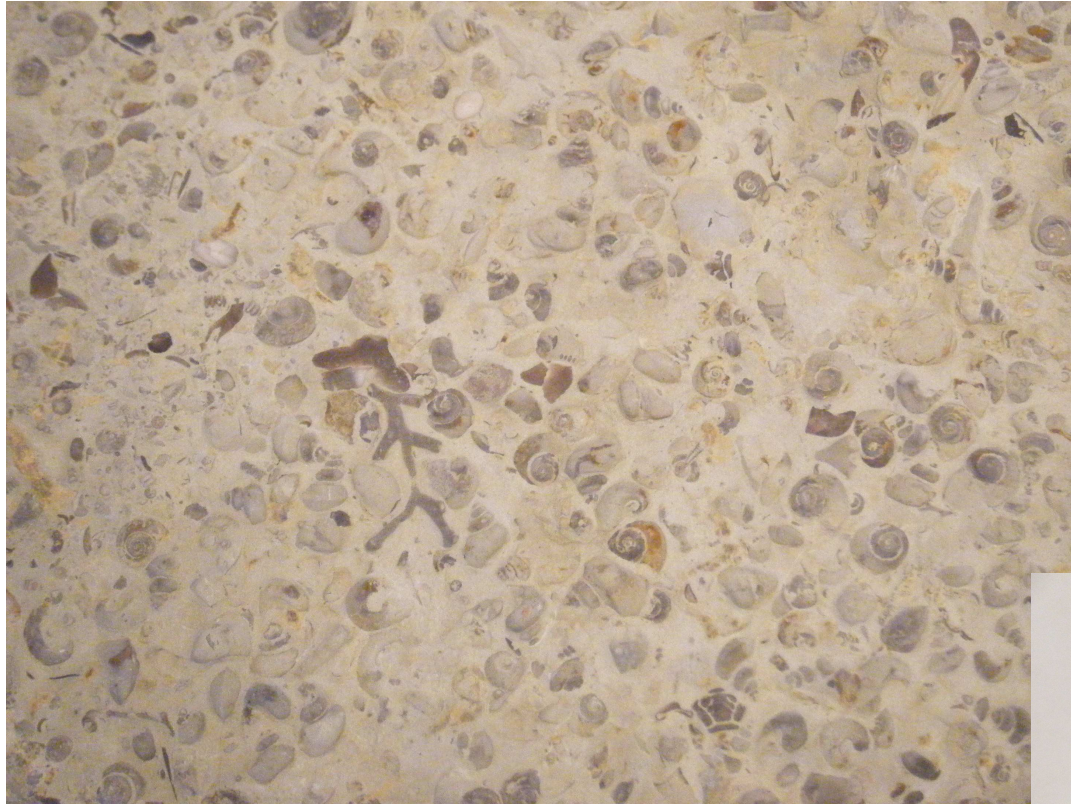
Gastropods can be found from the late Cambrian to the present day. The Cincinnati, part of the Ordovician, has abundant varieties and quantities.

CINCINNATIAN GASTROPODS-PRESERVATION



Mollusc shells are typically composed of a phosphatic substance called Aragonite. Unfortunately Aragonite does not preserve well in the Cincinnati, so most gastropod fossils are internal molds. An exception is Cyclonema.

CINCINNATIAN GASTROPODS-ABUNDANCE



Gastropods in the Cincinnati are quite plentiful as loose fossils. But they also occur in dense layers that run for miles.



CINCINNATIAN GASTROPODS



Cyclonema humerosum (Ulrich) 1 inch
Grant Lake to Waynesville Formations

Cyclonema is one of the few
Cincinnatian gastropods that
preserves as a shell instead of an
internal mold.



Cyclonema bilix lata (Conrad) ¾ inch
Arnheim to Liberty Formations



Cyclonema inflatum (Ulrich) ¾ inch
Fairview Formation

CINCINNATIAN GASTROPODS



Loxoplocus bowdeni (Safford) 2 inches
Grant Lake to Drakes Formations



Loxoplocus lophospira (Ulrich) 1 inch
Arnheim Formation

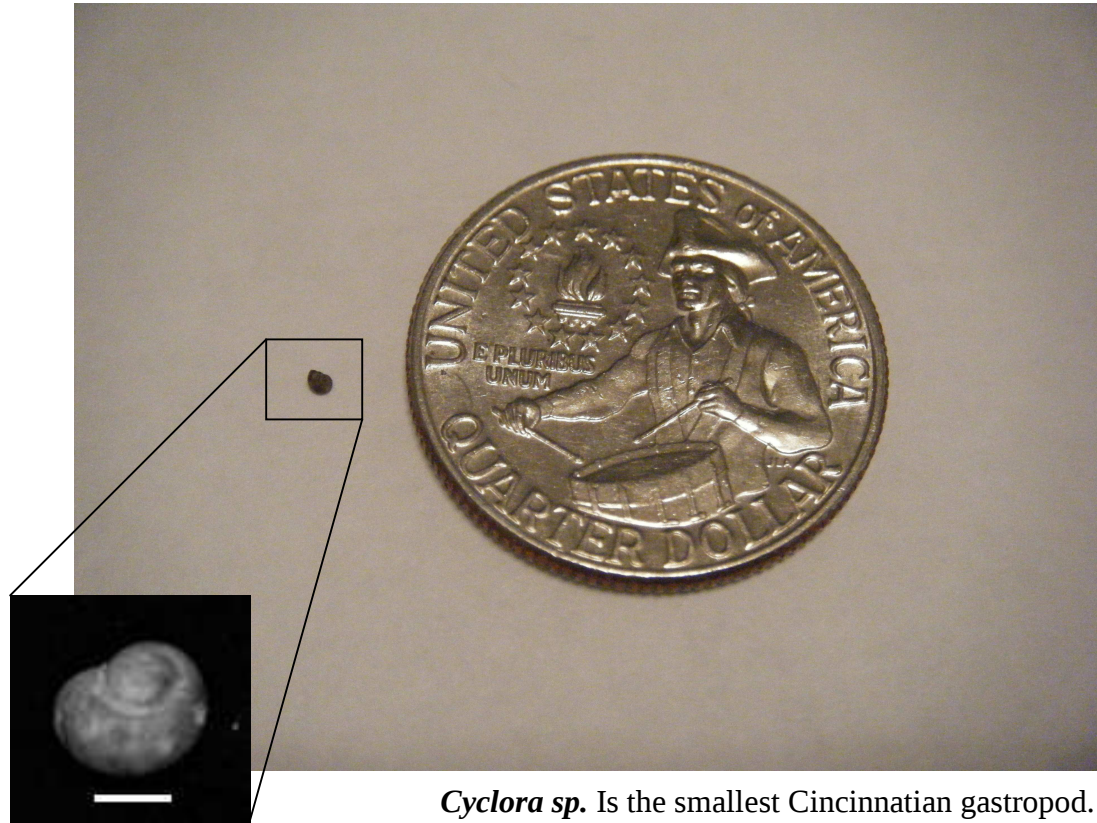


Clathrospira conica (Hall) 1 ½ inches
Fairview to Whitewater Formations

CINCINNATIAN GASTROPODS



Trochonema nitidum (Ulrich & Scofield) ½ inch
Southgate Member of Kope Formation



Cyclora sp. Is the smallest Cincinnati gastropod.
Arnheim to Liberty Formations

CINCINNATIAN GASTROPODS



Subulites sulcata (Ulrich)

Kope Formation

Subulites is one of the largest Cincinnati gastropods, reaching 4 inches.



Hormotoma terebriformis (Foerste) 1 inch

Kope Formation

CINCINNATIAN GASTROPODS



Liospira vitruvia (Billings) 5/8 inch

Liberty to Drakes Formations

CINCINNATIAN MONOPLACOPHORANS



Sinuities cancellatus (Hall) $\frac{3}{4}$ inch
Fairview to Whitewater Formations



Sinuities granistriatus (Ulrich) 1 inch
Kope Formation

Monoplacophorans are actually a separate Class of Molluscs. But their identity is not settled, and they are often considered to be primitive gastropods. They comprise all of the planispiral gastropods in the Cincinnati.

CINCINNATIAN MONOPLACOPHORANS



Phragmolites dyeri (Hall) 3/8 inch
Waynesville to Liberty Formations



Tetranota bidorsata (Hall) 1 inch
Kope Formation

CINCINNATIAN MONOPLACOPHORANS



Cyrtolites ornatus (Conrad) 1 ¼ inches
Kope to Whitewater Formations



Cyrtolites claysferryensis (Wuhlman) 3/8 inch
Kope Formation



Cyrtolites carinatus (Miller) ½ inch
Kope Formation

CINCINNATIAN MONOPLACOPHORANS



Salpingostoma richmondensis (Ulrich & Scofield) 2 ½ inches

Liberty to Whitewater Formations

BIBLIOGRAPHY

PAGE 1

Gastropod Slab: Photo by Ron Fine

PAGE 2

Cat <http://saypeople.com/2011/08/29/human-brain-region-telling-specifically-of-animals/#axzz1mPnm3QzP>

Birds <http://www.funny-potato.com/pictures-of-birds.html>

Fish <http://spelb.com/fish-wallpapers/>

Frogs <http://www.destination360.com/central-america/costa-rica/costa-rica-animals>

Scallop <http://capesanblasblog.com/2008/07/04/2008-scallop-season/>

Dragonfly <http://www.notesfromtheroad.com/about/dragonflies.html>

Cephalopod <http://www.itsnature.org/sea/other/dangerous-blue-ring-octopus/>

Gastropod <http://www.megahowto.com/how-to-get-rid-of-the-snails-in-your-gardens>

Bivalve <http://www.geile-muscheln.de/arten.php>

Scaphopod <http://www.starfish.ch/c-invertebrates/molluscs.html>

Aplacophoran <http://eol.org/pages/57709/overview>

Polyplocophoran http://biology.unm.edu/ccouncil/Biology_203/Summaries/Protostomes.htm

Monoplacophoran <http://picasaweb.google.com/lh/photo/MgnzstoR9Z18CnEIjCUktA>

Class Gastropoda <http://www.diverosea.com/Lembah%202008/IL3-095%20Natica%20sp..html>

PAGE 3

Slug <http://www.agriculture-4-u.co.uk/teaching/KS3/Science/ScienceKS3.php>

Land Snail <http://accuweather.tumblr.com/post/10980546281/giant-african-land-snails-infesting-south-florida>

Sea Butterfly <http://thescuttlefish.com/2011/03/sea-butterfly-potato-chip-of-the-sea/>

Conch <http://whatscookingamerica.net/History/Chowder/ConchChowder.htm>

Whelk <http://www.sedgwickmuseum.org/wenlock/creatures/gastropods/>

Limpet http://www.marietta.edu/~biol/biomes/rocky_shores.htm

Periwinkle http://skimmer.disl.org/pastissues/vol15_no3_2004/periwinkle.htm

Oyster Borer http://www.mesa.edu.au/AtoZ/Mulberry_Oyster_Borer.asp

Cowrie <http://wildlife-nature.factoidz.com/worlds-coolest-looking-orange-colored-creatures/>

Nudibranch <http://ocean.nationalgeographic.com/ocean/photos/nudibranchs/>

PAGE 4

Gastropods Arrayed: Photo by Ron Fine

PAGE 5

Gardens http://en.wikipedia.org/wiki/File:Vegetable_garden.jpg

Woodlands <http://www.newbattleabbeycollege.ac.uk/heritage/ancient-woodlands/>

Deserts <http://www.friendskorner.com/forum/f34/beautiful-photos-deserts-141280/>

Mountains <http://www.cruzone.com/2010/08/24/mountains-photography/>

Ditches http://www.dipity.com/tickr/Flickr_ditch/

Rivers <http://rainforests.mongabay.com/0602.htm>

Lakes <http://www.nj.gov/dep/wms/bfbm/lakes.html>

Estuaries http://celebrating200years.noaa.gov/transformations/coastal_research/estuary.html

Mudflats http://sunsetbeachandbirdislandnc.com/Sunset_Beach_Potpourri/Sunset_Beach_Potpourri.htm

Rocky Intertidal <http://tbscosystems.wikispaces.com/Rocky+Intertidal+Zone>

Sandy Subtidal <http://www.aquaeolas.com/wp/>

Ocean Depths http://en.wikipedia.org/wiki/File:Coral_Reef.jpg

Hydrothermal Vents

http://faculty.cascadia.edu/jvanleer/astro%20sum01/Hydrothermal%20Vent%20Final/hydrothermal_vents.htm

Tropical Rainforest <http://www.rainforestfauna.com/>

Near Arctic & Antarctic

<http://www.flickrriver.com/photos/tags/n%C3%A1tt%C3%BAr%C3%B3myndun/interesting/>

PAGE 6

Cincinnati Habitat *Fossils Of Ohio, Ohio Geological Survey, Bulletin 70, Columbus 1996*

PAGE 7

Herbivore <http://www.snail-world.com/What-do-Snails-Eat.html>

Carnivore <http://biologybiozine.com/>

Parasite <http://www.feedmebrains.com/tag/zombie-snails/>

Detritus <http://www.asnailsodyssey.com/LEARNABOUT/LITTORINE/littFeed.php>

Scavengers http://www.andrewjmartinez.com/image.pl/392/_Northern_Moon_Snails_scavenging_a_crab.html

Ciliary <http://www.microscopy-uk.org.uk/mag/artdec03/jmcsnails.html>

PAGE 8

Gastropod Diagram <http://classes.seattleu.edu/biology/biol235/hodin/gastropods/GASTROPODA.htm>

PAGE 9

Bottom Of Foot <http://www.molluscs.at/gastropoda/terrestrial/helix.html?/gastropoda/terrestrial/helix/morphology.html>

Snail On Anemone <http://www.divegallery.com/tun.htm>

Snail on Leaf <http://www.thenakedscientists.com/forum/index.php?topic=11576.0>

BIBLIOGRAPHY

PAGE 10

Radula <http://www.pirx.com/gallery/mollusks/radula>

Scraped Algae http://www.amateurphotographer.co.uk/features/Photo_Insight_with_Heather_Angel_snail_feeding_trail_features_310291.html

Drilled Hole <http://www.asnailsodyssey.com/LEARNABOUT/CLAM/clamDefe.php>

Cone Snail Harpoon <http://www2.fiu.edu/~goldberg/coralreefs/Mollusc%20Feeding%20Guilds.htm>

PAGE 11

Conch Eyes <http://www.coralreefphotos.com/category/ocean-realm/snails-clams-nudibranchs/>

Yellow Snail Antennae <http://www.applesnail.net/>

Orange Snail Antennae <http://www.freewebs.com/worldofsnails/slugs.htm>

PAGE 12

Whelk Operculum <http://www.texasbeyondhistory.net/coast/nature/images/shellfish.html>

Operculum <http://abugblog.blogspot.com/2010/02/sleeping-snails.html>

PAGE 13

Pink Conch Conispiral <http://blogs.gonomad.com/wake-and-wander/travel/united-states/eagle-island-georgia/bourbon-from-a-conch-shell-the-way-to-a-woman%E2%80%99s-heart/>

Green & White Snail Conispiral <http://www.hawaii-forest.com/index.php/articles/extinction-at-a-snails-pace>

Green River Snail Conispiral <http://louisvillefossils.blogspot.com/2010/11/cipangopaludina-japonica-river-snail.html>

Irregular Shell http://www.gastropods.com/7/Shell_1727.shtml

Plan View Planispiral [http://en.wikipedia.org/wiki/Whorl_\(mollusc\)](http://en.wikipedia.org/wiki/Whorl_(mollusc))

White Shell Planispiral <http://siratus-alabaster.over-blog.com/article-voyage-coquillage-poeme-de-marliou-et-spirula-spirula-55616943.html>

Brown Striped Shell Planispiral http://www.absoluteastronomy.com/topics/Marisa_cornuarietis

PAGE 14

Nautilus <http://creepyanimals.com/tag/underwater-curiosities/>

Orange Ammonite <http://chaoticutopia.com/friday-fractal-i>

Cutaway Ammonite http://www.amnh.org/exhibitions/expeditions/treasure_fossil/Treasures/Ammonites/ammonite.html#aa

PAGE 15

Cincinnati Hill Cut: Photo by Ron Fine

PAGE 16

Gastropod Preservation: Photo by Ron Fine

PAGE 17

Gastropod Layer: Photo by Ron Fine

Gastropod Rock: Photo by Ron Fine

PAGE 18

Cyclonema Photos: Photo by Ron Fine

PAGE 19

Loxoplocus Photos: Photo by Ron Fine

Clathrospira: Photo by Ron Fine

PAGE 20

Trochonema: Photo by Ron Fine

Cyclora With Quarter: Photo by Ron Fine

Cyclora Closeup: <http://strata.uga.edu/cincy/fauna/gastropoda/Cyclora.html>

PAGE 21

Subulites: Photo by Ron Fine

Hormotoma: Photo by Ron Fine

PAGE 22

Liospira: Photo by Ron Fine

PAGE 23

Sinuities Photos: Photo by Ron Fine

PAGE 24

Phragmolites: Photo by Ron Fine

Tetranota: Photo by Ron Fine

PAGE 25

Cyrtolites Photos: Photo by Ron Fine

PAGE 26

Salpingostoma richmondensis (Ulrich & Scofield)
<http://strata.uga.edu/cincy/fauna/gastropoda/Salpingostoma.html>