University of Iowa Paleontology Repository
Mid-America Paleontology Society

About this book

Rusty and Dunky are at the University of Iowa (UI) Museum of Natural History. You can visit them in the Iowa Hall exhibit. Iowa Hall displays the natural history of life in Iowa from around 500 million years ago to today. Join Rusty and Dunky as they look for fossils to add to the displays. Look for your own fossils. Work out how to identify them, and how to create a fossil collection.

Rusty and Dunky are assisted by:

You! As the first member of the Iowa Fossil Collecting Club! Fill out your membership card.
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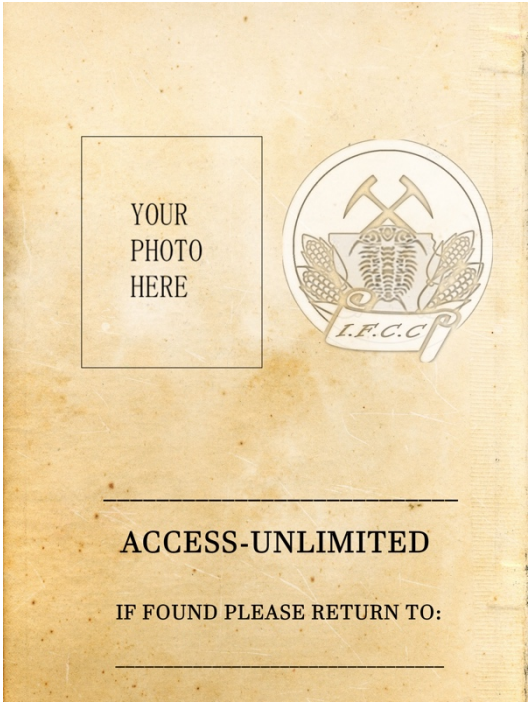


For Zephan, who loved fossils

What's in this book?

Books for people who love fossils:

"Iowa's Geological Past: Three Billion Years of Change" by Wayne I. Anderson. 1998. University of Iowa Press.

"Smithsonian Handbooks: Fossils" by David Ward. 2002. Dorling Kindersley.

"She Found Fossils" by Maria Eugenia Leone Gold and Abageal Rosemary West. 2017. CreateSpace Independent Publishing Platform. Also available in Spanish as "Ella encontró fósiles."

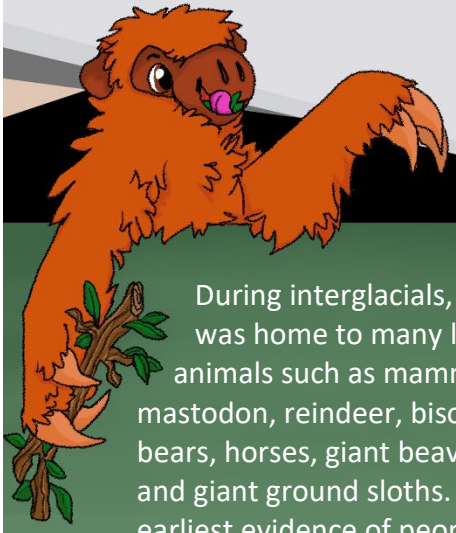
For additional copies of this book and answers to all your geological questions, please email: geology@uiowa.edu.

The Devonian age was a time period from 420 to 360 million years ago, when Iowa was covered by a warm, shallow ocean! Many types of prehistoric creatures and plants lived in this ocean—such as jawed fish, cephalopods (including squid-like animals with hard shells), brachiopods, bivalves (like clams & oysters), and trilobites. *Dunkleosteus* was an enormous fish of this era with strong jaws and tough skin.

Welcome to Iowa Hall at the University of Iowa Museum of Natural History. That big fish that you can see on display is me, *Dunkleosteus terrelli*. You can call me Dunky.

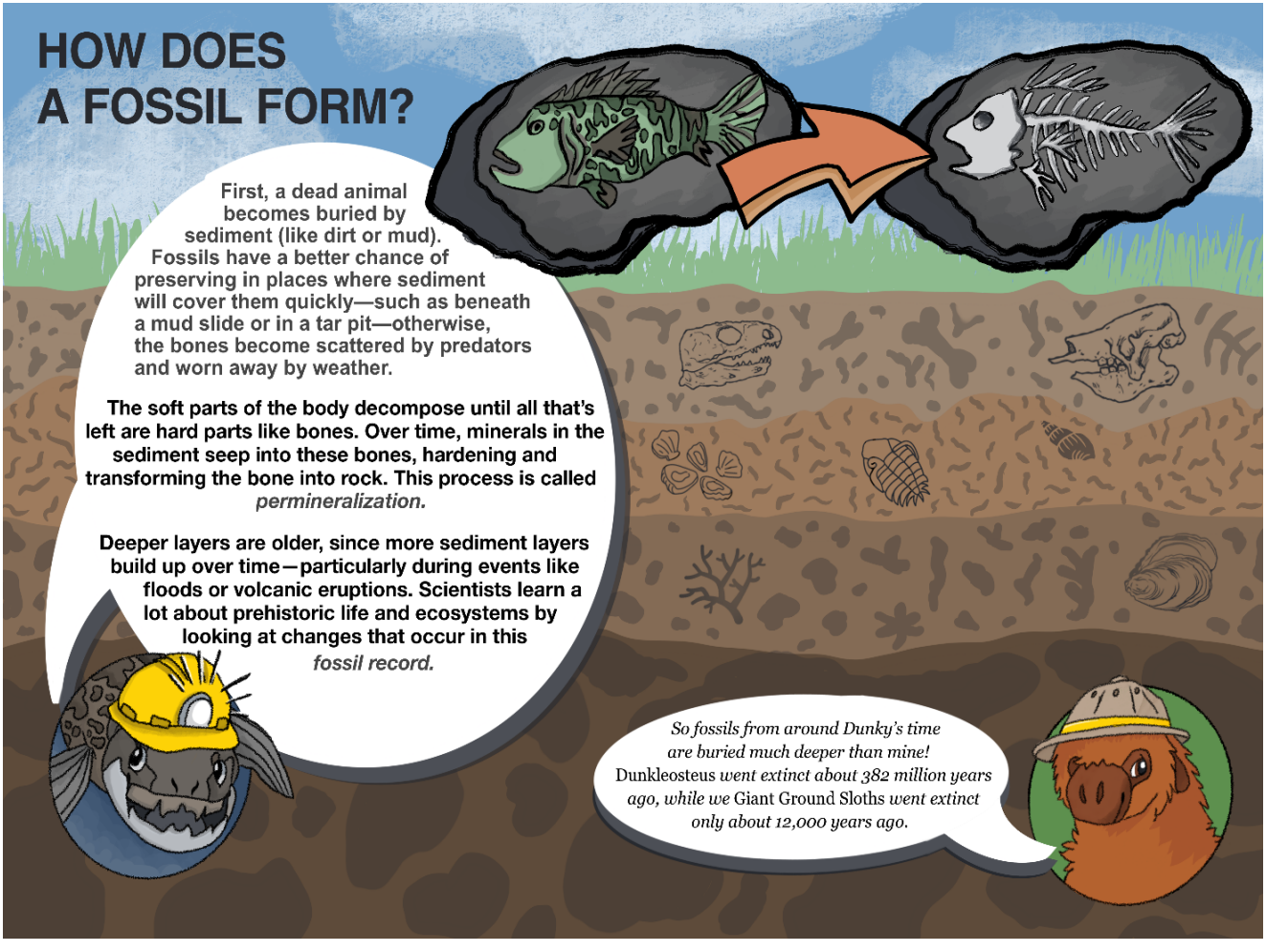
Iowa's Ice Age

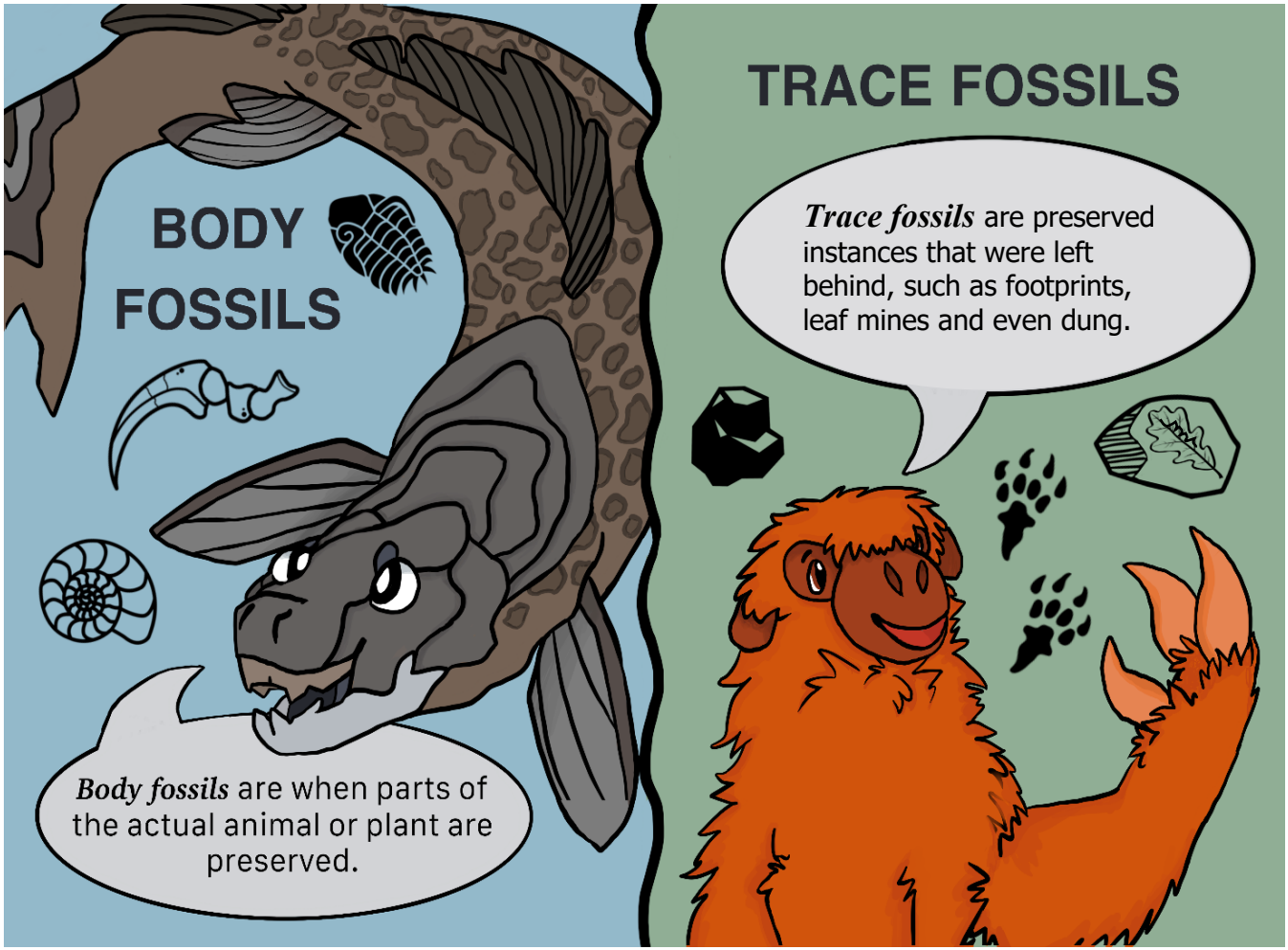
Between 2 million years and 12 thousand years ago, Iowa was in an ice age: cold icy periods (glaciation) and warm periods with woodlands and prairie (interglacials).



During interglacials, Iowa was home to many large animals such as mammoths, mastodon, reindeer, bison, bears, horses, giant beavers, and giant ground sloths. The earliest evidence of people living in Iowa is from 11,500 years ago.

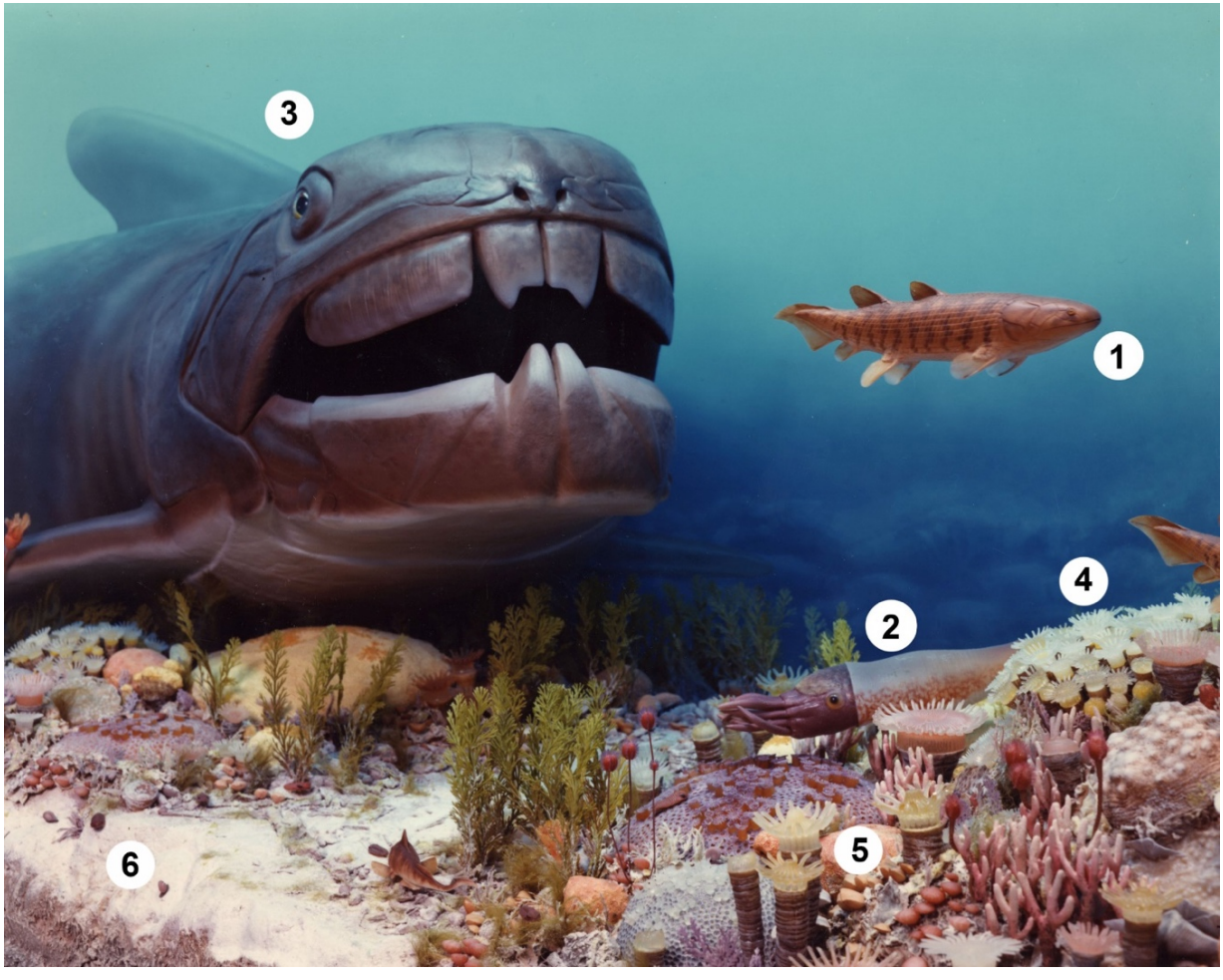
I'm Rusty, the giant ground sloth. Full name *Megalonyx jeffersonii*! I lived in Iowa around 140,000 years ago, so I'm a LOT younger than Dunky! Let's explore fossils!


HOW DOES A FOSSIL FORM?
First, a dead animal becomes buried by sediment (like dirt or mud). Fossils have a better chance of preserving in places where sediment will cover them quickly—such as beneath a mud slide or in a tar pit—otherwise, the bones become scattered by predators and worn away by weather.
The soft parts of the body decompose until all that's left are hard parts like bones. Over time, minerals in the sediment seep into these bones, hardening and transforming the bone into rock. This process is called *permineralization.*
Deeper layers are older, since more sediment layers build up over time—particularly during events like floods or volcanic eruptions. Scientists learn a lot about prehistoric life and ecosystems by looking at changes that occur in this *fossil record.*
So fossils from around Dunky's time are buried much deeper than mine! Dunkleosteus *went extinct about 382 million years ago, while we* Giant Ground Sloths *went extinct only about 12,000 years ago.*

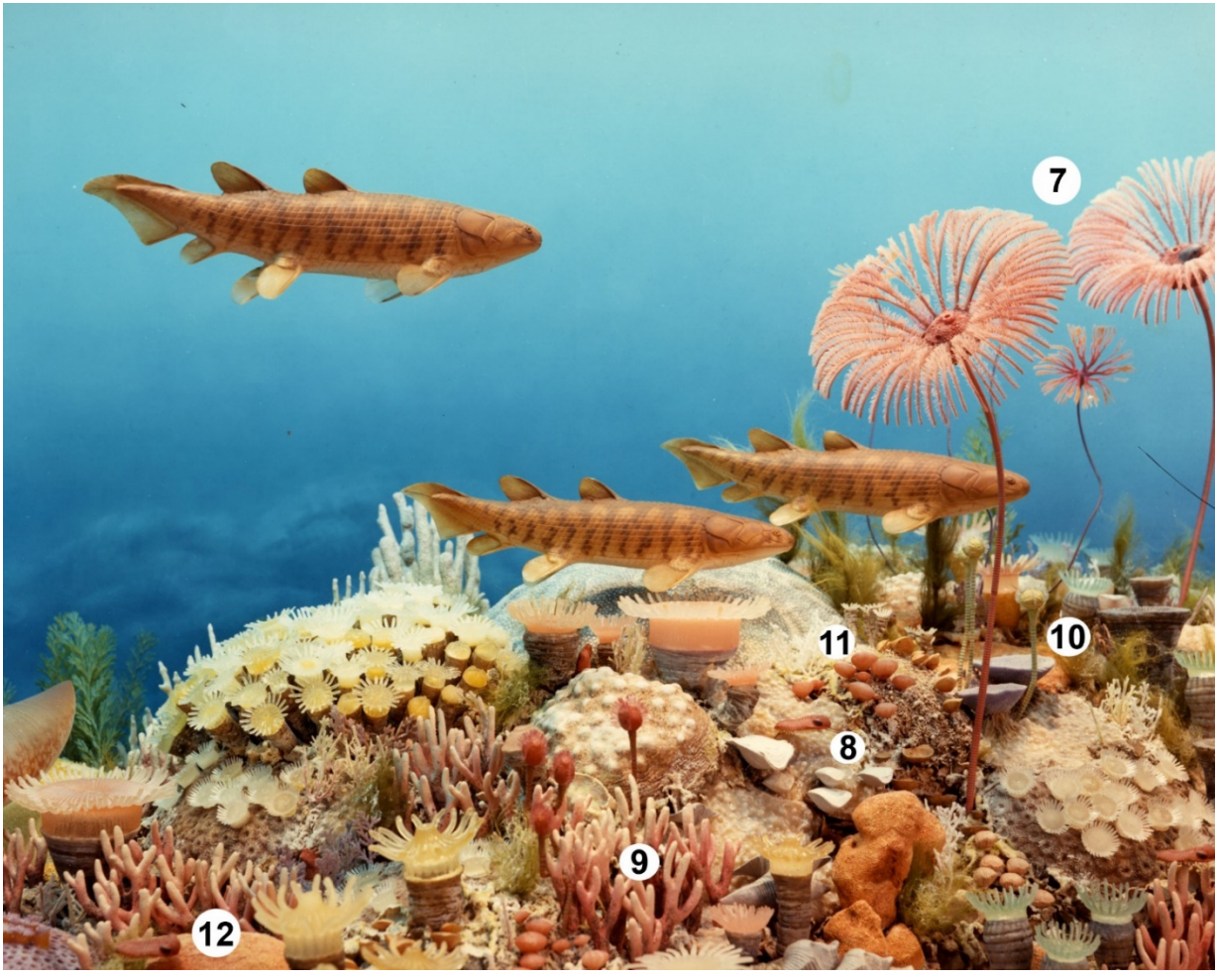

BODY FOSSILS
Body fossils are when parts of the actual animal or plant are preserved.
TRACE FOSSILS
Trace fossils are preserved instances that were left behind, such as footprints, leaf mines and even dung.

5 **Fossils reconstructed**

It's easier to identify fossils when you know what the organism (e.g., animal or plant) looked like when it was alive, and how its body or structure was organized. Paleontologists reconstruct fossils by comparing them with organisms that live today. Identifying fossils with no living equivalent can be tricky!



Here are close-ups of the Devonian Reef diorama (3D reconstruction scene) at the UI Museum of Natural History. Match the numbered organisms with the fossils in this book (look for blue dots).

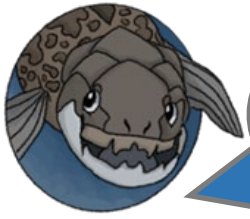


FOSSIL HUNTING

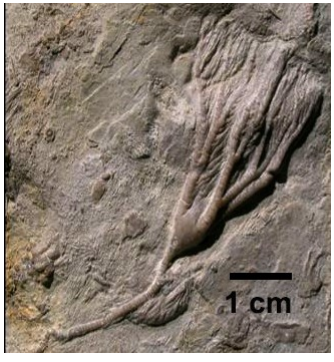
Where can I find fossils?

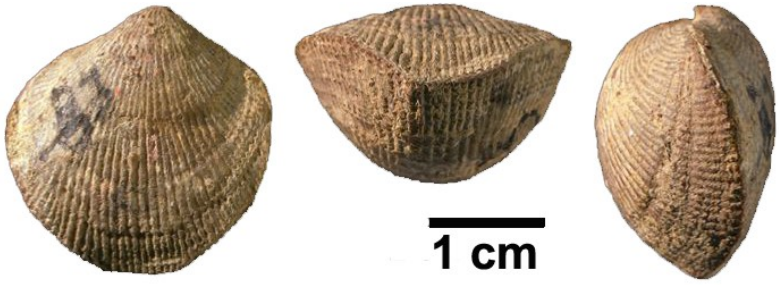
Look for sedimentary rocks along creeks, lakes and roadcuts, and in driveway gravel from quarries in Iowa. Not all of these places are easy to access, and you must be careful along roads and creeks. Good places to find fossils are around Coralville Lake near Iowa City, and Rockford Fossil and Prairie Park (picture below) in north-east Iowa. You can surface collect here – pick up fossils from the ground without having to use a hammer to break them out of rocks.

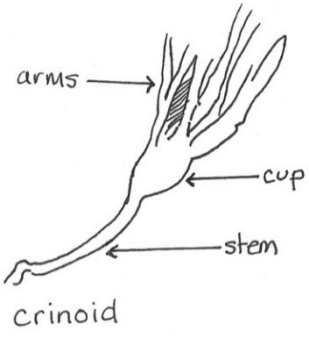
How do I recognize fossils?

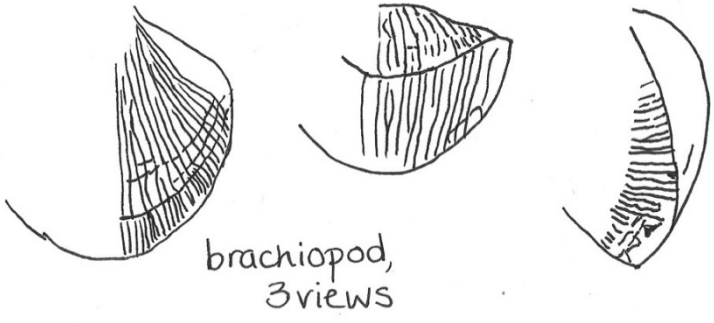


Look at pictures of fossils before you start collecting. Many fossils, like shells, bones, and leaves look like whole or parts of modern animals and plants. Look for something different from the surrounding rock. Keep an eye out for recognizable shapes and repeating patterns. Drawing is a great way to study fossils. See if you can finish the sketches below.









Help Rusty and Dunky find more fossils!

Some good fossil-collecting sites may not be open to the public, but welcome fossil clubs. Other fossil collectors may be able to tell you a lot about local fossil sites and what you can find there.

To find your local fossil hunting areas you can look in geological guidebooks, visit your local museum, and join a fossil-collecting club, like MAPS – the Mid-America Paleontology Society.

Find out more about MAPS online at midamericapaleo.org. You can also connect with fossil clubs all over the world at the myFOSSIL website: https://www.myfossil.org/paleosocieties/

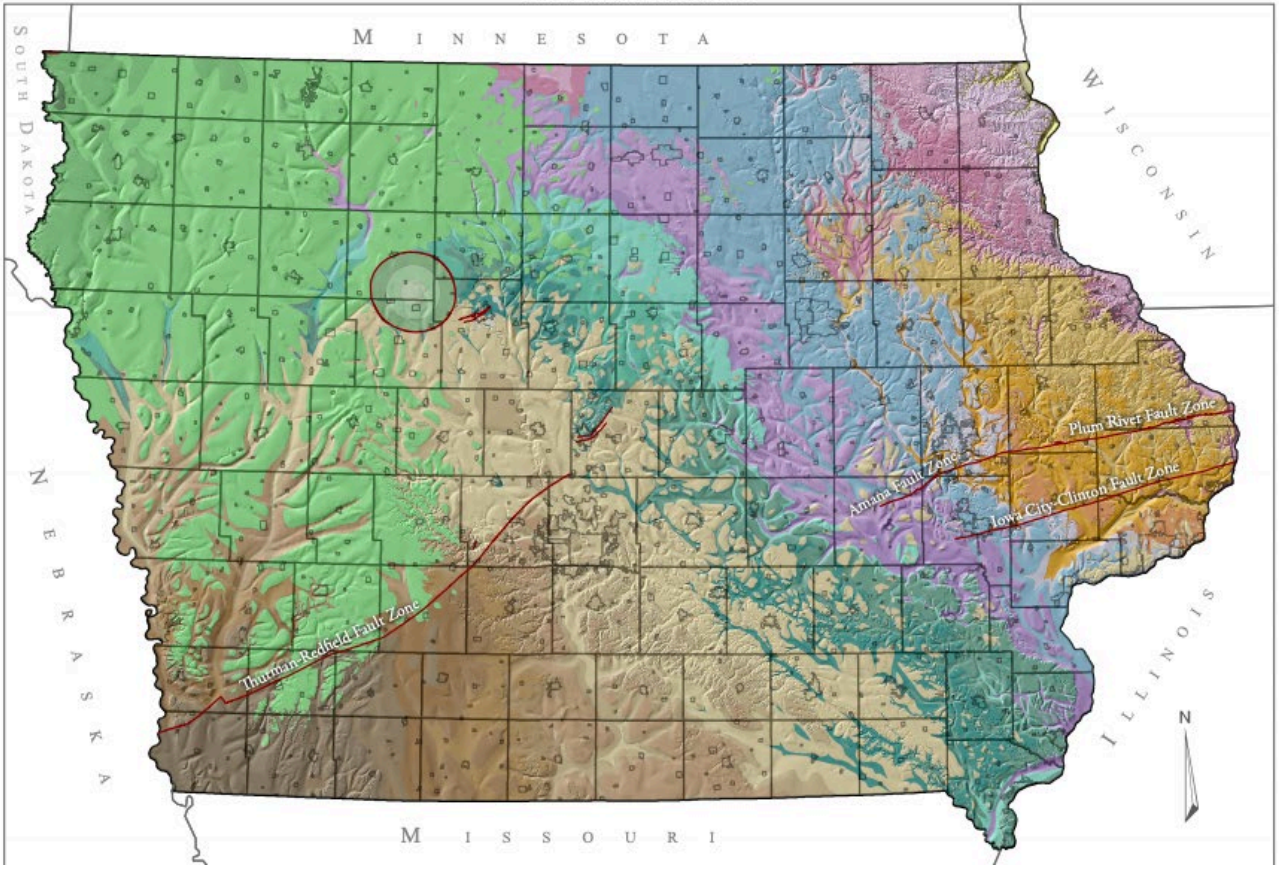
Fossil hunting kit

If you have a cell phone you can use it to record your location, make notes, take photos and magnify finds, but a notebook, map and pencil work great too. Take a tape measure for scale in photos, and a hand lens or magnifier to look at rocks in detail. Use a geological hammer if allowed and wrap your finds in paper towels or newspaper to bring home. The map on the next page shows you where different age rocks are in Iowa. Bedrock is the solid rock beneath the dirt.

Bedrock Geologic Map of Iowa

2010

Brain J. Witzke, Raymond R. Anderson, John, P. Pope



Precambrian | Cambrian | Ordovician | Silurian | Devonian

Mississippian | Pennsylvanian | Jurassic | Cretaceous

Precambrian	Cambrian	Ordovician	Silurian	Devonian
2910 – 545	545 – 505	505 – 438	438 – 420	420

millions of years before present

Fossil Key

- bivalves
- cephalopods
- brachiopods
- corals
- gastropods
- trilobites
- echinoderms
- plants
- marine vertebrates
- terrestrial vertebrates

Timeline Chart of Common Iowa Fossils

This chart shows the different geological ages represented in the bedrock and younger non-rock deposits in Iowa, and their most common fossil types.

IOWA FOSSIL FILES: IDENTIFY YOUR FINDS

BRACHIOPODS

ID clues:

- Sea-shell shape
- Two shells (valves) that are **not** alike
- A shell that has a line of symmetry (same on both sides of line) where the dotted line is drawn below
- Pattern of lines radiating from hinge to shell edge, and sometimes also across the shell

Brachiopod Status Report

Iowa Timeline: 500mya - 298mya.

Global Extinction Status: Extant (still living today).

Habitat: Oceans worldwide.

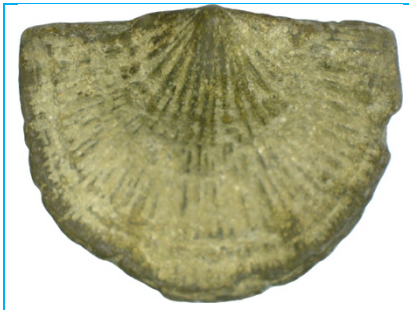
Life Habit: Marine (lives in the sea). Filters food from water. Lives attached to hard surfaces.

Science Fact: although brachiopods look like bivalves they're more closely related to bryozoans.

Brachiopods were most diverse (lots of different species) during the Devonian, so they are really common fossils in Iowa. How many brachiopods can you spot on this slab of sea floor?

Shape is one of the ways that brachiopods are classified into groups. Which types below do you think look similar? Are they the same group (rhynchonellid, strophomenid, orthid, spiriferid)?

		
Lepidocyclus (rhynchonellid)	*Douvillinaria* (strophomenid)	*Hebertella* (orthid)
		
Cyrtospirifer (spiriferid)	*Platystrophia* (orthid)	*Sowerbyella* (strophomenid)

		
Strophomena (strophomenid)	*Strophomena* (inside of shell)	*Pionodema* (orthid)
		
Platyrachella (spiriferid)	*Schizophoria* (orthid)	*Desquamatia* (spiriferid)

These funny-looking things are internal molds of Silurian *Pentamerus* brachiopods. The shells were filled with mud where they sat on the sea floor. Then the shells dissolved away so only the mud filling remains.

BIVALVES

ID Clues:

- Sea-shell shape
- Two shells (valves) that **are** alike (different from brachiopods)
- Line of symmetry where the dotted line is drawn below
- Pattern of lines radiating from hinge to shell edge, and across the shell

Bivalve Status Report

Iowa Timeline: 500mya to present.

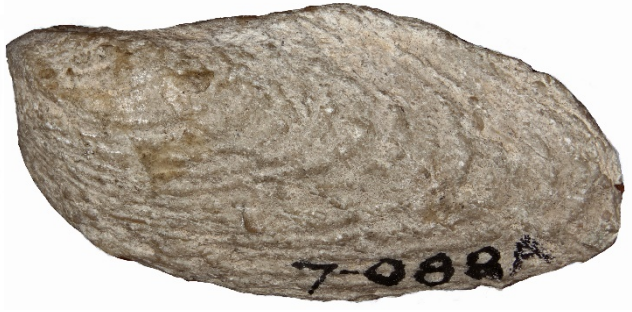
Global Extinction Status: Extant.

Habitat: Oceans, rivers and lakes worldwide.

Life Habit: Cement to hard surfaces, burrow into soft sediment or move short distances. Filter food from water.

Science Fact: Freshwater bivalves live in Iowa's rivers today.

11



Bivalves

CEPHALOPODS

ID clues:

- Circular flat coil that may have straight or wavy lines from inner to outer edge
- Straight cylinder that tapers at one end which may be rounded, with segments seen as lines (chamber suture lines) around the cylinder

Cephalopod Status Report

Iowa Timeline: 500mya-65mya.

Global Extinction Status: Ammonites extinct since end of Cretaceous. One genus of nautiloid remains. Squid, octopus, cuttlefish extant.

Habitat: Marine.

Life Habit: Capture prey in tentacles and use a sharp beak to take bites. Move backwards by spurting water from a tube called a siphuncle.

2

Dolorthoceras, straight nautiloid

Manticoceras, a coiled Devonian ammonoid

CORALS

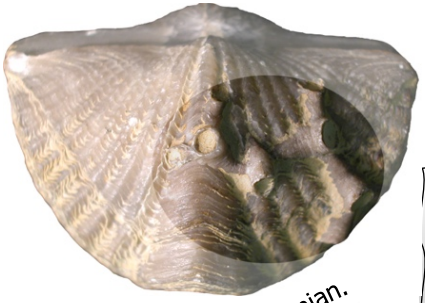
ID clues:

- Colonial coral: hexagonal patterns, dots, or chains
- Multiple corallites (holes or depressions) where each polyp (animal) lived
- Solitary coral: cone-shaped with a single corallite in wider end and lines radiating out like bicycle wheel spokes

5

Zaphrentis. This large solitary coral is from Devonian-age rocks.

Aulopora branching coral growing on a brachiopod shell.



Goniophyllum pyramidale. Also known as the Slipper Coral. It's found in Jones County, Iowa, and Gotland in Sweden!

Macgeea. Devonian.

Hadrophyllum. Devonian.

Solitary corals contained a single animal or polyp. They are also called horn corals.

Corals

Coral Status Report

Iowa Timeline: 500mya-298mya.

Global Extinction Status: Distinct from modern corals and extinct since the end of the Permian.

Habitat: Ordovician to Late Permian seas.

Life Habit: Marine. Filtered food from water. Lived attached to hard surfaces.

Science Fact: These fossil corals had skeletons made of calcite. Modern coral skeletons are made of aragonite.

4

Hexagonaria

Hexagonaria has a honeycomb pattern. It's a colonial coral from the Devonian. *Halysites* has a chain pattern that makes it easy to recognize.

Pachyphyllum

Favosites

Halysites

Colonial corals: Some have corallites spaced widely apart (*Pachyphyllum)*, other are close together (*Favosites*).

Corals

GASTROPODS

ID clues:

- Circular flat or tall coil with no suture lines (different from cephalopods)

Straparollus (Mississippian)

Maclurites (Ordovician)

Floyda (Devonian). The cut and polished fossil on the right shows the internal spiral of the shell.

Gastropods

Gastropod Status Report

Iowa Timeline: 500mya to present (freshwater and land snails live in Iowa today).

Global Extinction Status: Extant.

Habitat: Marine, freshwater and terrestrial, worldwide.

6

Platyceras (Silurian - Permian) snails (above and right) are sometimes found on top of crinoid crowns - perhaps the snails grazed on crinoid waste!

TRILOBITES

ID clues:

- Divided into three lobes (left, middle, right)
- Articulated (complete) trilobites have a head shield, segmented thorax (body) and a tail
- The individual segments plus the tail and parts of the head shield may be found separately (disarticulated)

Dikelocephalus head and tail (Cambrian)

Smooth, burrowing trilobite

Spiny trilobite

12

Trilobite Status Report

Iowa Timeline: 500mya-298mya.

Global Extinction Status: Extinct since the end of the Permian.

Habitat: Marine.

Science Fact: Trilobites' eyes were made of calcite lenses.

Lifestyle of Trilobites

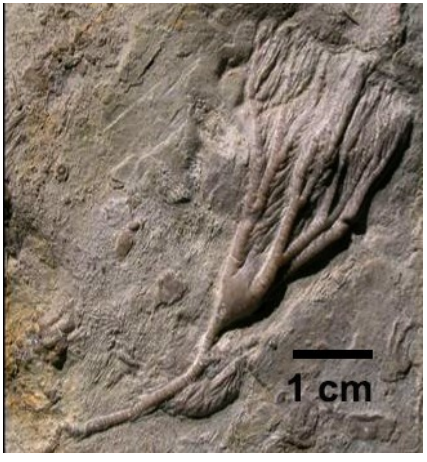
Trilobites developed different traits and lifestyle to adapt to various environments. Some could curl up or had spines for protection, some burrowed or swam.

Enrolled or curled-up trilobite

ECHINODERMS

ID clues:

- Star-shaped fossil, either flat star or draped around a ball
- Stalk with round ball at one end, with or without branching arms
- Single plates with five sides or circles with a hole in the middle



Crinoids
Also known as sea lilies, these animals are attached to the sea floor by a stem made of little discs (columnals). At the top of the stem a cup with arms filters food from the water.

Look out for crinoids in the rocks at Devonian Fossil Gorge, and a spectacular slab of crinoids from the Le Grand Formation is on display at the State Historical Museum of Iowa in Des Moines.

Many crinoid fossils are disarticulated (the skeleton fell to pieces before fossilization), and the little plates and discs that make up the stem, cup (where the animal lives) and arms are found separately.

Crinoid arm plates

Crinoid stem plates

7

Crinoid cup

Echinoderm Status Report

Iowa Timeline: 500mya–298mya.

Global Extinction Status: Mostly extant. Blastoids and cystoids are extinct.

Habitat: Marine, worldwide.

Life Habit: Filters food from water. Free-swimming, crawling on sea bed or cemented to surfaces, e.g., sea bed, floating object.

Starfish
Starfish fossils are very rare in Iowa but easily identified by their five arms.

Blastoids and cystoids
Extinct relatives of crinoids, the cup was attached to the sea floor by a thin stem. It is very difficult to find the tiny arms of blastoids, but the tulip-shaped cup is much more common and looks like a starfish wrapped around a ball.

There are lots of different types of echinoderms including crinoids (sea lilies), echinoids (sea urchins), blastoids and starfish. They all have a special character in common – a 5-fold symmetry pattern, e.g., the five arms of a starfish.

10

MARINE VERTEBRATES

ID Clues:

- Whole or partial bones that are heavier and darker than modern animal bones
- Teeth, usually dark and glossy, in a lighter rock, or loose
- Trace fossils such as coprolites (dung)
- Marine vertebrates are usually found in areas of limestone or shale

Shark tooth
Just like modern sharks, the skeleton of ancient sharks was made of cartilage that rarely fossilizes. Teeth are the most common shark fossils.

Rhizodont tooth
While most of Iowa's aquatic vertebrate fossils are marine, large predatory rhizodont fish dominated Mississippian-age freshwater rivers and lakes. Rhizodonts are one of the fossil fish species most closely related to four-legged land animals.

Plesiosaur vertebra (back bone)
This marine reptile had four flippers and a long neck. Look for thick, disc-shaped bones.

Ptyctodont fish tooth
One of the first jawed fishes. A smaller version of Dunky, that also became extinct at the end of the Devonian.

1

Pavement-toothed shark tooth
Teeth can give you clues about the animal's diet. This shark had large flat teeth for crunching shellfish, rather than the sharp, pointed teeth of fish-eating sharks.

3

It's me! This is an imprint of a bony plate from a placoderm fish, like *Dunkleosteus*.

Marine Vertebrate Status Report

Iowa Timeline: 412mya-65mya.

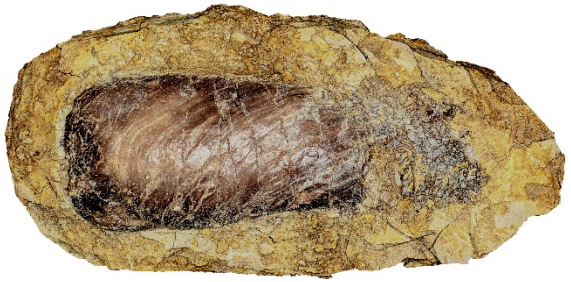
Global Extinction Status: This large group has seen many extinctions (marine reptiles), and many modern marine vertebrates are endangered today.

Habitat: Marine, worldwide.

TERRESTRIAL VERTEBRATES

ID Clues

- Whole or partial bones that are heavier and darker than modern animal bones
- Teeth, usually dark and glossy, in a lighter rock, or loose
- Trace fossils such as footprints, burrows and coprolites (dung)
- Terrestrial vertebrates are commonly found on sand and gravel bars in Iowa creeks and rivers. Take care when searching!



Coprolites are fossilized poop. They do preserve under rare conditions!

Rib bone from an early land animal found in Whatcheer, Iowa. You can meet *Whatcheeria* on page 29!

Tiny fragment

Dinosaur fossils are very rare in Iowa because the Jurassic and Cretaceous rocks are not exposed at the surface or are marine rocks. A tiny fragment of hadrosaur bone has been found in Iowa.

Mastodon tooth

Mammoth tooth

An exceptionally beautiful giant ground sloth claw!

Terrestrial Vertebrates Status Report

Iowa Timeline: 354mya to present.

Global Extinction Status: Very much extant. You are a terrestrial vertebrate!

Habitat: Terrestrial, worldwide.

Life Habit: Includes amphibious (water and land-dwelling), underground, surface-dwelling, and flying animals.

Land, at last! So much of Iowa's fossil record is marine! If you are missing dinosaurs, look around outside for their living relatives – birds! Iowa's giants are the Ice Age animals – mammoth, mastodon – and giant ground sloth (me)!

PLANTS SPECIAL REPORT

During the Pennsylvanian, the Midwest was part of the biggest swamp forest of all time, a bit like the Florida Everglades, but much, much bigger! Over millions of years the decaying plant material from the forest was turned into coal. This is why coal is called a fossil fuel. Burning coal releases gases into our atmosphere that have been locked away for 300-million years!

Lepidodendron trunk impression (extinct)

Seed fern leaf (extinct)

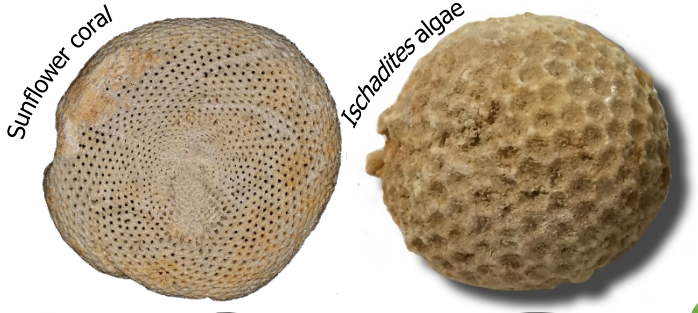
Coal, formed from decayed plants

Stigmaria root (extinct)

OTHER FOSSILS

There is such diversity (lots of different things) in life on Earth that there are many other fossils you could find. Books, websites, online fossil forums, and other fossil collectors are valuable sources of information for identifying and investigating fossils! Here are some examples of other fossils found in Iowa.

An appendage (arm) from the biggest and oldest-known giant sea scorpion in the world.
But that's another book…



Marine Algae. The sunflower coral is neither a sunflower, nor a coral! It's a marine alga called *Fisherites* (it's not a fish either)!

Bryozoans

Sponges

Creating a Fossil Collection

The Locality Field Notebook

Every place you collect fossils is called a locality. Paleontologists keep a locality field notebook of where they found each fossil. They record:

- **Locality** – the geographical place where they found the fossil
- **Stratigraphy** – the name of the rock layer the fossil was found in
- **Age** – the geologic time period the fossil belongs to, based on what rock layer it came from.

There is a locality field notebook for you to use on the next page. We've recorded two examples to get you started. You can give each of your localities its own number and copy that number onto the fossil or a slip of paper kept with it, so you can refer to the details in your field notebook.

Each locality is given a number and you start with the number 1. For example, pretend you live in Cedar Rapids, Iowa and the first place you find a fossil is in the gravel in your yard. You would write it in your field notebook like this:

Locality Number	Locality	Age and Stratigraphy
1	home: US, Iowa, Linn County, Cedar Rapids, your address, gravel in yard	?

We don't know the geologic age of the gravel, so we put "?" Now pretend the second place you collect a fossil is on a field trip to the Fossil and Prairie Center in Rockford, Iowa. To record this locality like a paleontologist, first you would find the Center on a printed or online map then describe its location relative to the nearest town. If you use an online map, you can find the latitude and longitude easily. The complete information for your Locality 2 will look like this:

Locality Number	Locality	Age and Stratigraphy
2	Fossil and Prairie Center: US, Iowa, Floyd County, 2 miles west of Rockford. Lat/Long: 43.0472509, -92.9779797	Devonian, Lime Creek Shale

Locality Number	Locality	Age and Stratigraphy
1 (example)	home: US, Iowa, Linn County, Cedar Rapids, your address, gravel in yard	?
2 (example)	Fossil and Prairie Center: US, Iowa, Floyd County, 2 miles west of Rockford. Lat/Long: 43.0472509,-92.9779797	Devonian, Lime Creek Shale
3		
4		
5		
6		
7		
8		
9		
10		

Locality Number	Locality	Age and Stratigraphy

How to clean your fossils

When you get your fossils home, unwrap them carefully so that you don't lose any locality numbers you've marked on or with them. Most fossils will just need to be cleaned by washing in soap and water with a toothbrush or scrub brush. Be careful not to break off any small pieces. Let the fossils dry thoroughly.

Sometimes parts of a fossil are hidden by rock. You can use pins and small nails to chip away the surrounding rock, taking care not to push too hard and scratch the fossil. Experts use electric tools. It takes time and patience to clean fossils. Work slowly because you don't know exactly where the fossil is under the rock.

A broken fossil can be glued back together with white glue. White glue is safe to use and can be removed by soaking in water, if necessary.

Making a Fossil Collection Catalog

Paleontologists record information about individual fossils in a Fossil Collection Catalog. Each fossil is given its own unique number that is recorded in the catalog and written on the fossil, or on a label that you keep with the fossil. The catalog lists the unique number, identification or name of the fossil, locality number, the date you collected it, and any special notes you want to remember about the fossil. We've started a catalog for you on the next page with examples to follow. Both fossils were found at Locality Number 1 where Rusty and Dunky were collecting together. Keeping records will help you enjoy your collection for years to come!

Thank you for helping Rusty and Dunky to find fossils!!

Fossil Collection Catalog

Catalog Number	Name of fossil (identification)	Locality Number	Date Collected	Notes
1	Brachiopod: *Hebertella*	1	2/13/2021	A perfect brachiopod found by Rusty
2	Brachiopod: (unidentified)	1	2/13/2021	One brachiopod valve found by Dunky
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Collection Labels

Fill in a label to cut out and keep with the fossil. You can copy these pages if you need more labels, or you can make your own. We've filled out the first one for you as an example.

Rusty and Dunky's Collection Catalog No. 1 Identification brachiopod: Hebertella Locality No. 1 Notes a perfect brachiopod found by Rusty on 2/13/2021	_____ Collection Catalog No. _____ Identification _____ _____ Locality No. _____ Notes _____ _____ _____	_____ Collection Catalog No. _____ Identification _____ _____ Locality No. _____ Notes _____ _____ _____
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Don't be a fossil-hog!

Leave some fossils for other people to collect.

Only pick up fossils where collecting is allowed.

Ask permission before collecting on private property.

Don't leave an outcrop-eyesore! Take your litter home.

Only use a geological hammer to break rocks if it is allowed.

Only use a hammer on fossils that you can easily break out of rock. If it's a large fossil, leave it, and take a photo. Don't break off bits of it.

Resources:

Devonian Fossil Gorge and Coralville Lake Visitor Center. 2850 Prairie Du Chien Rd NE, Iowa City, IA 52240-7820. Phone: (319) 338-3543 ext. 6300
Website: https://www.mvr.usace.army.mil/Missions/Recreation/Coralville-Lake/Recreation/Devonian-Fossil-Gorge/
Fossil and Prairie Center. 1227 215th Street, Rockford, Iowa 50468.
Phone: 641-756-3490. Website: http://www.fossilcenter.com
Fryxell Geology Museum, Augustana College. 820 38th St, Rock Island, IL 61201
Phone: (309) 794-7318
Website: https://www.augustana.edu/locations/fryxell-geology-museum

Mid-America Paleontology Society.
Website: http://midamericapaleo.org/
Putnam Museum and Science Center. 1717 W 12th St, Davenport, IA 52804.
Phone: (563) 324-1933.
Website: http://www.putnam.org/
State Historical Museum of Iowa. 600 East Locust St., Des Moines, IA 50319
Phone: (515) 281-5111.
Website: https://iowaculture.gov/history/museum
University of Iowa Museum of Natural History.
Macbride Hall, Iowa City, IA 52242.
Phone: (319) 335-0480.
Website: https://mnh.uiowa.edu/