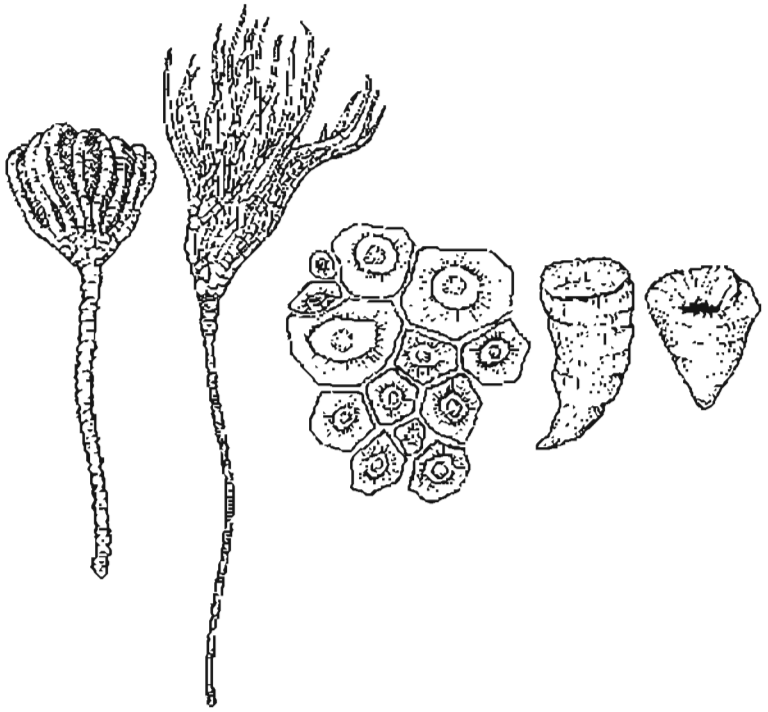
The Devonian Fossil Gorge

A Visitor's Guide to Geologic Features at the Coralville Lake Emergency Spillway

by Jean Cutler Prior

Historic floods during the summer of 1993 poured over the emergency spillway at Coralville Lake and eroded a deep channel into the underlying bedrock deposits. It is now possible to walk across acres of Devonian-age sea floors and get a first-hand look at features normally hidden from view or glimpsed only in vertical cuts along roadsides or in quarries. The exposed rocks provide a rare opportunity for public observation of Iowa's geologic past.



Crinoids (left); colonial coral (Hexagonaria, middle); horn corals (right). Illustration by Patricia Lohmann.

This diorama of a Devonian coral reef shows diverse marine life recognized today as fossils in Iowa's limestone deposits. It illustrates how the Devonian Fossil Gorge may have looked 375 million years ago. Iowa Hall Gallery, The University of Iowa Museum of Natural History.

Photo by Kay Irelan.

The Rocks

Composition: The shelves of bedrock and scattered rock slabs are composed of limestone. This sedimentary rock originated as lime-rich deposits accumulating on sea floors during the Devonian period of geologic time, some 375 million years ago. Some of the limestone is fine grained, composed of limy muds that settled out of calm, quiet water. In other places, the grains are more coarse, often composed of broken shells concentrated by sea-floor currents. Crystals of calcite (calcium carbonate), the most common mineral in limestone, are occasionally seen reflecting in the sunlight as they fill openings in the rocks.

Fractures: Notice occasional breaks along the limestone surface that follow nearly straight lines and are generally parallel to each other. These fracture traces extend across many miles horizontally and hundreds of feet vertically. They were caused by warping of the earth's crust and by stress on the brittle sedimentary strata in the geologic past. These fractures serve as pathways for water to move underground. The groundwater contained in these fracture systems at depth is an important aquifer tapped by wells throughout the region.

Shapes: Limestone slowly dissolves during contact with subterranean groundwater flow. The rock surfaces exposed by the 1993 floodwaters display good examples of small-scale "karst" features that characterize the insides of eastern Iowa limestone formations. Notice especially the smooth-sided channels formed by the scour of flowing water. Occasionally these channels are enlarged into rounded potholes, ground smooth by the swirling action of cobbles. Look under rock ledges for the openings to small cave systems.

Flood Evidence: The power of floodwater is still seen in the position of large slabs of limestone that were plucked from their bedrock foundation and moved downstream. Some slabs came to rest in an overlapping fashion, as they were shoved together and slanted in the direction of the flood's flow.

Structure: Looking north toward the spillway from some distance down the gorge, you can see inclines in the limestone strata that form a dome-like structure across the area. This feature may be the result of irregular settling of the sedimentary layers when they were still soft, or the result of much later, broad-scale warping of rock units across the Midwest. Small geologic faults are also exposed here, with vertically displaced strata and tiny gouges along the rock faces indicating movement in the geologic past.

Fossils: Excellent fossil remains of marine life that inhabited the clear, warm, shallow Devonian seas can be observed. Look for solitary horn corals and for larger colonial coral forms, especially *Hexagonaria* and *Favosites*. Some of the coral masses are upside-down, overturned by an ancient storm surge. Crinoids (sea lilies) are also abundant and well preserved, especially segments of the slender, flexible stems that rooted these animals to the sea floor. Other common fossils include shells of brachiopods, especially "spirifer" types with wide hinge lines. More rare are fossil trails of worm burrows through the sea mud and occasional trilobite fragments.

Glacial-Age Deposits: In the middle of the exposed rock channel is a stream-lined mound of dark brown deposits that are much softer than the bedrock beneath. These deposits are all that remain of earth materials that formed the land surface across the gorge prior to flooding. The materials are layered and weathered, which indicate deposition by water, probably during a glacial-age chapter of the Iowa River's history.

Prepared August, 1993, by Iowa Department of Natural Resources, Geological Survey Bureau, 109 Trowbridge Hall, Iowa City, IA 52242 [Revised May 1998]

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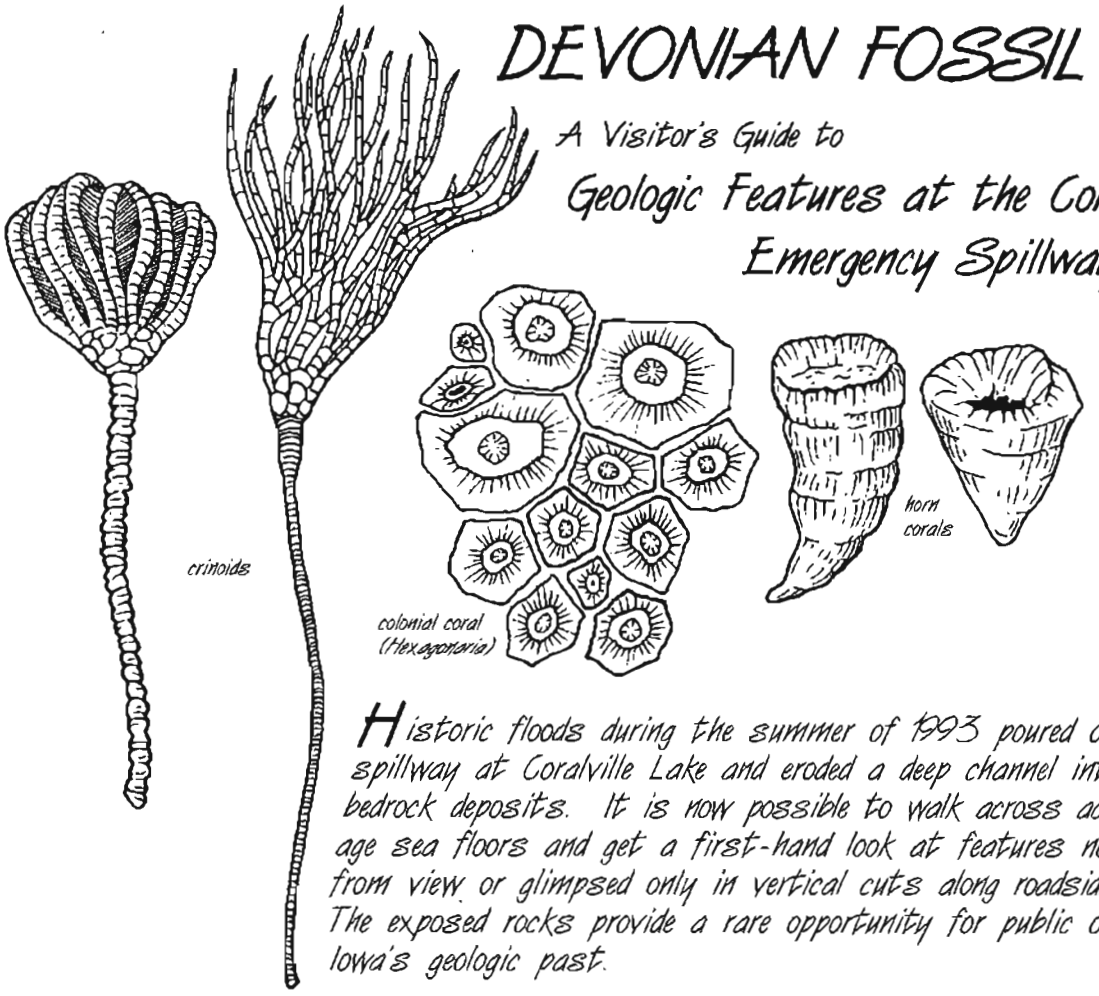

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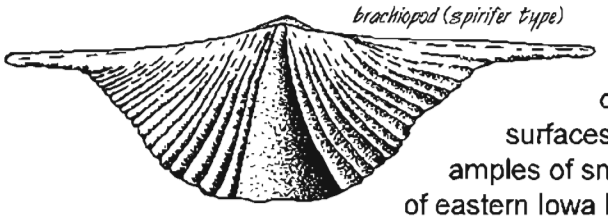

brachiopod (spirifer type)

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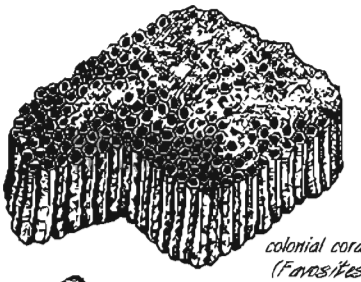

colonial coral (Favosites)

brachiopod (Atrypa)

Prepared by
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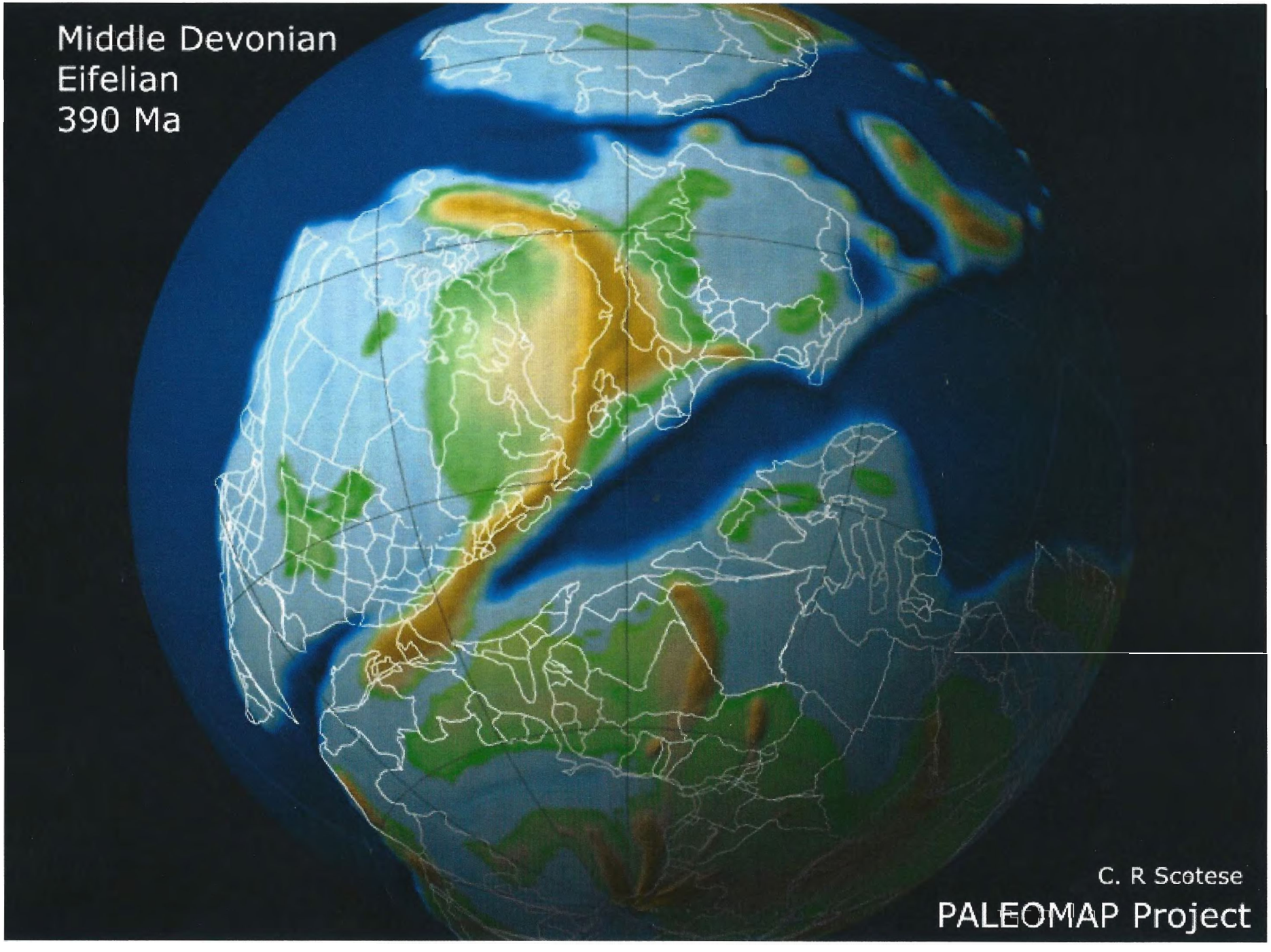
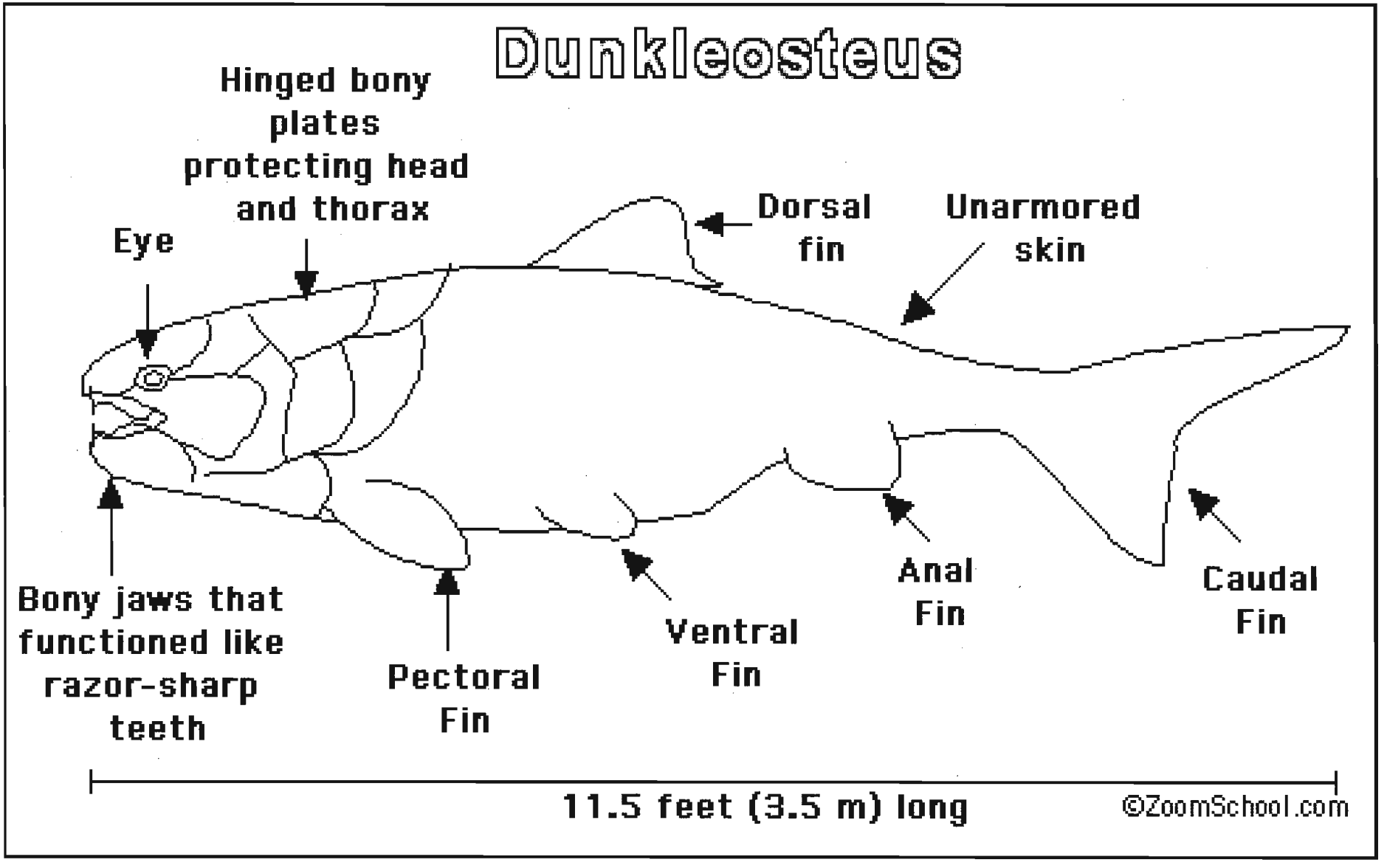
Illustrations.
Brachiopods from "Geology of Iowa" by W.I. Anderson (1983)
Others by the Geological Survey Bureau


Middle Devonian
Eifelian
390 Ma
C. R Scotese
PALEOMAP Project


Dunkleosteus
Hinged bony plates protecting head and thorax
Eye
Dorsal fin
Unarmored skin
Bony jaws that functioned like razor-sharp teeth
Pectoral Fin
Ventral Fin
Anal Fin
Caudal Fin
11.5 feet (3.5 m) long
©ZoomSchool.com

The Devonian Period (395-340 Million Years Ago)

The Devonian was a time that was dominated by Marine life. Many unique fishes, brachiopods, crinoids, and corals dwelled in the Devonian seas. The fish alone have been divided into five categories: Agnatha or "jawless fish," spiny fish, Placoderms, Chondrichthyes or sharks, and bony fish.

As you can see the Devonian was very diverse, but more than that it was a time of great change. The first Amphibians made their way onto land. These Amphibians my have evolved from lobe fish. Also Tetrapods, which are "land living vertebrates" and Arthropods, which are insects and arachnids moved to land.

Animals were not the only organisms moving to land, plants were as well. These plants most likely did not have roots, leaves, or vascular tissues, and did not grow over a few centimeters tall. However, since the Devonian period was full of change, by the end of the period the plants had leaves, true wood, and bared seeds.

Later on in this packet we will be discussing some of the marine animals that lived during the Devonian period.

Devonian Tectonics

Before we go any further we need to discuss "*tectonics*." This will help you to understand how Iowa, and other parts of North America, have remnants of fossilized marine animals.

During the Devonian period there were only two "*super continents*" known as Euramerica and Gondwana. All around these super continents were areas called *subduction zones*. Subduction zones were areas where the continents would rub and push against one another. This allowed for continental movements and collisions.

Keep in mind that our organisms were tropical marine organisms. So our super continents at some point had shifted to areas that had a tropical environment.

Because of the continental collisions and movements, continental flooding was quite frequent. The flooding allowed for the marine organisms to be deposited in shallow continental seas.

Towards the end of the Devonian, water receded and left behind the organisms. When the organisms died their "*hard parts*" were fossilized and deposited in limestone, these *hard parts* are what you see today.

DUNKLEOSTEUS

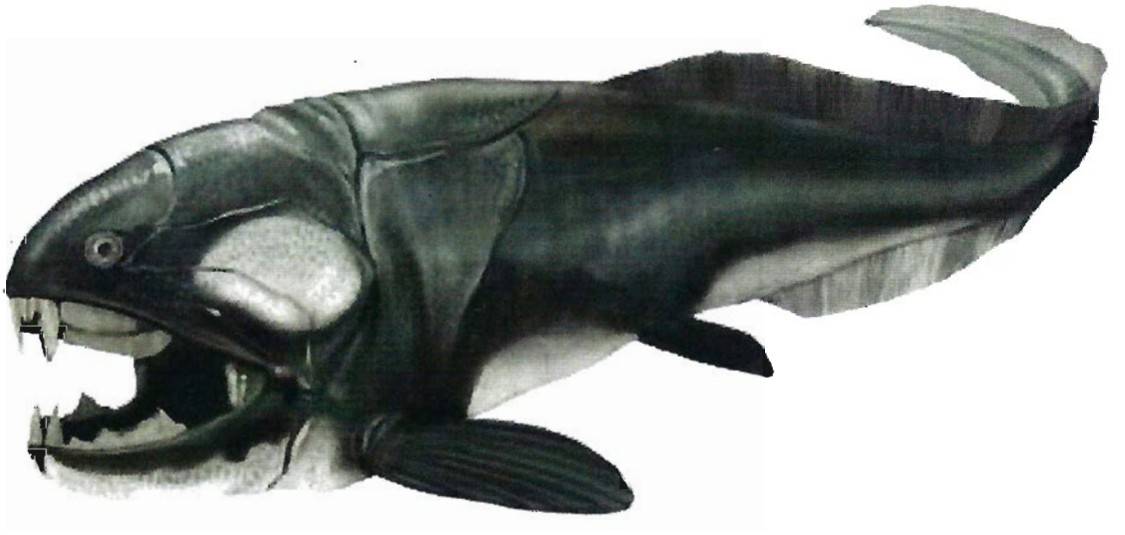
Pronounced *Dunk-lee-os-t-us*

Dunkleosteus has been speculated to be the top predator of the Devonian seas. He was a carnivore. This means that he ate other fishes and animals for dinner.

Dunkleosteus could get up to thirty feet in length. He had a thick bony plate in his neck region that would allow him to move his head up and down. This helped him to catch his prey. The rest of Dunkleosteus' body was smooth, like the body of an eel.

Dunkleosteus was a type of *Placoderm*. Placoderms are extinct armored fishes with jaws. Dunkleosteus didn't have teeth, but sharp bony jaws. The jaws would rub against one another further sharpening them.

Fossil evidence suggests that placoderms may have had red tummies and silver backsides. This further suggests that they may have had color vision.



TRILOBITES

Pronounced *Try-lo-bite*

Trilobites are an extinct Arthropod. However there are Arthropods living today, some examples are the pill or sow bugs, also known as "rollie pollies."

Trilobites had a head, a neck region called a thorax, and a tail.

Recall from the beginning of this packet that the world was mostly covered by shallow seas, trilobites lived in seawater.

Most trilobites were able to crawl along the bottom of the seafloor, some could even swim.

Trilobites had many types of feeding methods. Evidence suggests that they may have been scavengers, grazers, or filter feeders. Evidence also suggests that trilobites lacked large mandibles, so they were probably not predators.

Trilobites would eat by stirring up food from the sea floor; they would then pass the particles forward to their mouth.

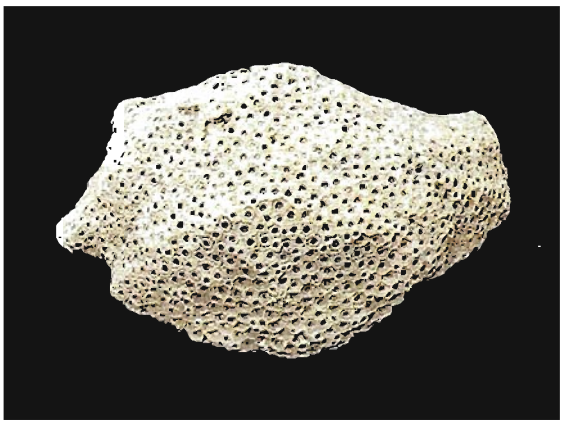
CORALS

Two types of Corals lived in the Devonian seas; they are Colonial Corals and Solitary Horn Corals

Both of these corals are extinct. However some of these extinct corals resemble corals found in oceans and seas today.

There are a few similarities to pint out between the Colonial corals and the Horn corals. First, both organisms functioned in building large reefs. Second, they both had an animal living in them that resembled a modern sea anemone. These animals had tentacles and would grab food with them as it passed by. However, the creature that inhabited colonial corals was much smaller than the one in the Horn corals. Lastly, both types of corals were sessile creatures, meaning they did not move around.

Colonial corals and Horn corals have many similarities, but they also have differences too. A big difference is shape. Solitary Horn corals are shaped like Bugles corn chips; whereas the Colonial corals are shaped like honeycombs found in a beehive.



Colonial Coral

Colonial Coral

Horn Corals

BRACHIOPODS

Pronounced *Brack-e-o-pod*

Brachiopods are marine creatures that only live in seawater. Surprisingly Brachiopods are still common in today's seas. However, they make their home in very deep, cold regions and are not encountered very often.

Brachiopods resemble modern clams. Like clams, Brachiopods are bivalves, meaning they are made from two shells. Even though Brachiopods resemble clams, it's important to realize there are differences between the two.

Clams have a foot that allows them to move along the sea floor. Their shells are the exact shape and size.

Brachiopods have an arm that attaches them to the sea floor. Their shells are two different sizes. The lower, smaller shell fits into the bigger, upper shell.

Brachiopods eat by filter feeding. Filter feeding means that they filter out tiny food particles from the water. Their shells are mostly occupied by an organ that pumps and filters water.

CRINOIDS

Pronounced *Cry-noid*

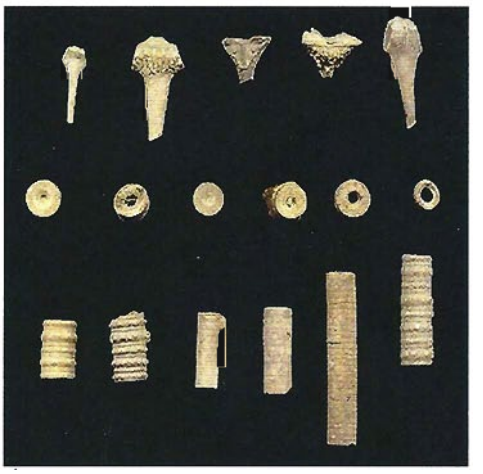
Crinoids are a type of Echinoderm. (Examples of Echinoderms are star fish, sea urchins, and sea cucumbers.)

Like the rest of our organisms that we have examined, crinoids live only in sea water and are quite uncommon in today's seas.

Crinoids, also known as "sea lilies," are animals with a plant-like appearance. They have three parts to their body. They have a stem, which attaches them to the sea floor. It also helps to support their body. They have body or "calyx" that contains the vital organs. The mouth and anus are located on the top of the body and are connected by a small gut. Their skeleton is composed of hundreds or tiny plates, which fall apart when they die. Crinoids also have arms. The arms have three jobs. First, they contain the reproductive organs. Second, the arms are used for respiration. Third, the arms gather small food particles from the water and transfer it to the mouth.

This type of body arrangement allows for flexible movement in the body and arms to gather food.

It is very unusual to find a complete fossilized Crinoid. This is because the body falls apart upon the death of the animal. Typically disc shaped pieces that resemble "cheerios" are found.



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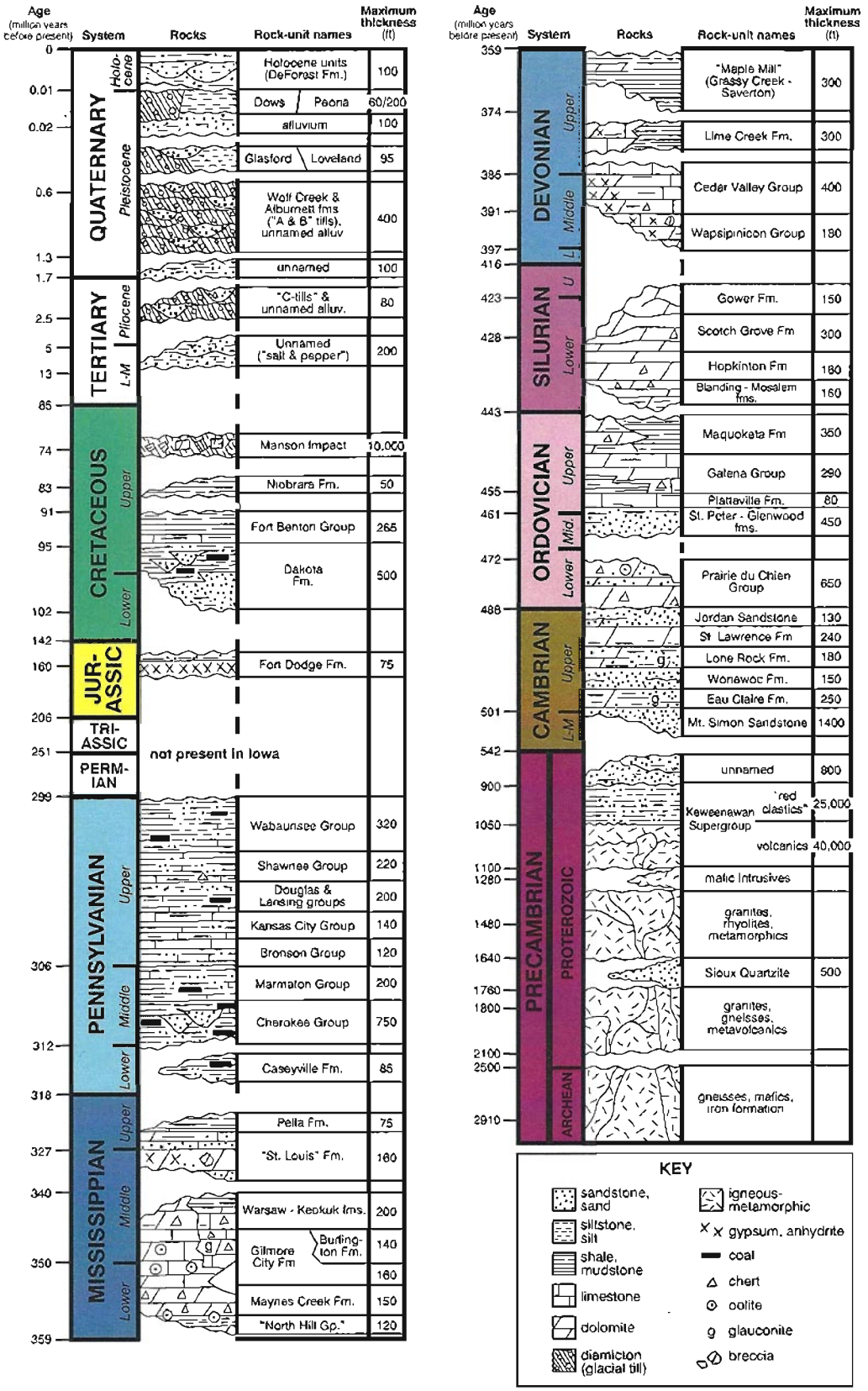
STRATIGRAPHIC COLUMN OF IOWA

2004



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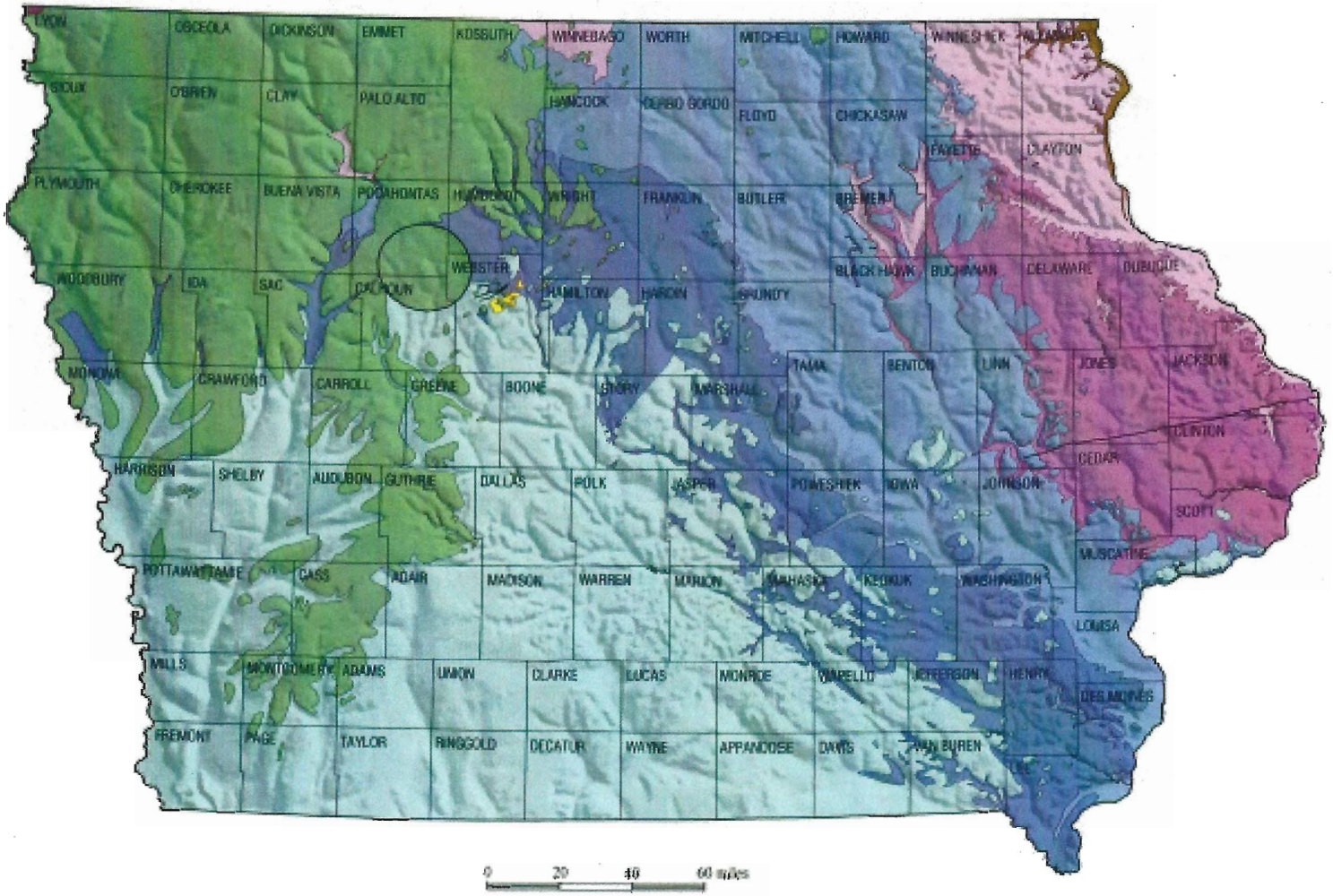
BEDROCK GEOLOGIC MAP OF IOWA

1998



Geologic Systems

Age of rocks in Iowa
(million years before present)

- **Cretaceous** (74–102)
- **Jurassic** (160)
- **Pennsylvanian** (298–320)
- **Mississippian** (325–353)
- **Devonian** (355–385)
- **Silurian** (415–435)
- **Ordovician** (439–505)
- **Cambrian** (505–530)
- **Precambrian** (600?–2,910+)
- Fault trace
- Manson Impact Structure

Shading highlights relief on the bedrock surface

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