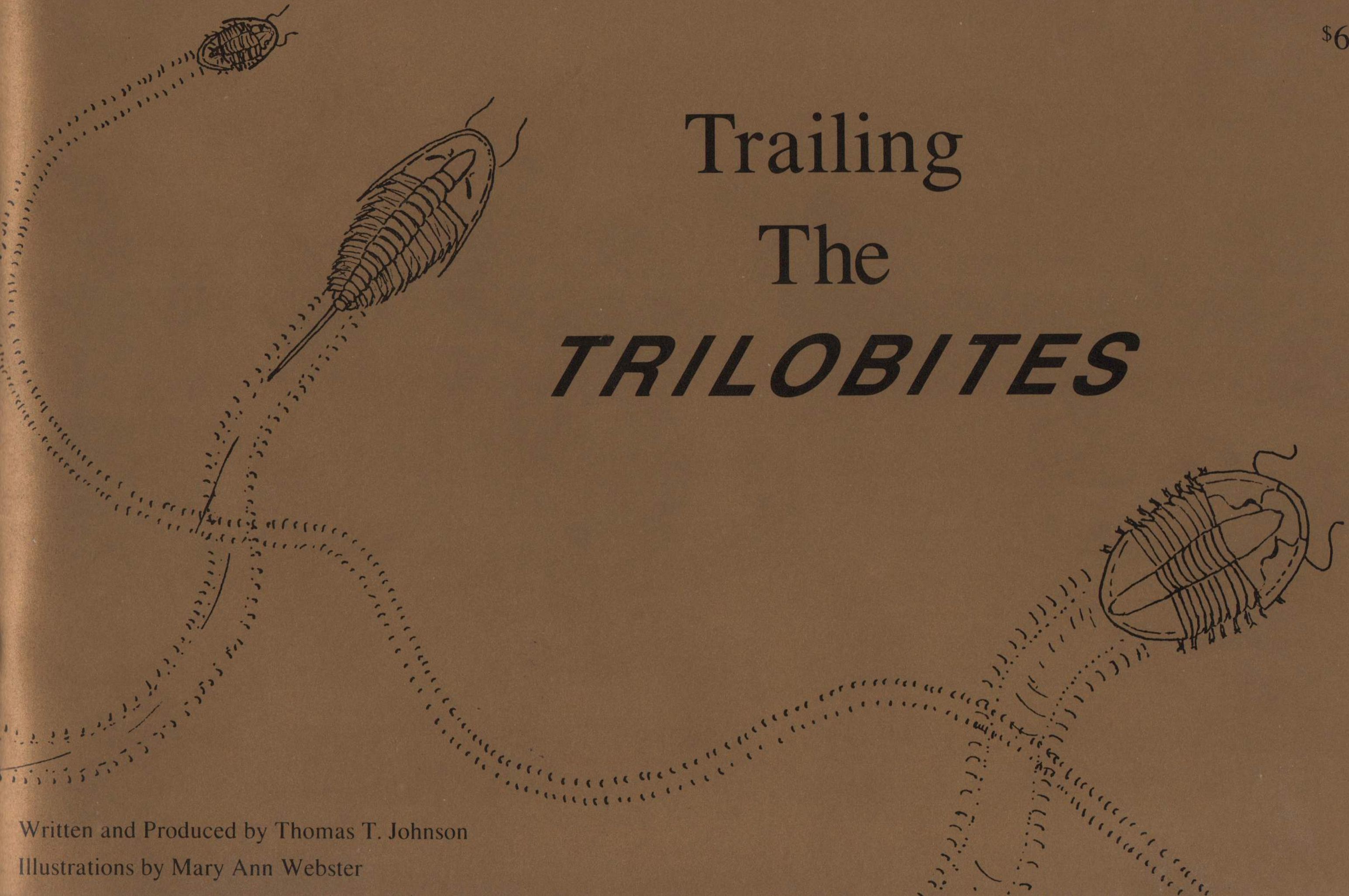
$6.95

Trailing The *TRILOBITES*



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Illustrations by Mary Ann Webster

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INTRODUCTION

At the dawn of the Paleozoic Era some 570,000,000 years ago the first trilobite appeared in the Cambrian Seas. Within 35,000,000 years the trilobites diversified and multiplied into thousands of species. For the next 290,000,000 years the trilobites populations slowly declined. By the end of the Permian Period or about 245,000,000, years ago the last trilobite disappeared thus ending their 325,000,000 years existence.

Ever wonder why trilobites attract so much attention from fossil collectors and paleontologist throughout the world? The fact that they had complex eyes and once ruled the seas is reason enough to study them. "Trailing The Trilobites" will reveal some of the trilobites life habits and explain some of their predators. There is much to learn about trilobites and why they became extinct. Join in the search for the elusive trilobite. Perhaps a new found interest in trilobites will help science better understand the mysteries surrounding their extinction.

A map of the United States is used with each specimen to show in what state the individual specimen was found.

Trilobite authors, family names, and orders have been purposely deleted to make this book more readable to the younger student. Please consult professional literature for this information.

Each copy of this book has been given an individual registration number. If the reader of this edition would like to enter the author's data base, please fill out a postcard with the registration number and mail to: Trailing The Trilobites, P.O. Box 28, Morrow, Ohio 45152.

Your registration number is: 1061 of 5200

CONTENTS

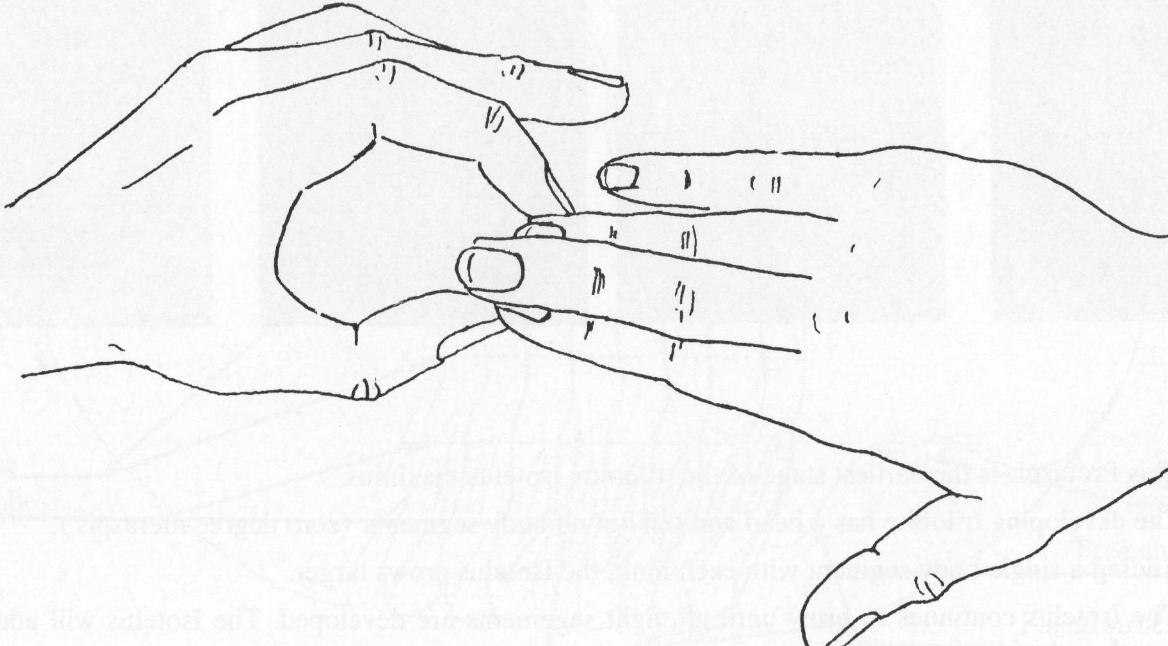
CHAPTER I

THE TRILOBITE

The word trilobite comes from the Greek word *treislobos*, meaning three-lobed. The three lobes run parallel to the axis of the trilobite or the length of the body. To better understand the three-lobed concept, try this simple demonstration. Using both hands (see drawing), take your thumb and index finger and squeeze together the index and ring finger on the other hand. Be sure the middle finger is above and not below. You have just created three lobes. You can even roll your fingers up in a ball, just like a trilobite.

Some trilobites were burrowing types, while others could swim and crawl about. All are considered scavengers who ate mud, seaweed or algae for food. All trilobites molted or shed their old hard shells as they grew (See p. 10). The shell, or shed, called an exoskeleton, was probably like a finger nail in consistency and hardness. When fossilized this exoskeleton turned to calcite, CaCo3, a common mineral.

The trilobite could also roll up in a ball to protect its soft underside from predators (See pgs. 71-87). A segmented body (thorax) allowed the trilobite to roll up and flex its body into a number of positions. A pair of jointed legs attached to each thoracic (body) segment, allowing the trilobite easy mobility on a soft muddy sea floor (See p. 8). Some species of trilobites had spines. The spines added beauty and protection to this otherwise defenseless creature.



GROWTH OF A TRILOBITE

1.

2.

3.

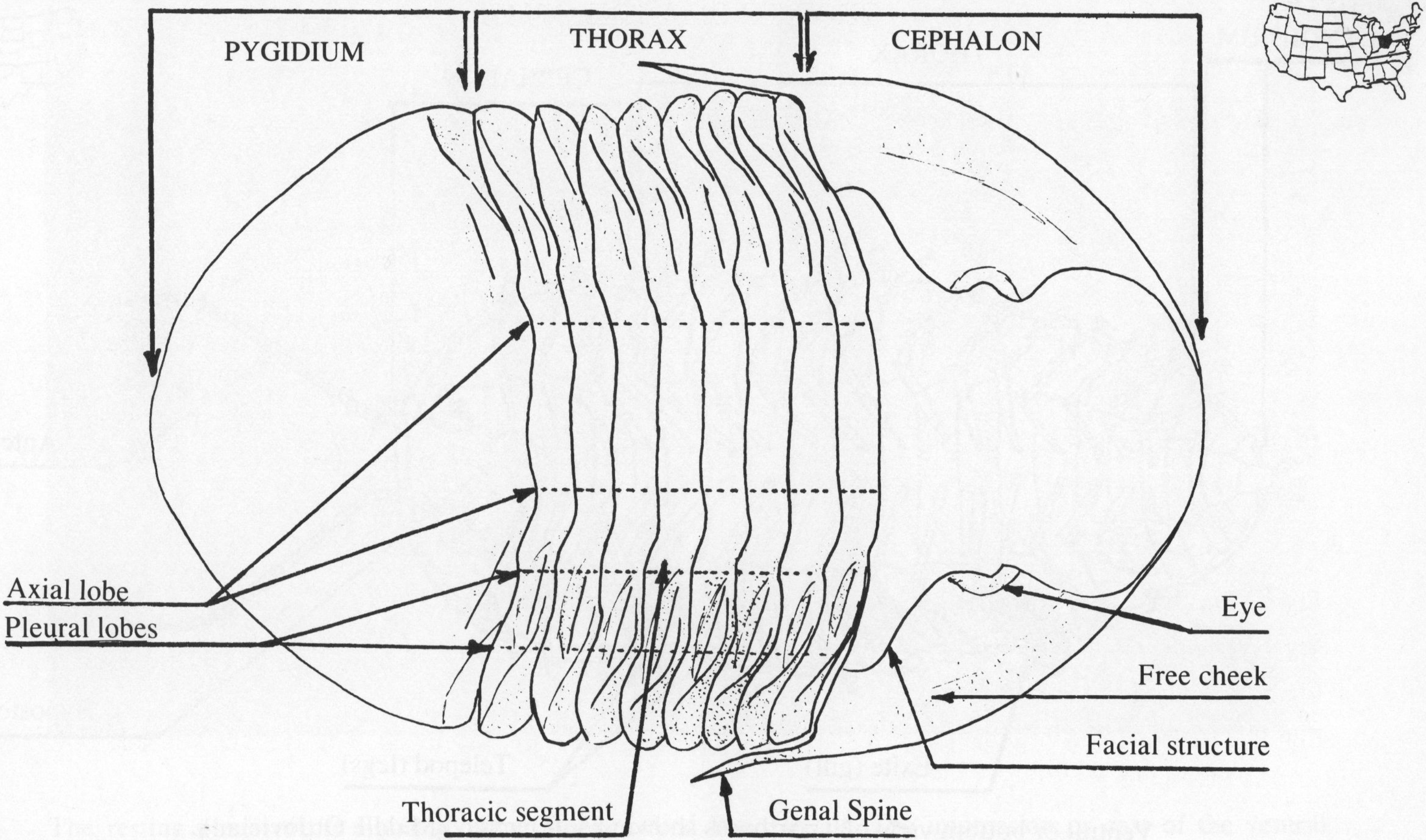
4.

Fig 1. This Protaspis is the earliest stage of the trilobite, Isotelus maximus.

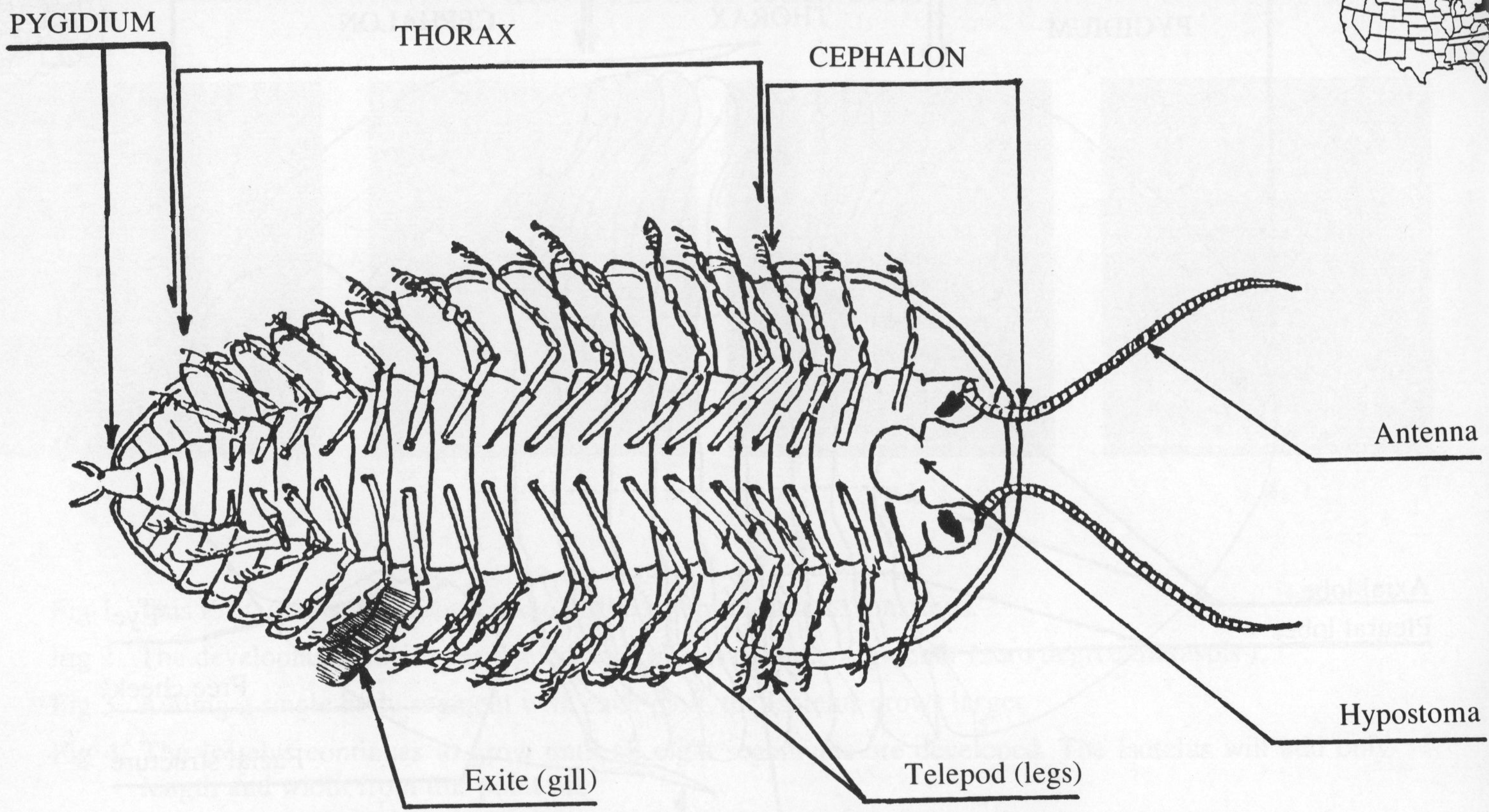
Fig 2. The developing trilobite has a head and tail but no body segments (zero degree meraspis).

Fig 3. Adding a single body segment with each molt, the Isotelus grows larger.

Fig 4. The Isotelus continues to grow until all eight segements are developed. The Isotelus will add only length and width from this point on.



Above is a dorsal or top view of the adult Isotelus maximus: Upper Ordovician.

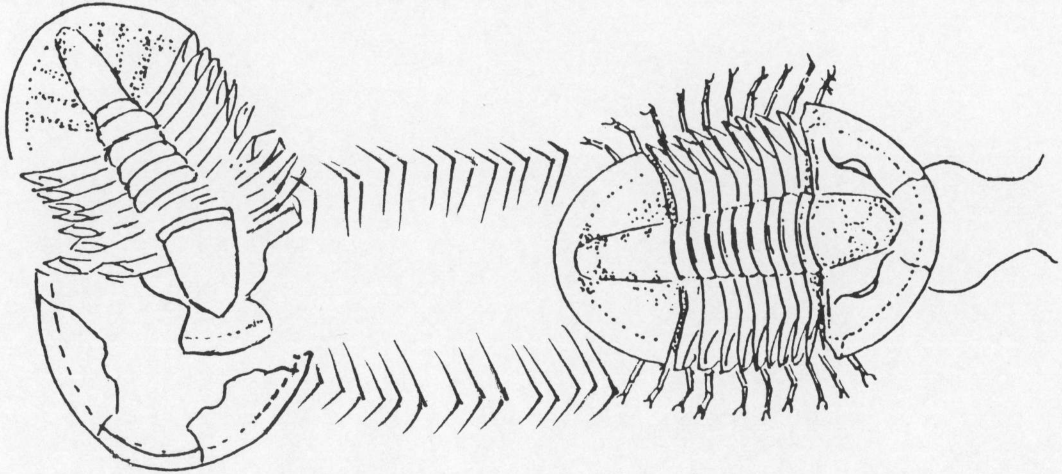


Ventral or bottom view of Triarthurus showing soft parts (Middle Ordovician).

Each leg of the trilobite was equipped with a gill. Only one is illustrated in the drawing.

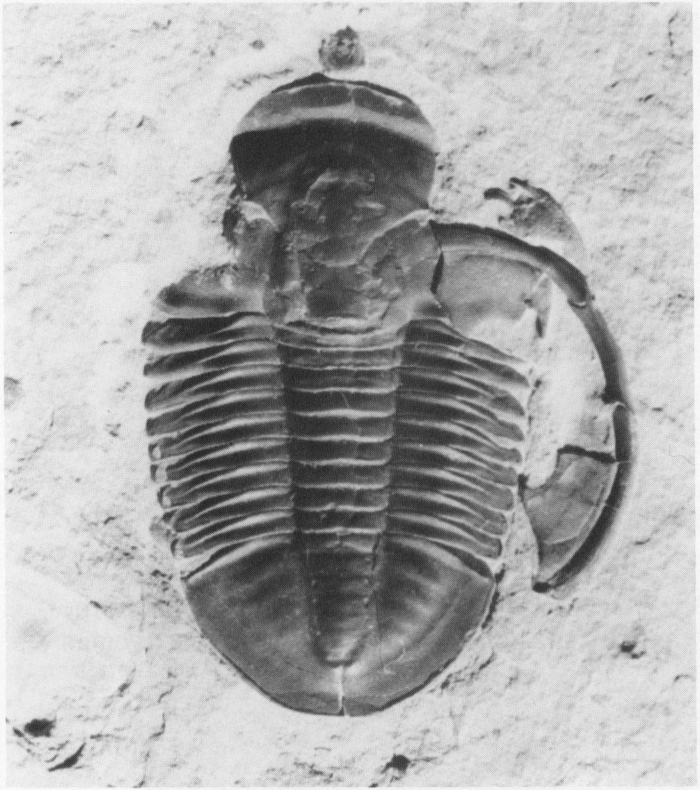
The resting place of the Flexicalymene meeki called Rusophycus. The impression or cast of the ventral side of the trilobite is called a trace fossil:

THE MOLTING TRILOBITE

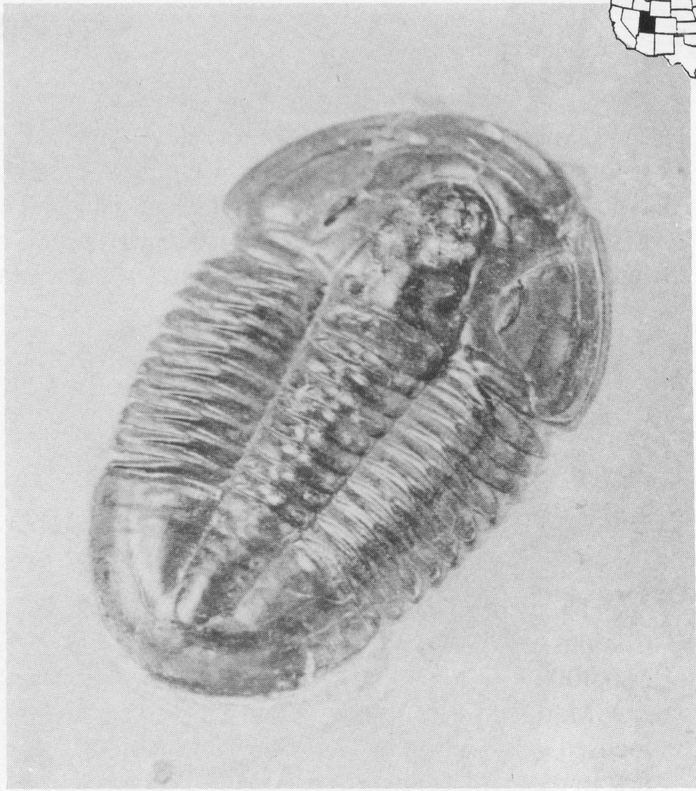


A line illustration of the molting trilobite Asaphiscus wheeleri. The developing trilobite soon outgrows it's exoskeleton and must cast off the old shell. The new soft shell trilobite is subject to attack from hungry predators. Hiding is a key to the survival of the individual (Middle Cambrian).

The trilobite Asaphiscus molts by pushing up on the center of its head and tearing apart the facial suture.



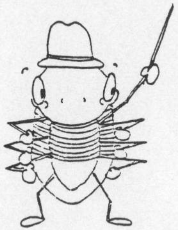
This is the actual specimen of the molted Asaphiscus used in the line drawing.



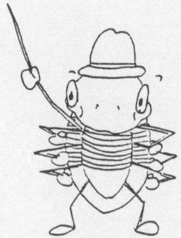
A complete specimen of Asaphiscus wheeleri with free cheeks intact.

TRILOBITE EYES

Trilobites had the first complex eyes on earth (as far as scientists know). Some were blind, but most trilobites had a complex eye. Two types of eyes were used during their 325,000,000 year span. The first type of eye is called holochroal and consisted of numerous lenses packed side by side and covered with a single continuous cornea. The second type of eye is called schizochroal and consisted of numerous lenses, each encased in a separate cylinder, possessing it's own cornea.

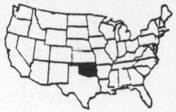


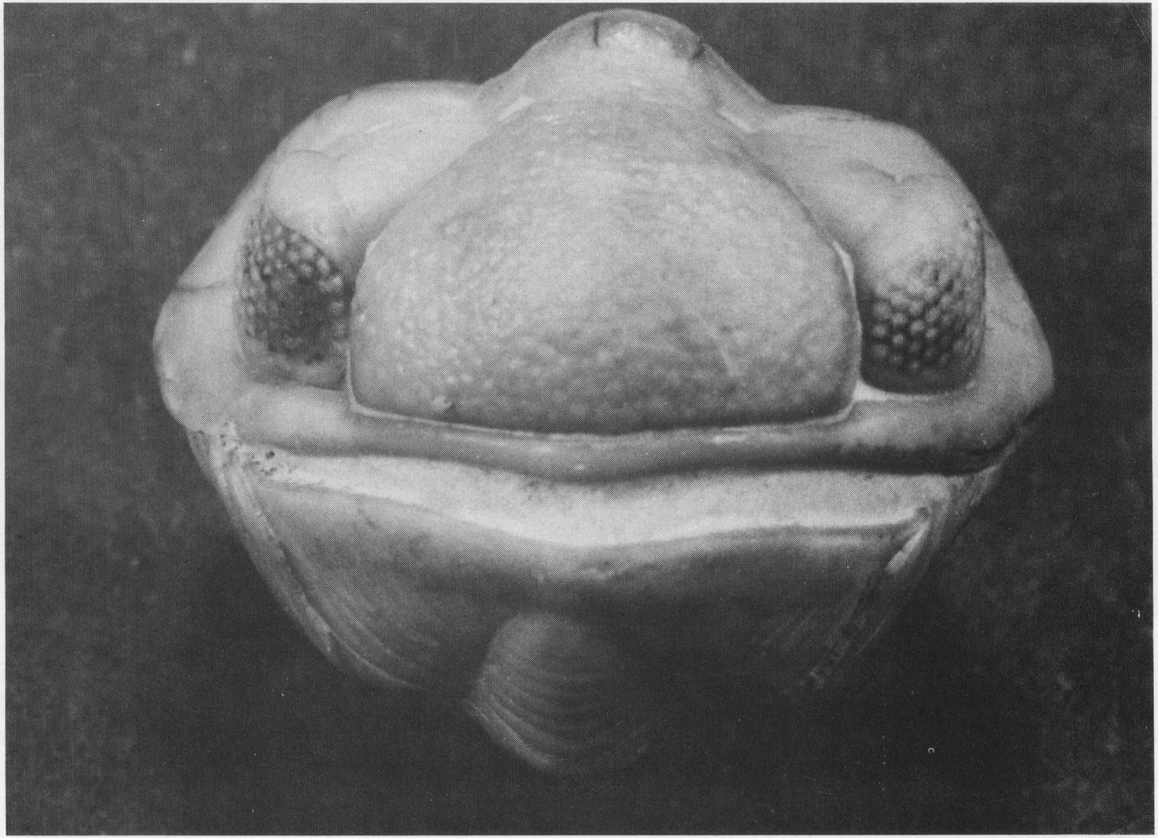
THE SCHIZOCHROAL EYE



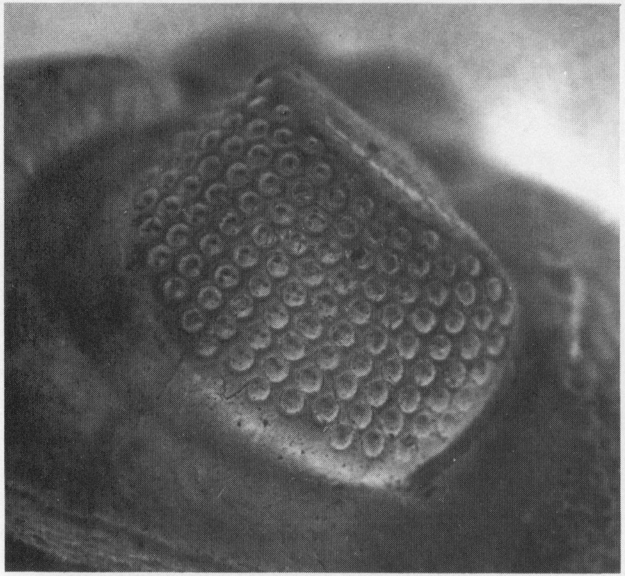
The schizochroal eye was the more complex of the two eyes; however, it became extinct before the trilobite did. Beginning in the Early Ordovician, 505,000,000 years ago and existing through the Devonian 360,000,000 years ago, the schizochroal eye worked 145,000,000 years successfully.

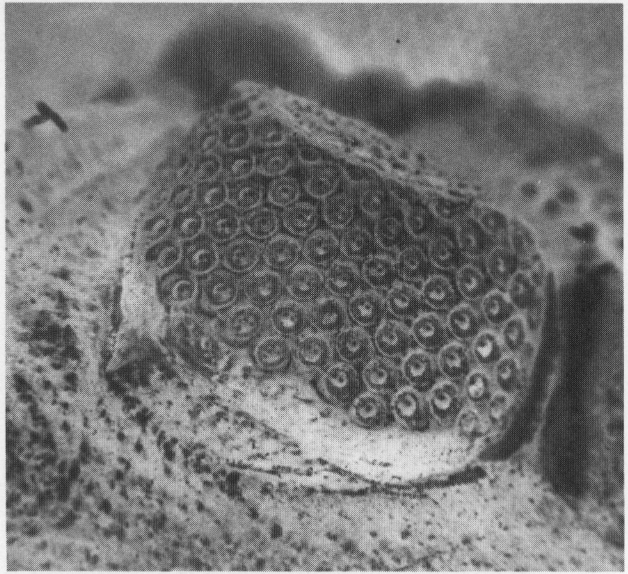
Man is just now beginning to understand how the eyes worked. Each lens had its own cornea and focused on a certain distance and area. The number of lenses and corneas in each eye ranged from a few to over 750 in some species.





The front view of a Ananaspis guttulus shows the schizochroal eyes. This Silurian trilobite is from Oklahoma and measured one inch across the cephalon.

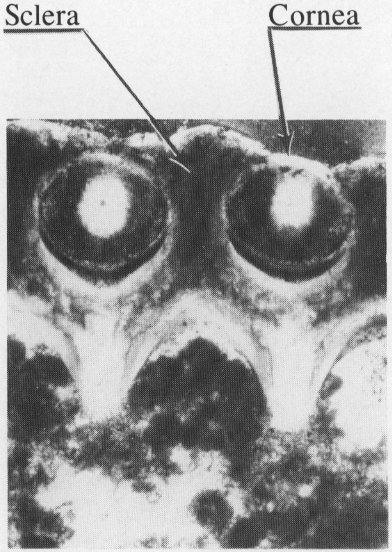




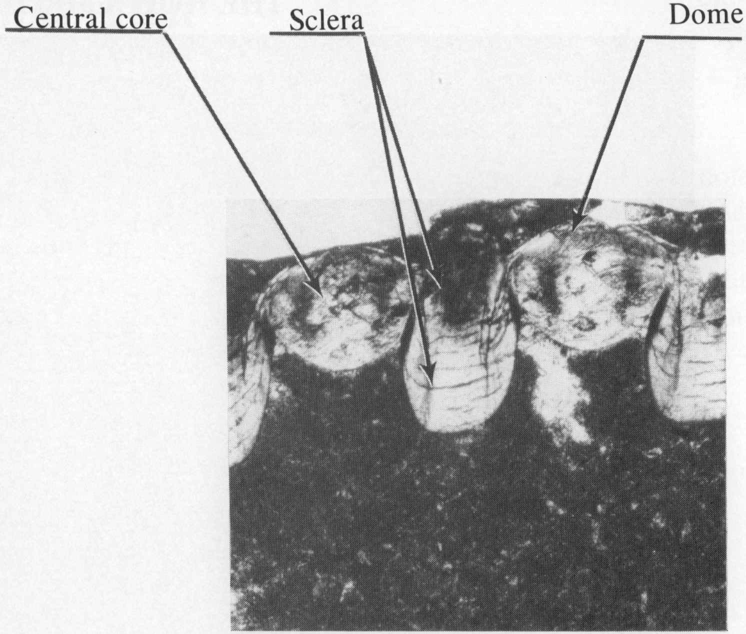
The eye of the Phacops rana milleri is at the left. This schizochroal eye contained 116 individual lenses and corneas. Each trilobite eye had a different number of lenses according to the species. Most only varied by a few lenses in a given species.

The eye of the Phacops rana crassituberculata is at the right. This schizochroal eye contained eighty-two lenses, somewhat less than the milleri at left.

(Negative Photographs)

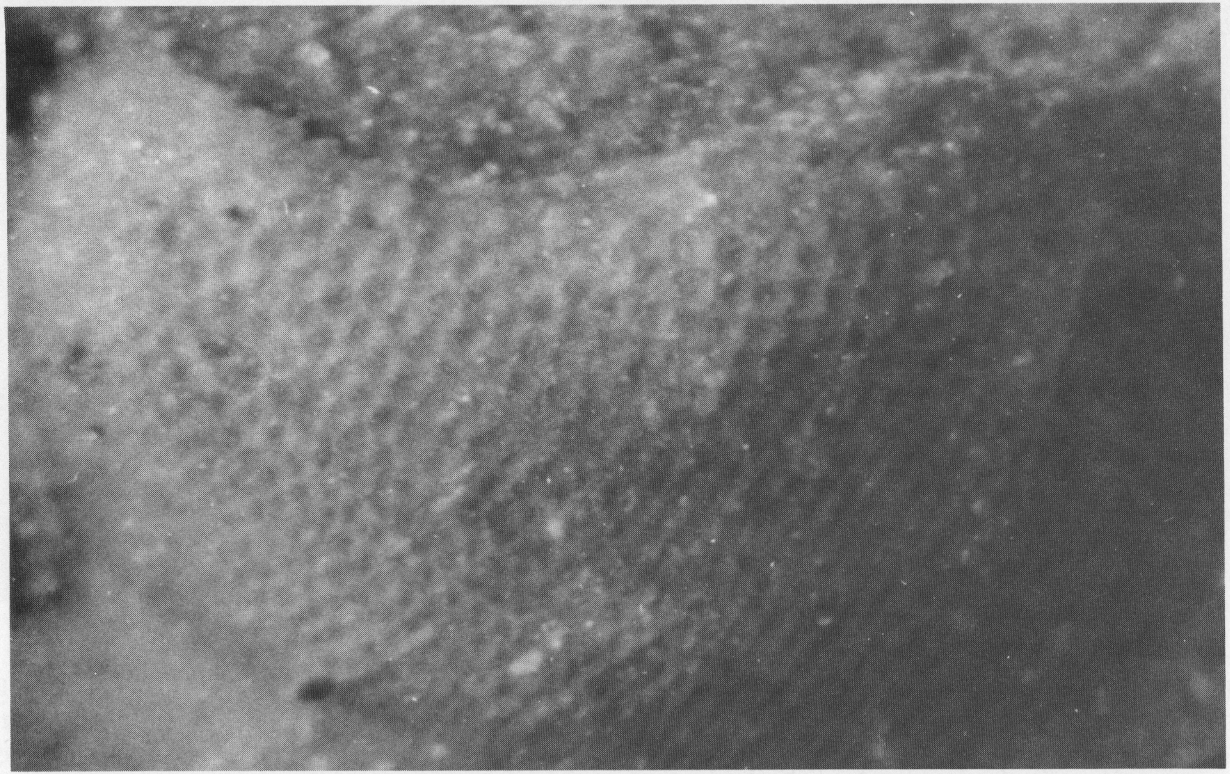


A thin section shows the lense structure of the schizochroal eye of the Phacops rana from Ohio. This thin section was prepared and photographed courtesy of Geoscience Resources, Burlington, North Carolina.



Thin section shows the lense structure of the schizochroal eye of a Paciphacops raymondi from Oklahoma. Thin section was prepared and photographed courtesy of Geoscience Resources, Burlington, North Carolina.

THE HOLOCHROAL EYE



The holochroal eye was the first type of the eye used by the trilobite. (It was also the last.) An example of the holochroal eye is shown here using the Isotelus maximus. An estimated 3,000 lenses are packed side by side and covered with a single continuous cornea.

CHAPTER II

COLLECTING TRILOBITES

Collecting trilobites is fun but requires a great deal of patience, luck, and a sharp eye. The whole family can participate on field trips as there is always a job for everyone. All land is owned by someone, so get permission first. Surface collecting is the most common way to collect and the easiest by far. Surface collecting means just that, only collecting on the surface. All that is needed is a collecting bag for the fossils, newspaper to wrap them and a pen and pad to record findings. Keeping records will be as important as finding the fossil. Without recording the findings, the fossil is worthless to science. This will be discussed later in the chapter.

An example of an excellent collecting site is Caesar Creek Lake, Ohio. This is a U.S. Army Corps of Engineers Project where thousands of school children as well as adults collect every year. With a permit issued by the Corps of Engineers anyone can collect here. Trilobites, brachiopods, crinoids, coral and bryzoans are common despite continuous surface collecting, (Upper Ordovician).

This is the way one should collect when working on a study site. Most of the time is spent on the knees, looking for small fossils.

When searching for small trilobites a microscope is required. Some trilobites are smaller than the period at the end of this sentence.

Walking creeks is popular, searching road cuts or wherever sedimentary rock such as limestone and shale are exposed. The weather is an important factor in surface collecting. Every change in the weather has an effect on exposed sedimentary rock. Rain, heat, freezing, thawing, wind, all change the exposed rock. Many times fossils are just laying around after a good rain.

Safety should always be exercised while collecting fossils. When surface collecting, stay out of restricted areas such as ledges, overhangs or steep walls of rock. When using small hand tools safety glasses should be worn as flying rock chips are hazardous. With the proper tools, collecting fossils is a safe hobby. In addition to safety glasses, good boots and gloves should be worn. When collecting in the bright sun for extended periods, a sun screen and sunglasses should be used.

Taking notes should be done in the field and at home. Important information may be lost when note-taking is negelected. To designate a location of the fossil always make a note of where the trilobite or other fossil was found. Paleontologist number their locations to simplify note taking and protect their sites. Placing labels on specimens is a must. Two labels per specimen are suggested, one for the field and one for packing and storage.

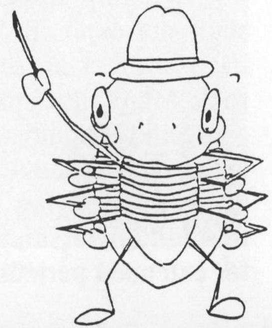
The field label will look like this:

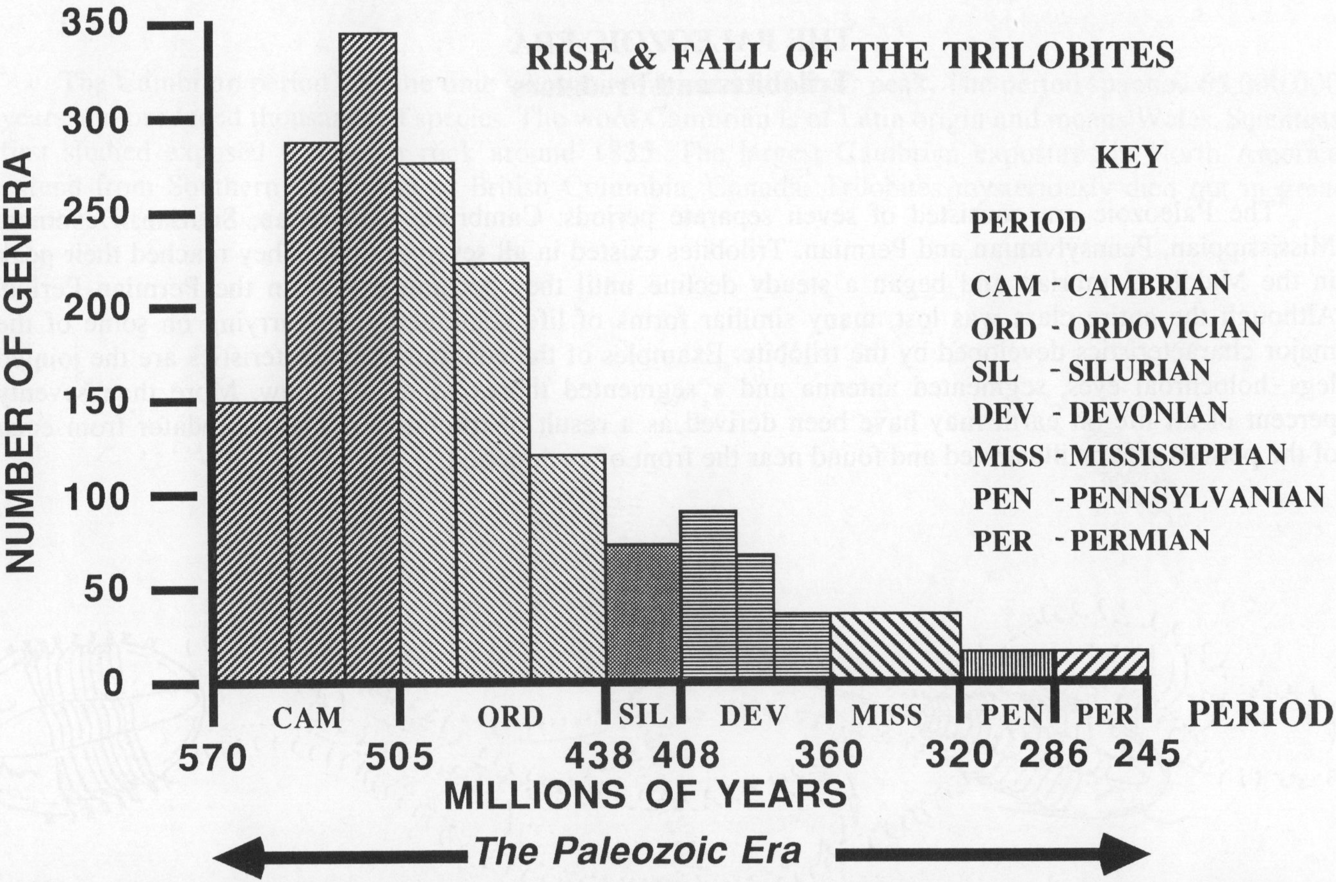
Locality:	# 26	Specimen:	# 3
Date:	Aug 23, 1988		
Specimen:	Trilobite		
Position:	Dorsal side up		
Direction:	N N W (North - North - West)		
Formation:	Waynesville		

Note: The direction refers to the way the head or front of specimen is facing.

Field labels should be entered into a notebook for safe keeping. The packing label should look like this: (Always include specimen number and locality number into catalog number.)

Specimen:	# 3	Locality: # 26
Genus & species:	Isotelus maximus	
Size:	3″ × 2″	
Comments:	Excellent condition (display grade)	
Catalog #:	3-26-I-m	

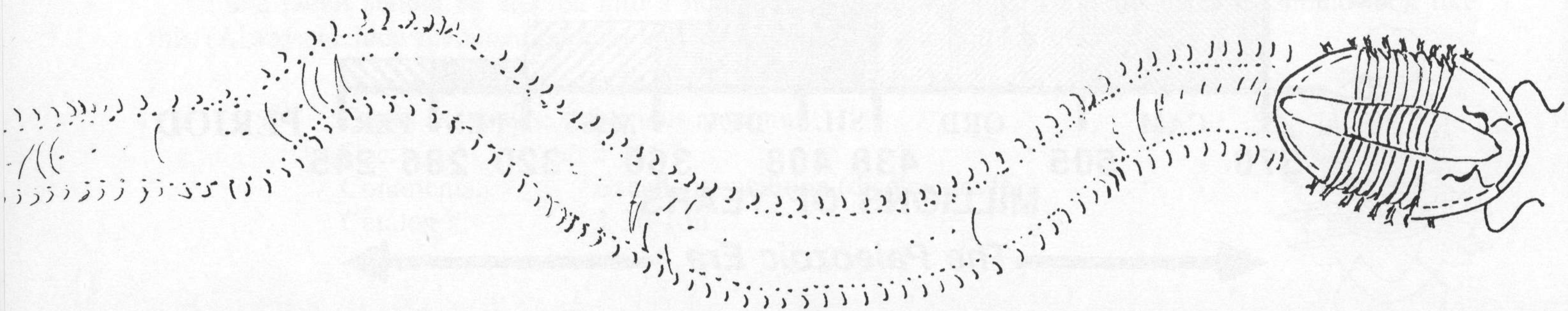



RISE & FALL OF THE TRILOBITES
KEY
PERIOD
CAM - CAMBRIAN
ORD - ORDOVICIAN
SIL - SILURIAN
DEV - DEVONIAN
MISS - MISSISSIPPIAN
PEN - PENNSYLVANIAN
PER - PERMIAN
NUMBER OF GENERA
350
300
250
200
150
100
50
0
CAM
ORD
SIL
DEV
MISS
PEN
PER
PERIOD
570
505
438
408
360
320
286
245
MILLIONS OF YEARS
The Paleozoic Era

CHAPTER III

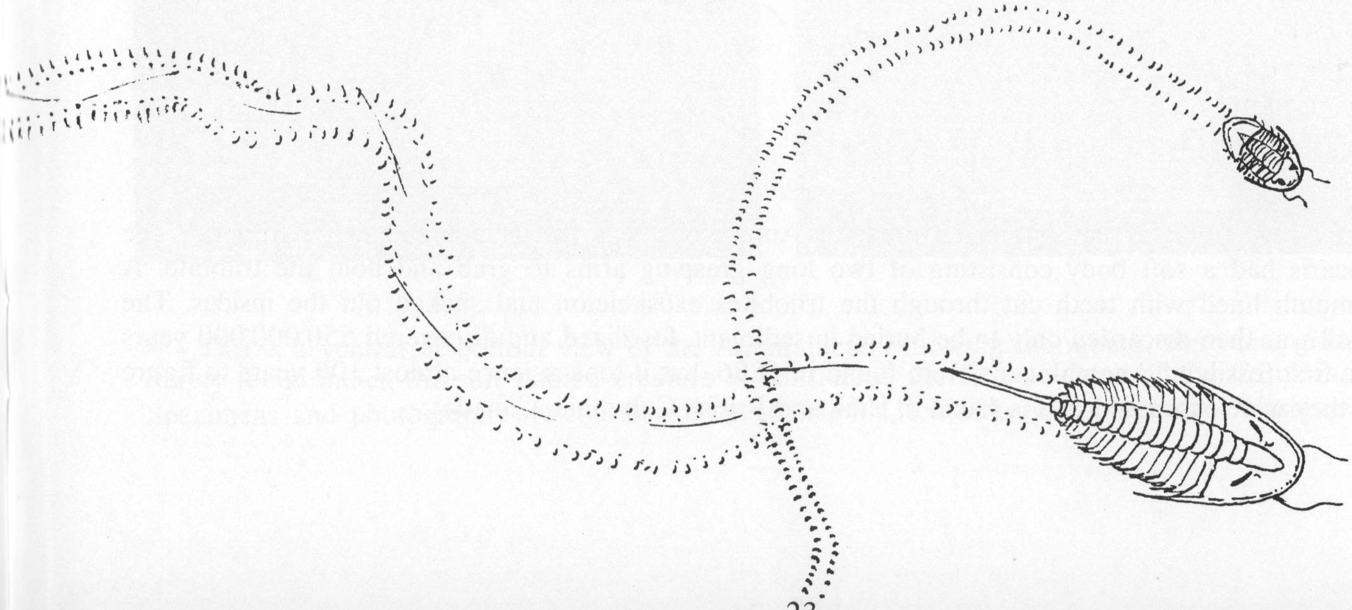
THE PALEOZOIC ERA
Trilobites and Predators

The Paleozoic era consisted of seven separate periods: Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian and Permian. Trilobites existed in all seven periods. They reached their peak in the Middle Cambrian and began a steady decline until they became extinct in the Permian Period. Although the entire class was lost, many similiar forms of life continued, thus carrying on some of the major characteristics developed by the trilobite. Examples of the continuing characteristics are the jointed legs, holochroal eyes, segmented antenna and a segmented thorax to name a few. More than seventy percent of all life on earth may have been derived as a result of trilobites. A major predator from each of the periods will be illustrated and found near the front of each period.

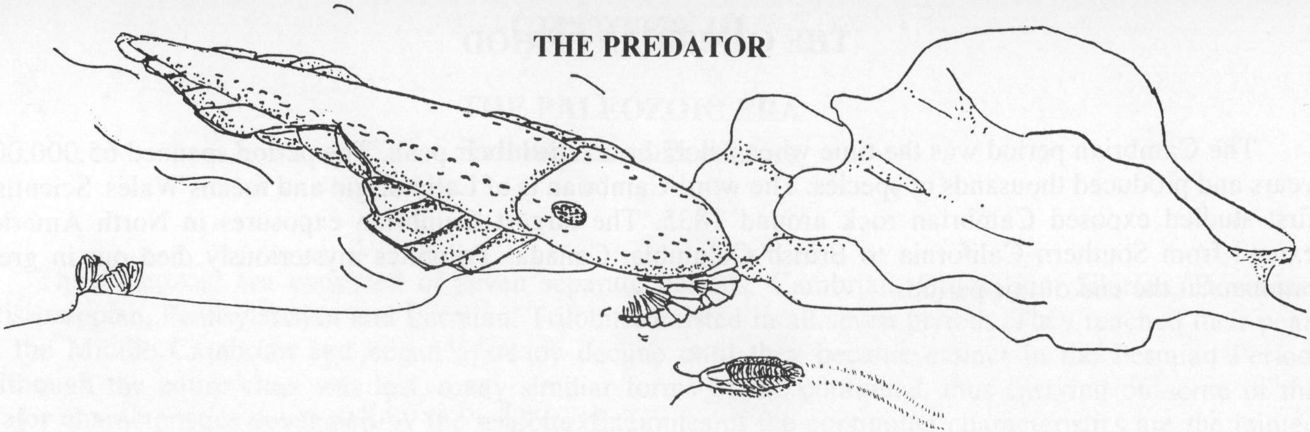


THE CAMBRIAN PERIOD

The Cambrian period was the time when trilobites reached their peak. The period spanned 65,000,000 years and produced thousands of species. The word Cambrian is of Latin origin and means Wales. Scientists first studied exposed Cambrian rock around 1835. The largest Cambrian exposures in North America extend from Southern California to British Columbia, Canada. Trilobites mysteriously died out in great numbers at the end of this period.

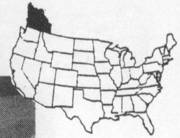


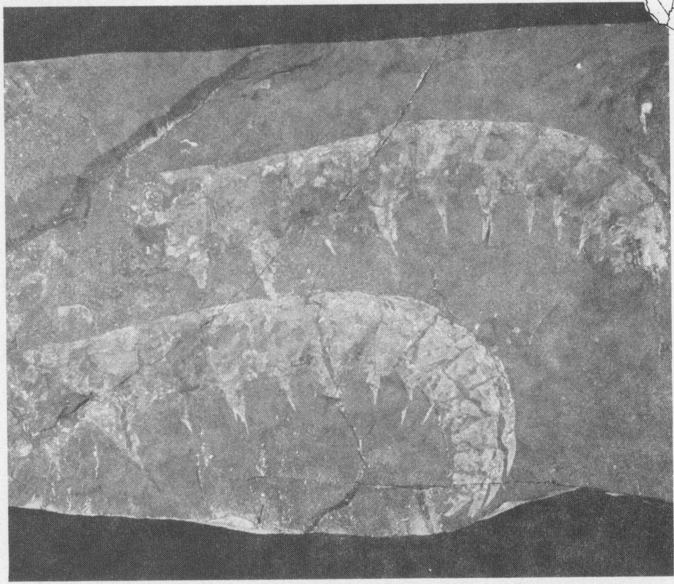
THE PREDATOR



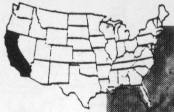
Artist's conception of the Cambrian predator Anomalocaris is shown approaching a trilobite. The Anomalocaris had a soft body consisting of two long grasping arms to grab and hold the trilobite. A circular mouth lined with teeth cut through the trilobites exoskeleton and sucked out the insides. The empty shell was then discarded only to be buried in sediment, fossilized and discovered 550,000,000 years later. The first fossils of Anomalocaris were found in 1886, but it took science almost 100 years to figure out what they were. Anomalocaris is found in Utah and British Columbia, Canada.

THE PREDATOR

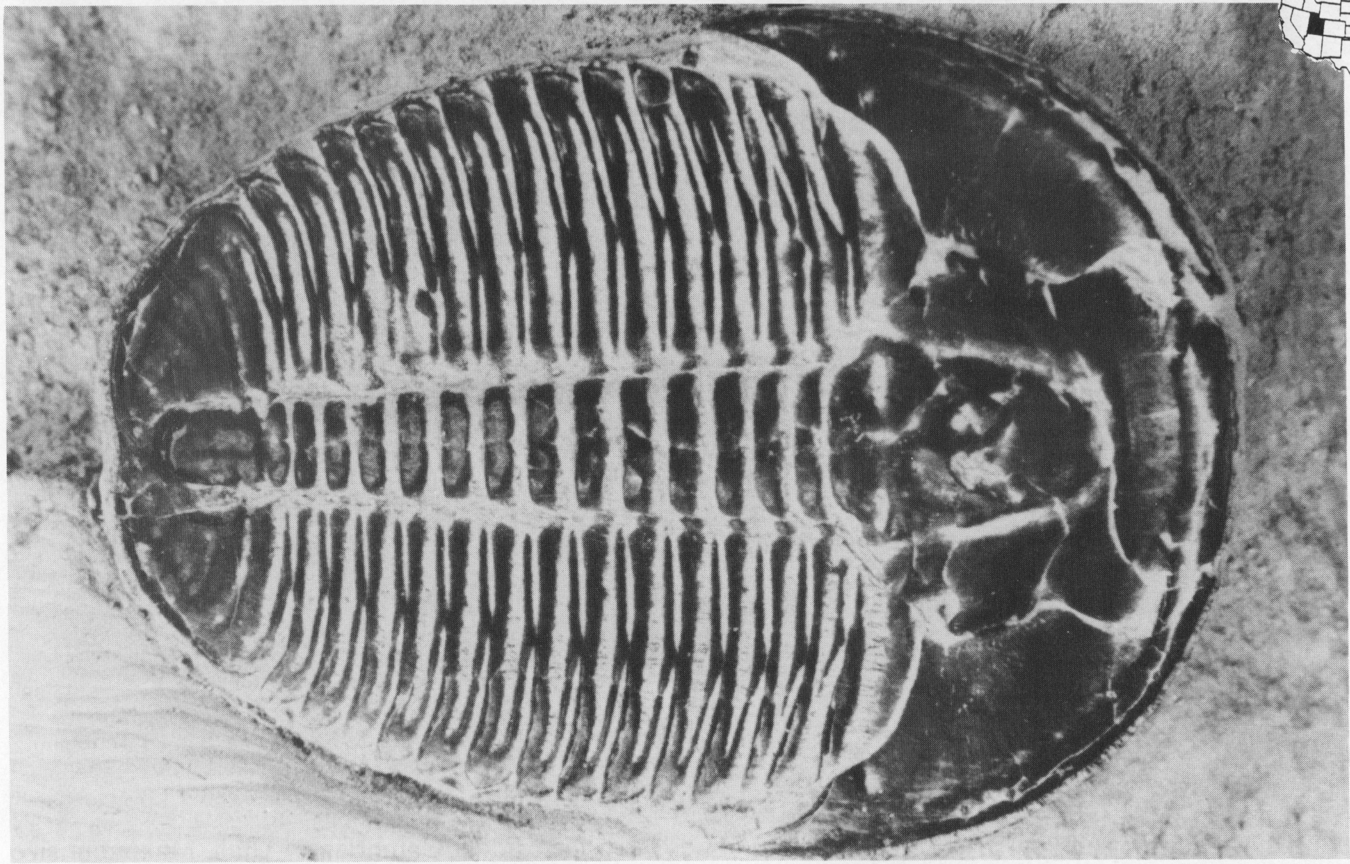


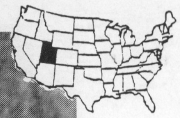


This is a ventral or bottom view of the Anomalocaris showing the mouth, teeth and grasping arms. Rarely found intact, this soft bodied creature is considered the first predator of the Cambrian seas. Specimens and photographs are courtesy of the U.S.N.M.N.H. Smithsonian Institution, Washington, D.C.

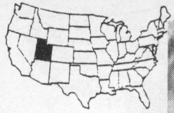


Here are several small Olenellus sp. found in the Nopah Range of Southern California. Olenellus were some of the first trilobites to roam the seas. This trilobite was considered common and dated at 570,000,000 years. Maximum size was six inches.

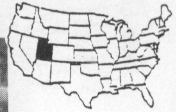


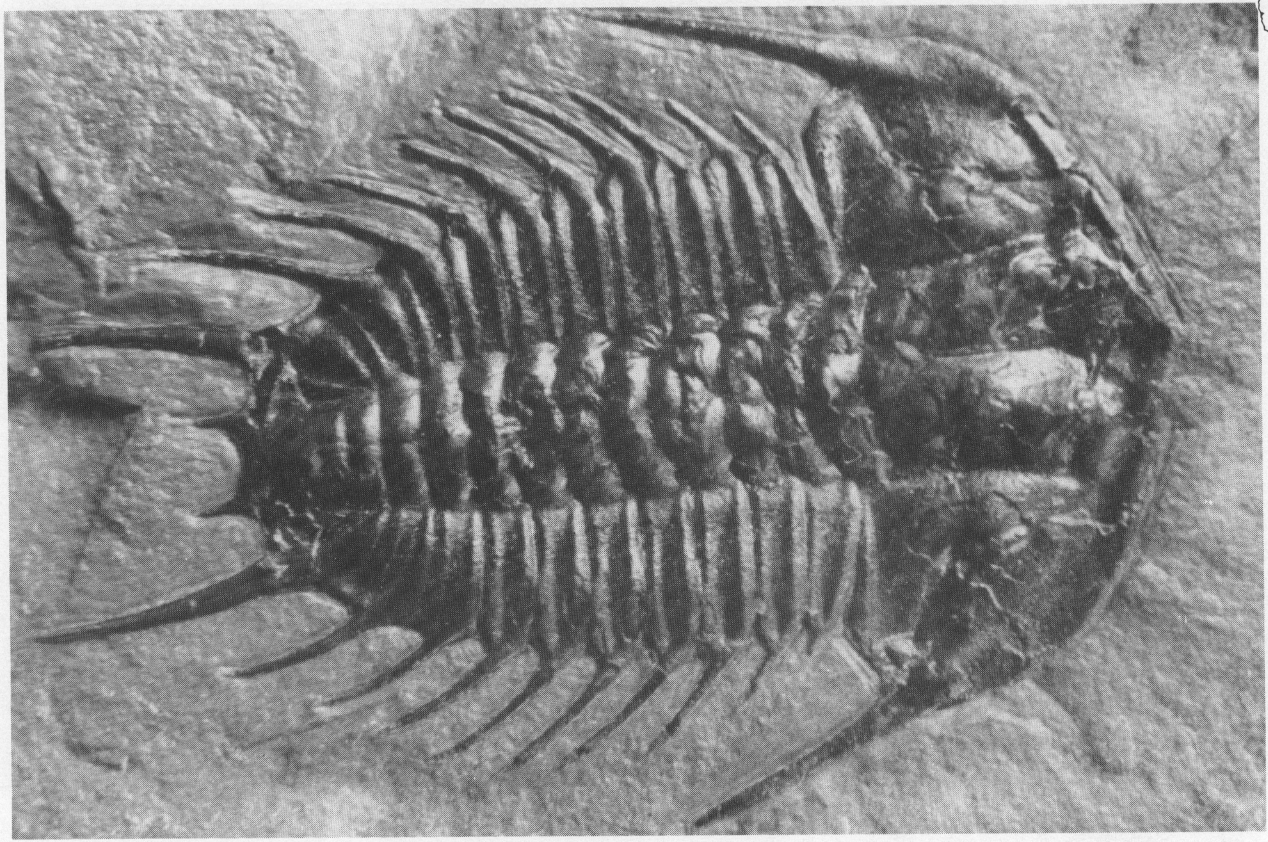


This Elrathia kingii was from the Middle Cambrian of Utah and considered common. Specimen was found in the Wheeler Amphitheater near Delta, Utah. Maximum size of this trilobite was two inches and is 550,000,000 years old.

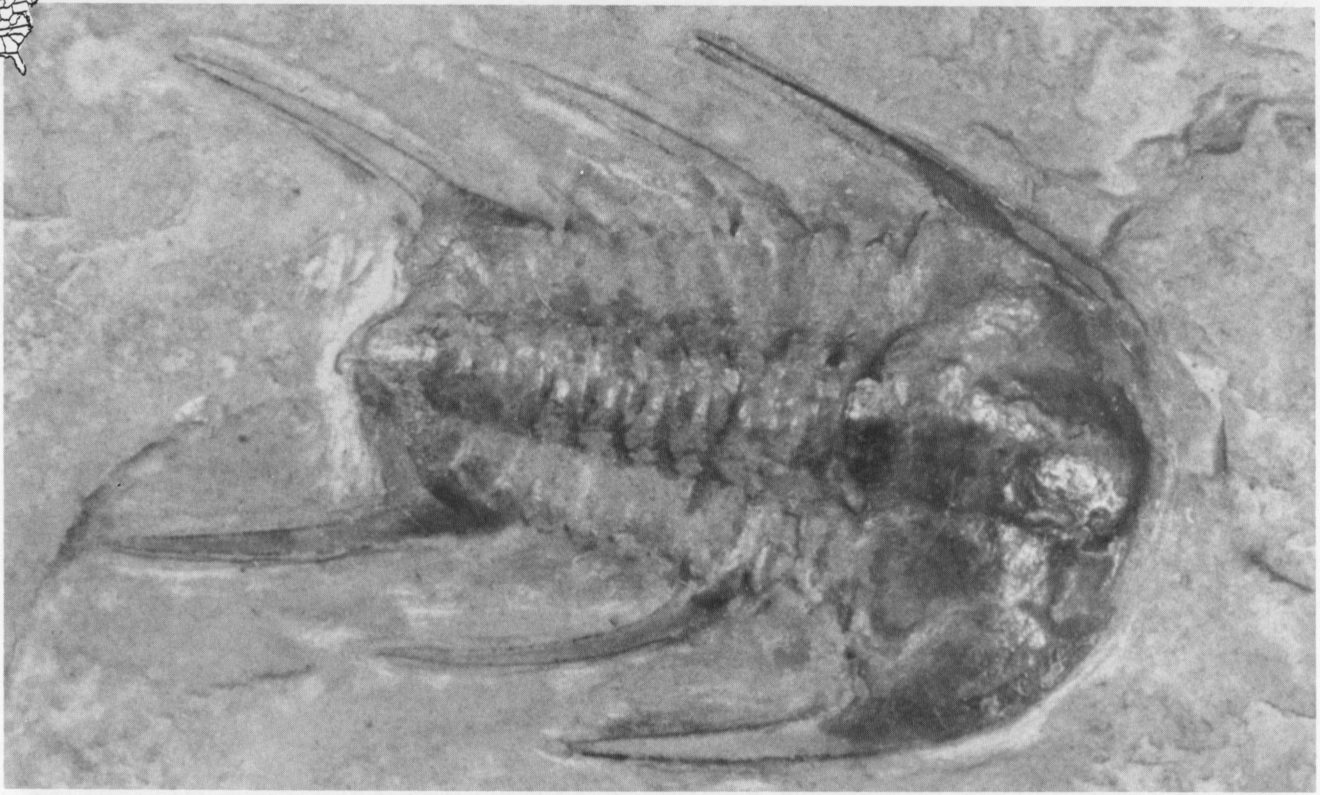


These Peronopsis interstricta were blind trilobites from the Middle Cambrian of Utah. Maximum size is five-eighths inch and considered common, 550,000,000 years old.





An Olenoides nevadensis from the Middle Cambrian of Utah. This trilobite was rare and very spiny. Maximum size was two and one-half inches.

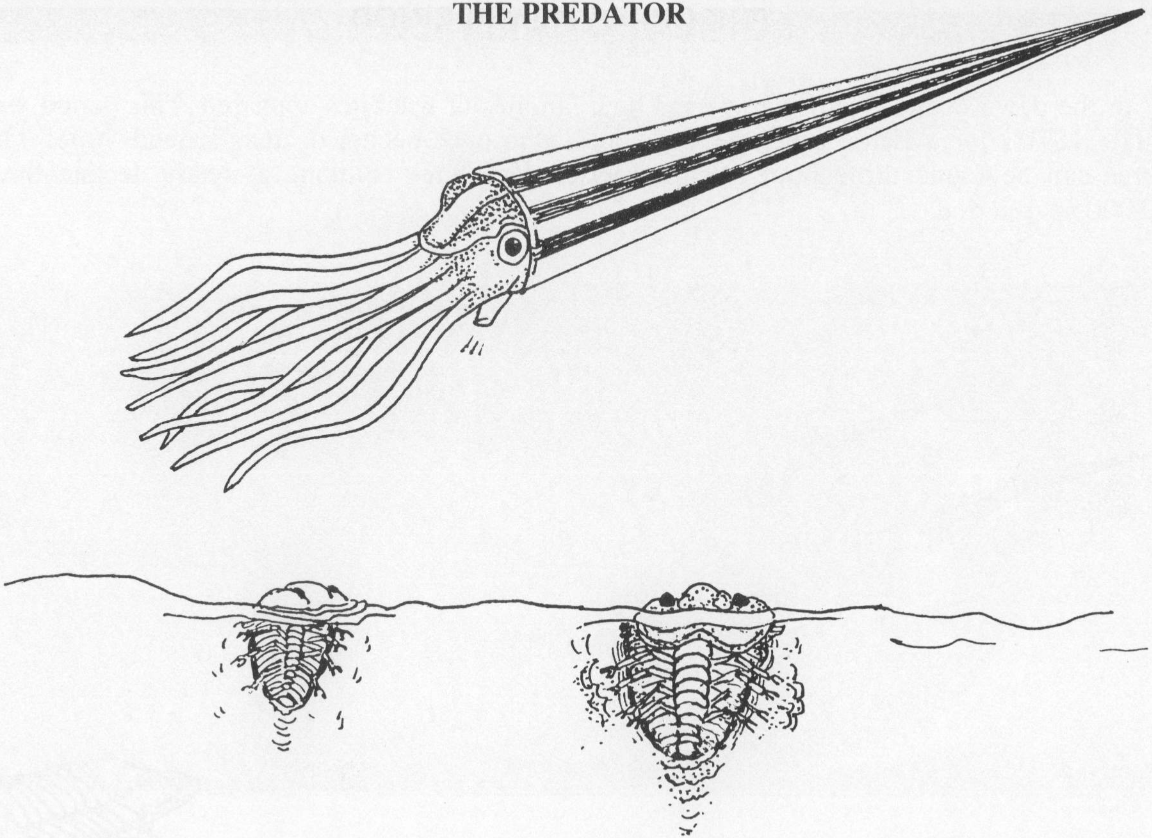


An Albertella helena from Nye Co, Nevada. This trilobite was rare and from the Lower Middle Cambrian, maximum size two and three-quarters inches.

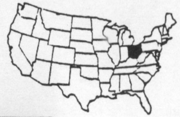
THE ORDOVICIAN PERIOD

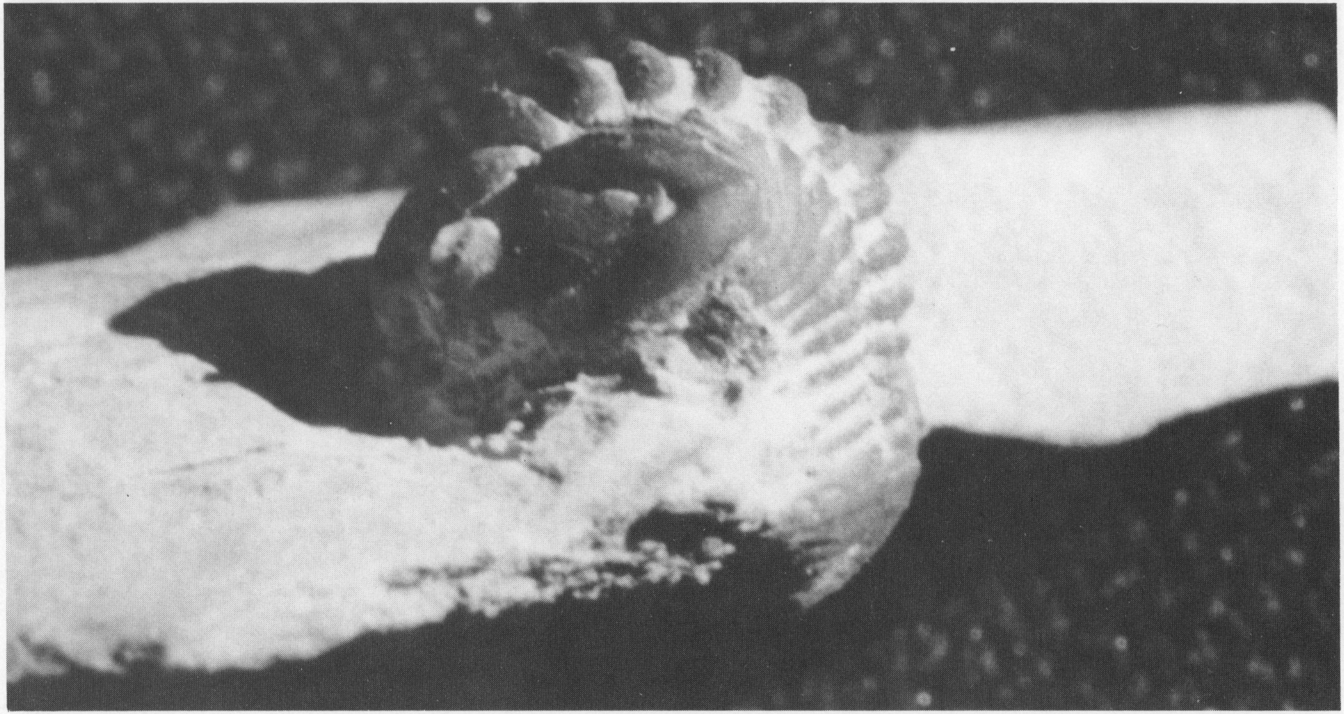
With the dawn of the Ordovician period new families of trilobites appeared. This period was named in the late 1870's for a Celtic tribe, the Ordovices, who once occupied areas around Wales. Ordovician exposures can be found throughout North America. Trilobites continue a steady decline through this 67,000,000 year period.

THE PREDATOR

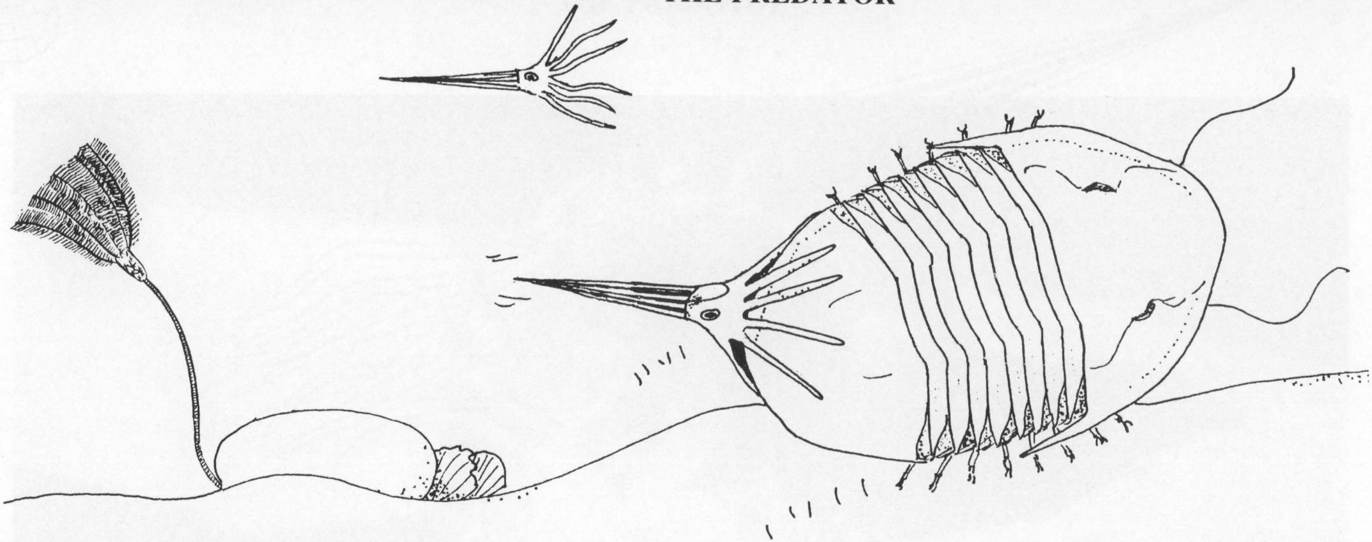


An artist's conception of the major predator of the Ordovician, the cephalopod. Notice how the trilobites hide in the sediments on the bottom of the sea. The trilobite could burrow in the mud and leave only its eyes and part of its head exposed to the would be predator.

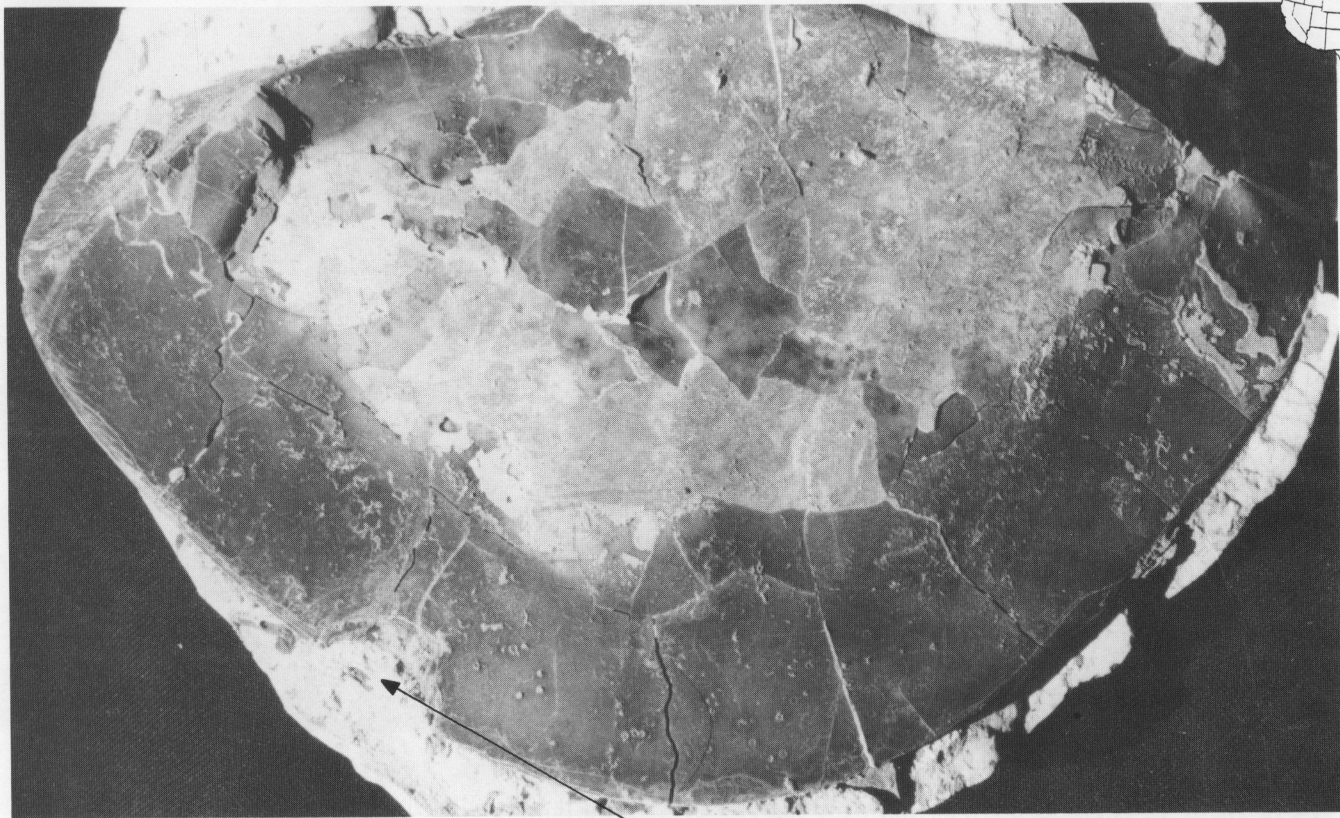




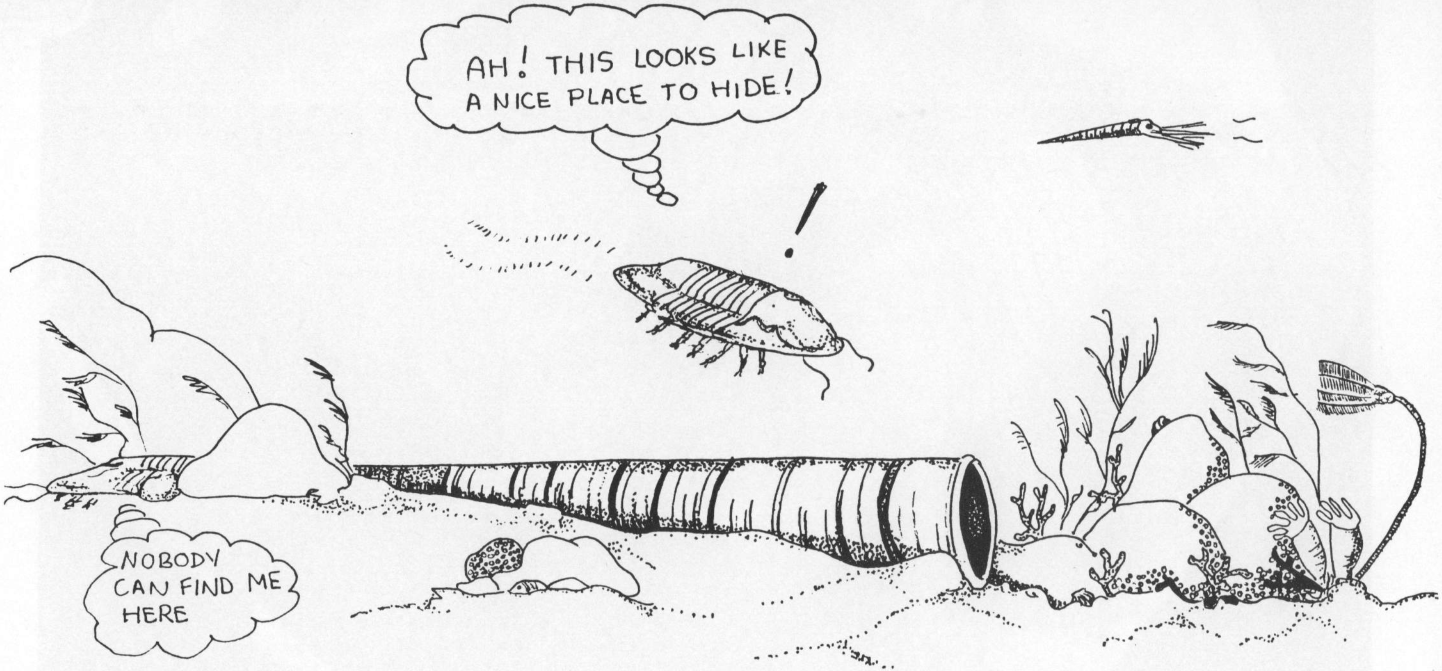
Flexicalymene meeki fossilized in assumed hiding position. This specimen measures a half inch in width and is found near Waynesville, Ohio (Upper Ordovician).



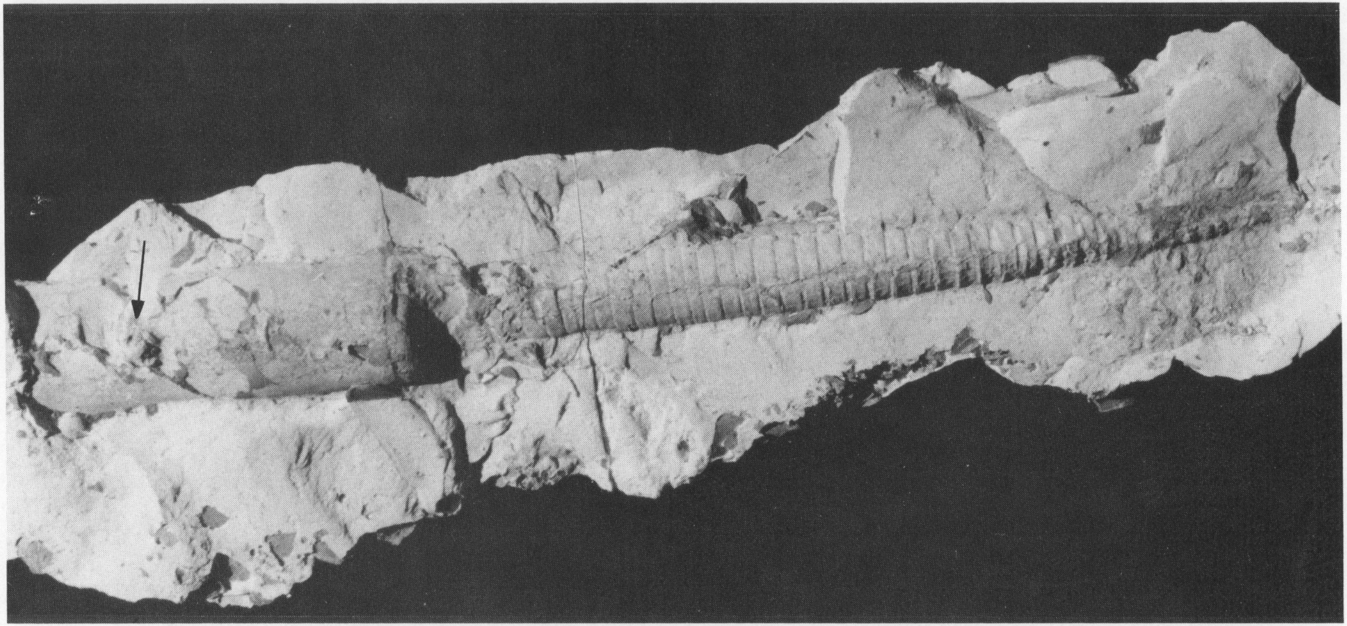
Its eyes were bigger than its stomach. This is an artist's conception of a cephalopod attacking a large Isotelus maximus. Unable to kill its prey, the cephalopod would often bite a hole in the pygidium (Upper Ordovician).



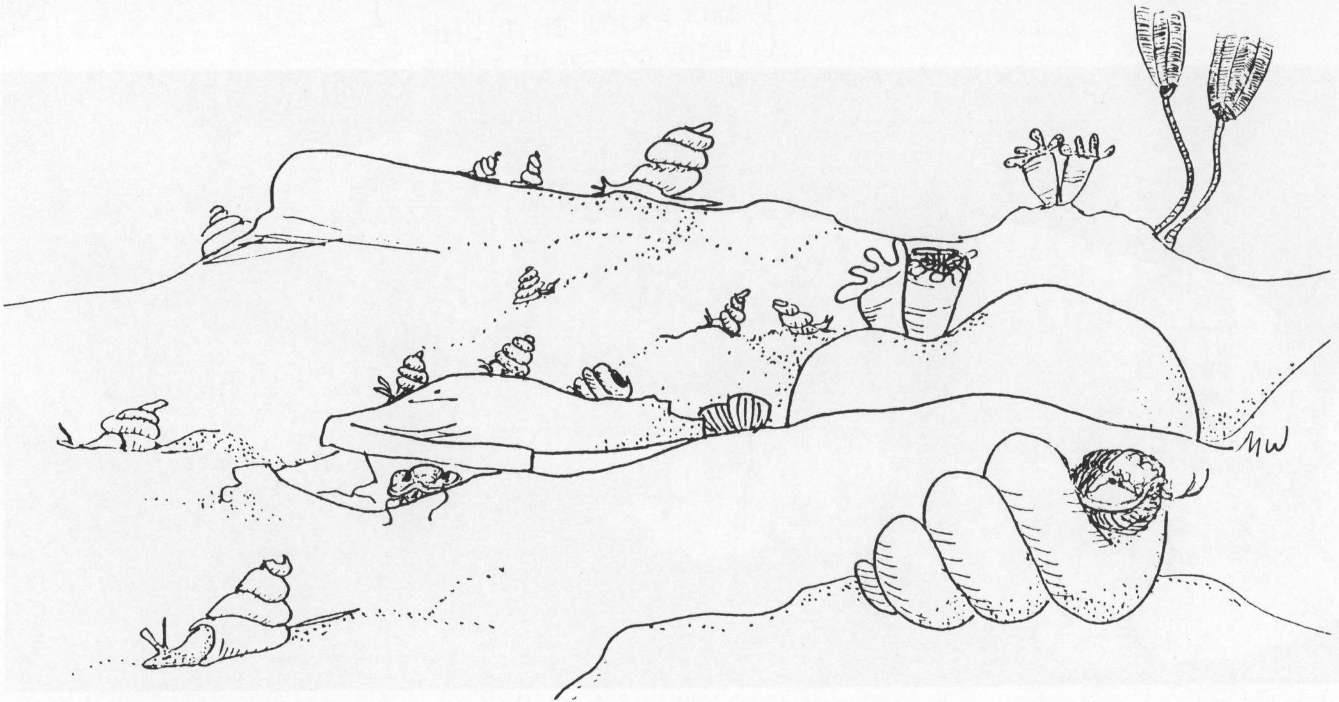
The pygidium of the Isotelus maximus has a bite mark on the rim. In most cases the injury would heal but sometimes a larger cephalopod would come along and the Isotelus would become a good meal. This pygidium was from a twelve inch specimen (Upper Ordovician) .



Trilobites were always looking for an opportunity to hide and perhaps rest from their predators. Trilobites have been found inside a variety of fossils including cephalopods.

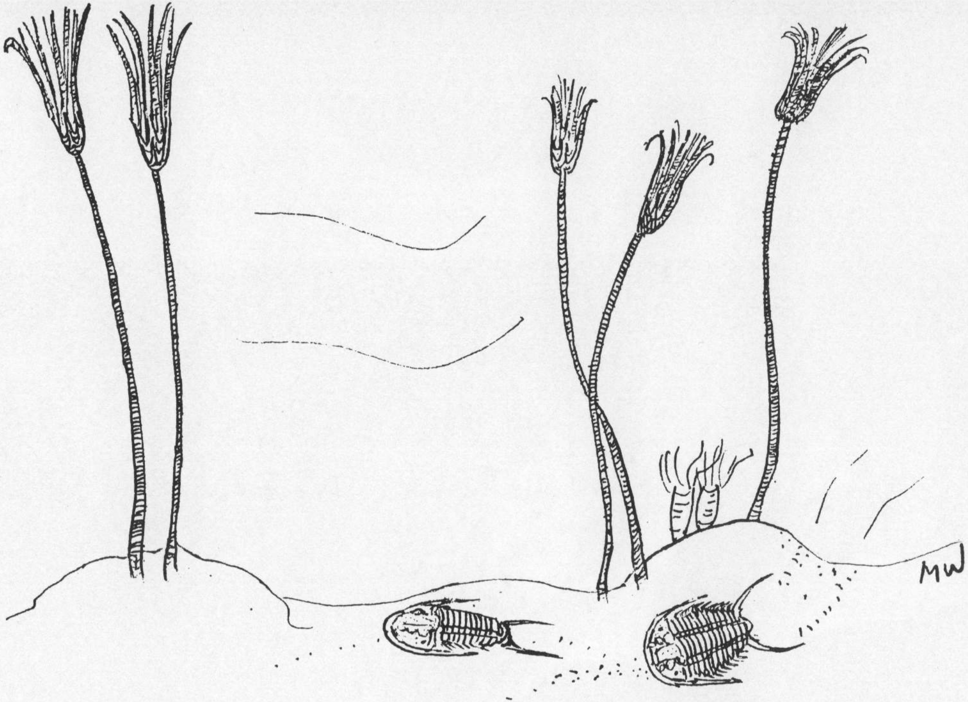


This is an actual specimen of the cephalopod, Treptoceras with enrolled Flexicalymene in its grasp. Length of the cephalopod was thirteen inches and found near Waynesville, Ohio (Upper Ordovician).

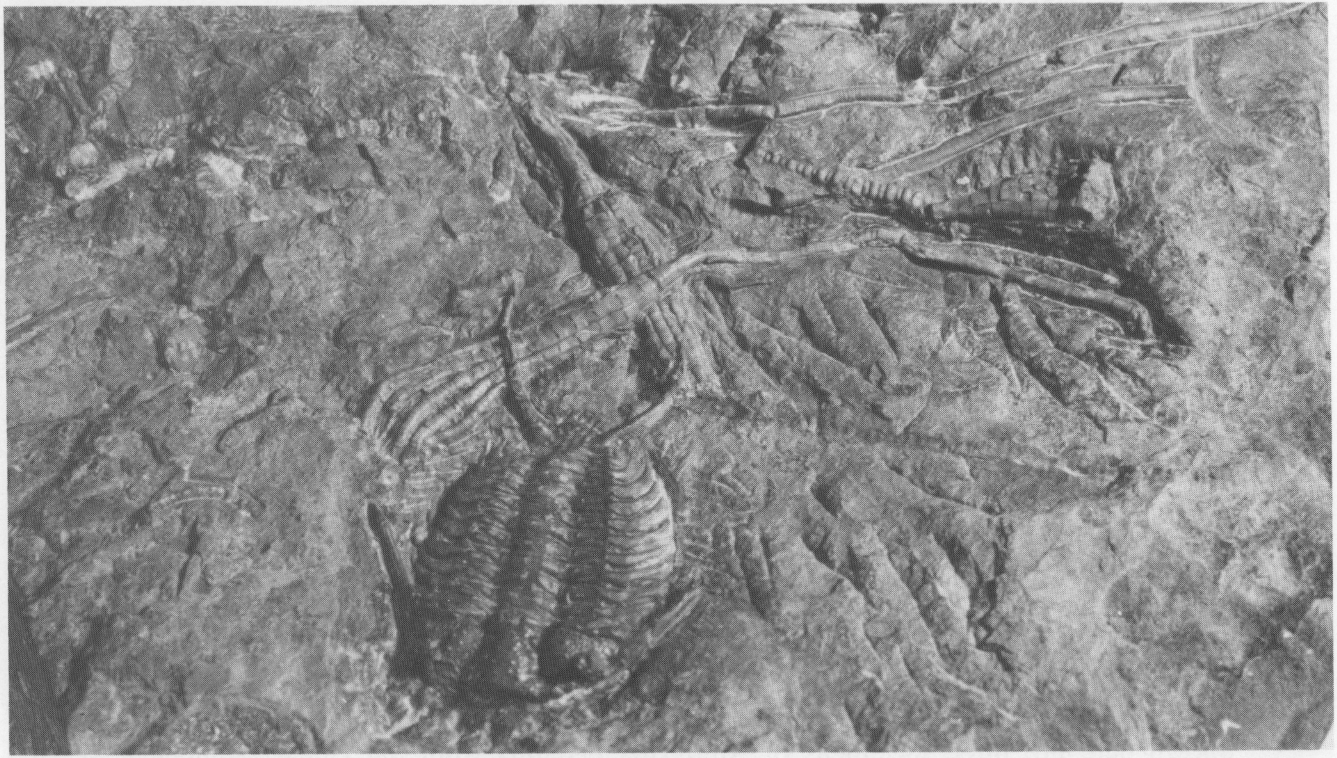


An artist's conception of a Flexicalymene resting in a gastropod (snail). Again, the trilobite took advantage of small hiding places. Gastropods lived in colonies and when one died the empty shell offered a shelter to a trilobite (Upper Ordovician).

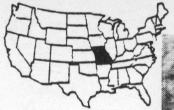
Ruling out the possibility of coincidence, four such specimens of trilobites have been found in this type of gastropod from the Waynesville, Ohio area. Trilobites have been found in brachiopods, pelecypods, cephalopods and cystoids (Upper Ordovician).



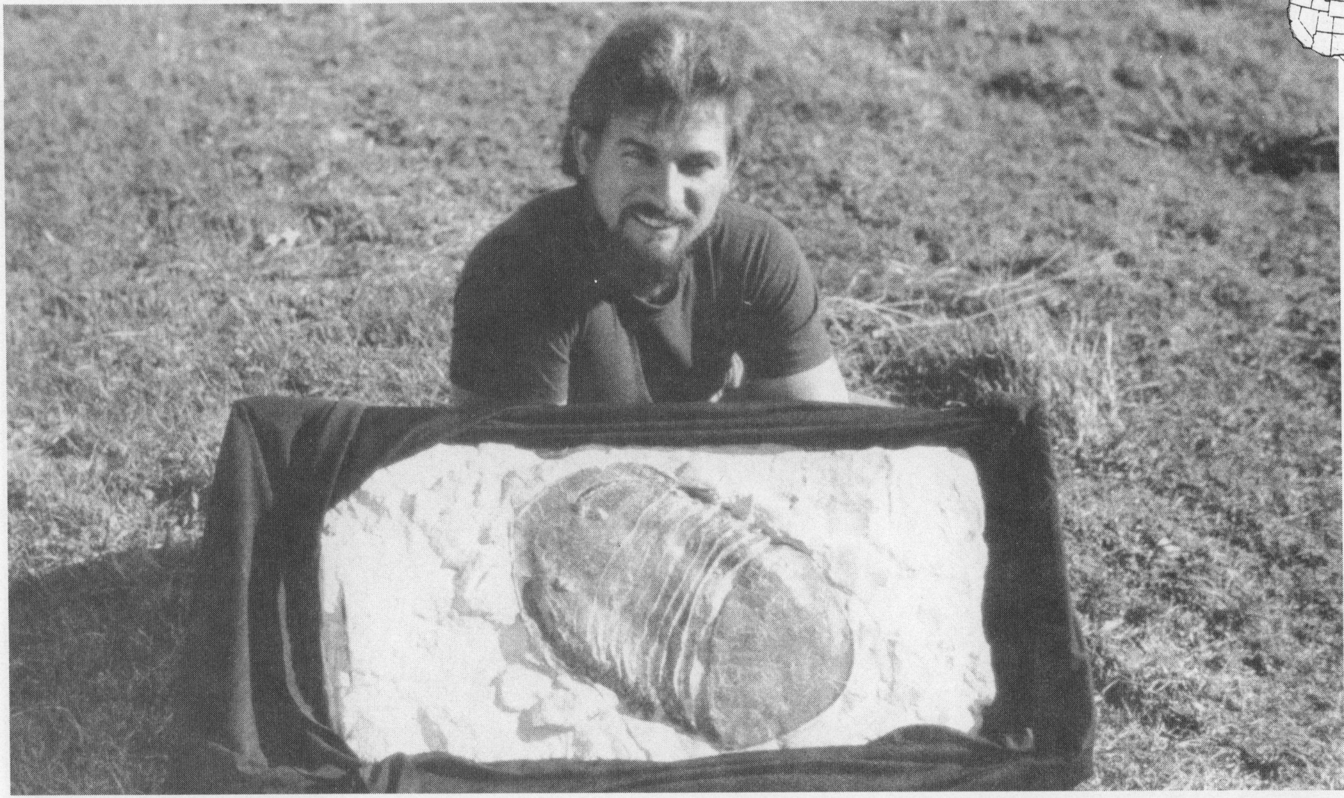
Trilobites, such as Ceraurus, found quiet environments a suitable place to live. Crinoids enjoyed the same type of environment which explains why the crinoids and trilobites were buried together (Artist's conception) .

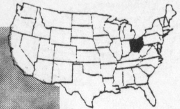


A Ceraurus pleurexanthemus with crinoids from Ontario, Canada. Specimens of this nature are not common and when they are found together a good story emerges. The trilobite pictured here measured about two inches (Middle Ordovician).



Shown here are three specimens of Ampyxina bellatula from the Upper Ordovician of Missouri. Photograph is courtesy of the Smithsonian Institution, Washington, D.C.



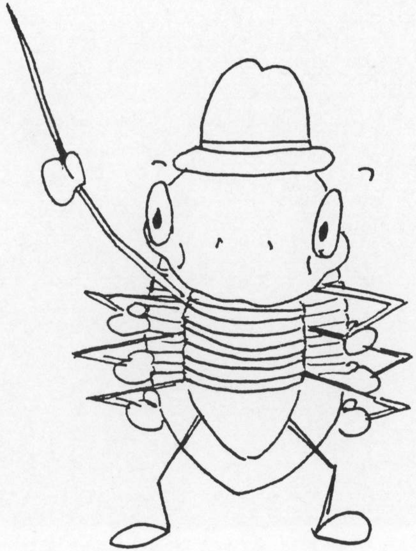


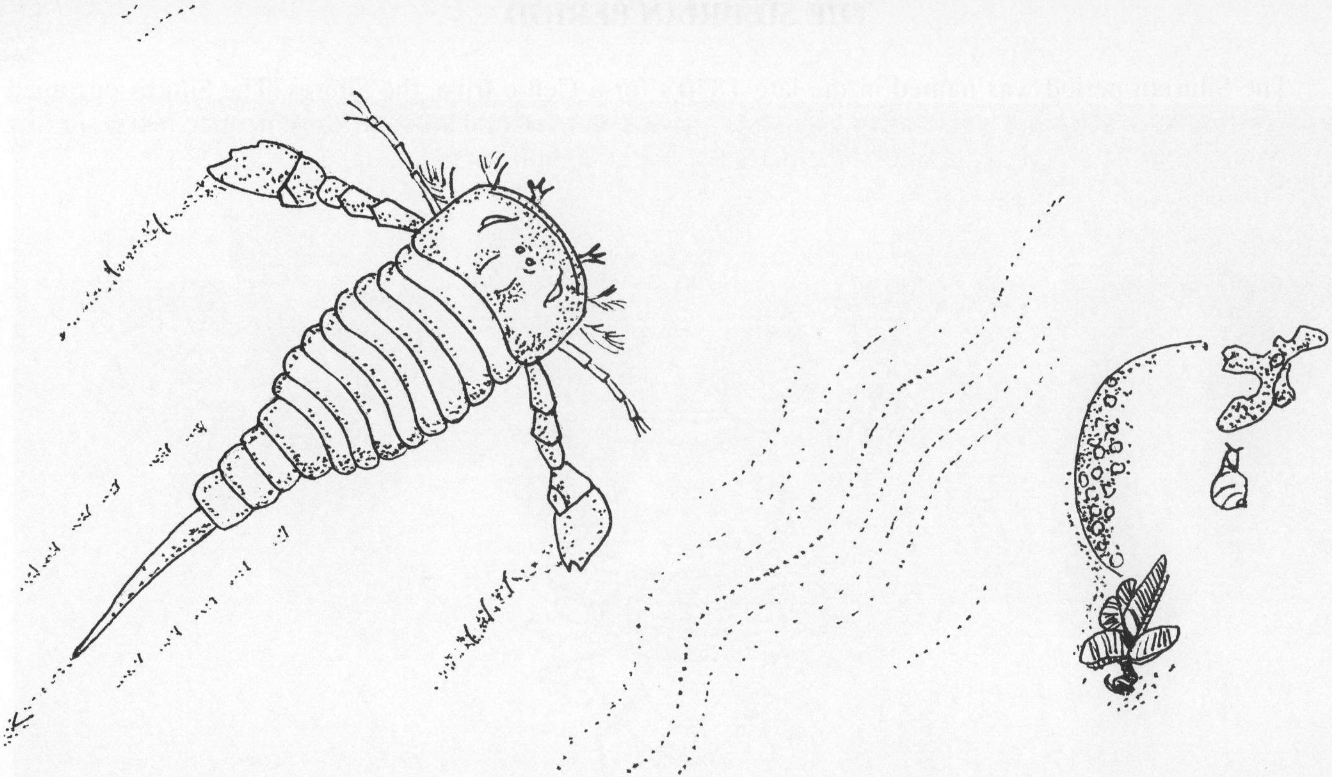
This is the largest Isotelus maximus ever found. This specimen was uncovered on September 28, 1988, near Dayton, Ohio, by the author. It measured sixteen inches in length. It is believed that Isotelus grew to lengths in excess of two feet. Isotelus is the official state fossil of Ohio. Ohio was the first state in the Union to name a trilobite as their state fossil (Upper Ordovician).

Trilobites died in groups so they possibly could have lived in groups. Pictured is a group of Homotelus bromidensis from Oklahoma. Average size of the Homotelus pictured was two inches (Middle Ordovician).

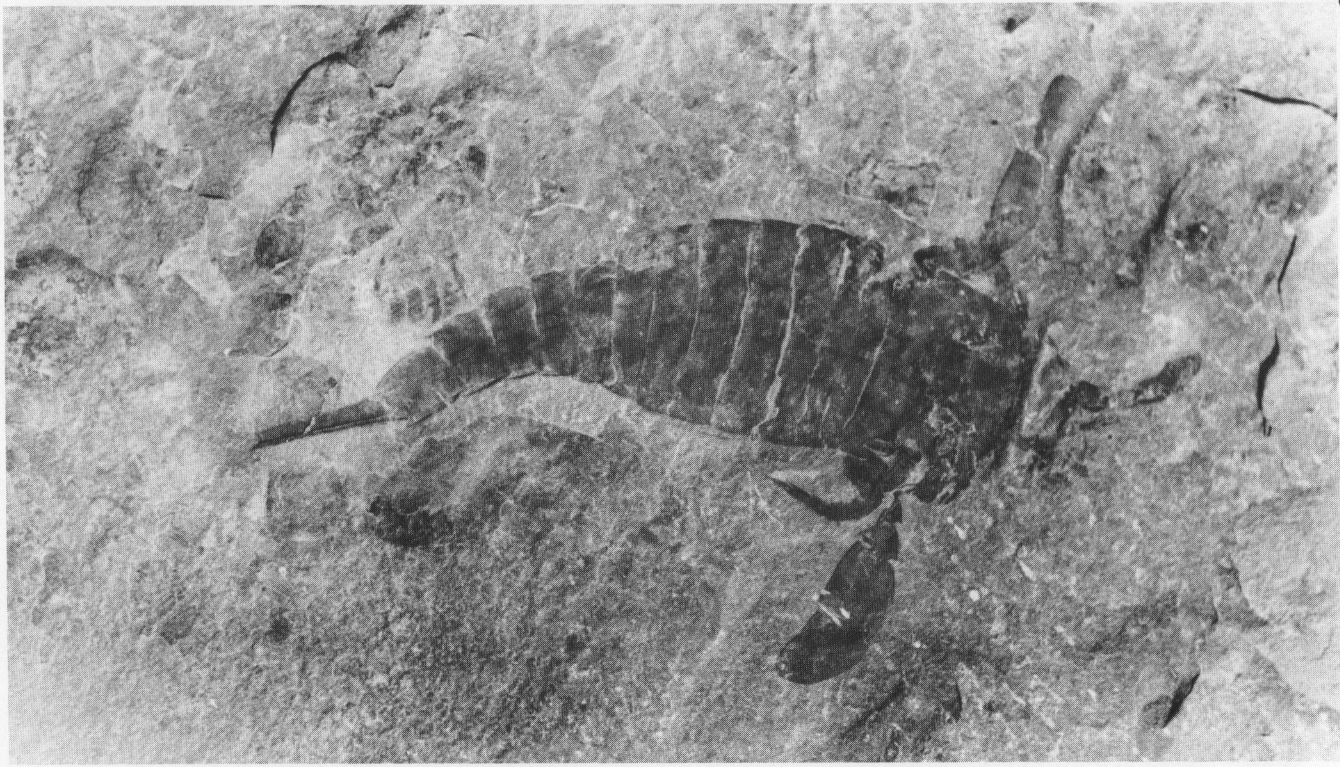
THE SILURIAN PERIOD

The Silurian period was named in the late 1830's for a Celtic tribe, the Silures. The Silures occupied parts of Southern England and Wales. Trilobite genera were at an all time low, neither increasing or decreasing during this period. Length of the period was 30,000,000 years.

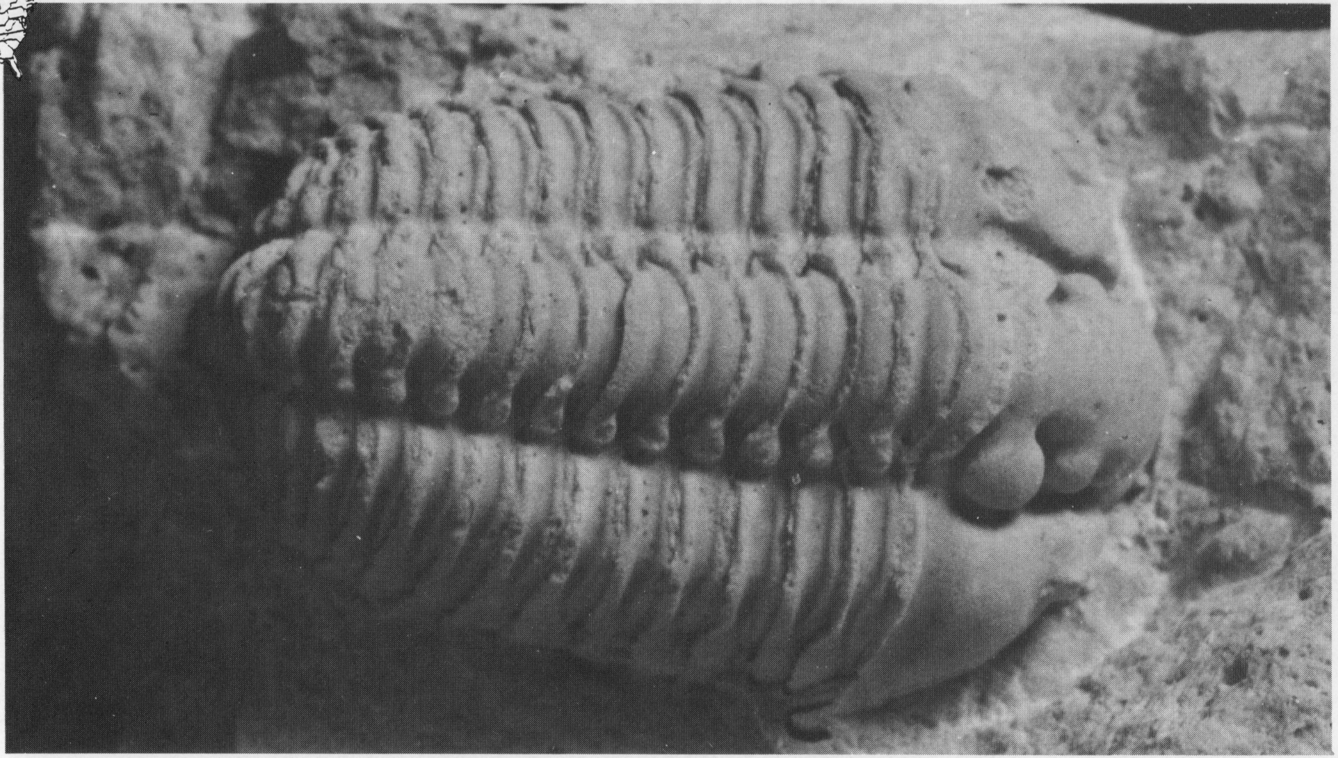




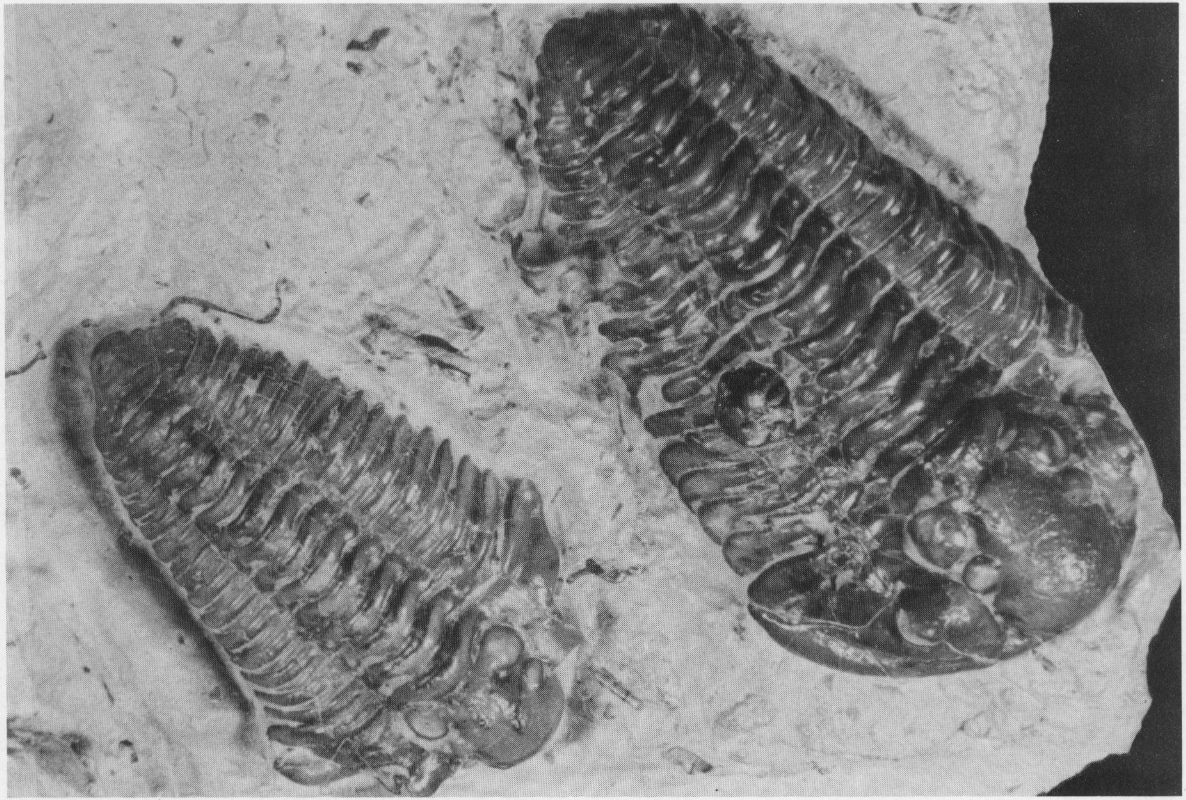
Eurypterus remipes is from Herkimer, New York. This species grew to one foot in length. Other Eurypterids, such as Pterygotus, grew to lengths of eight feet or more.



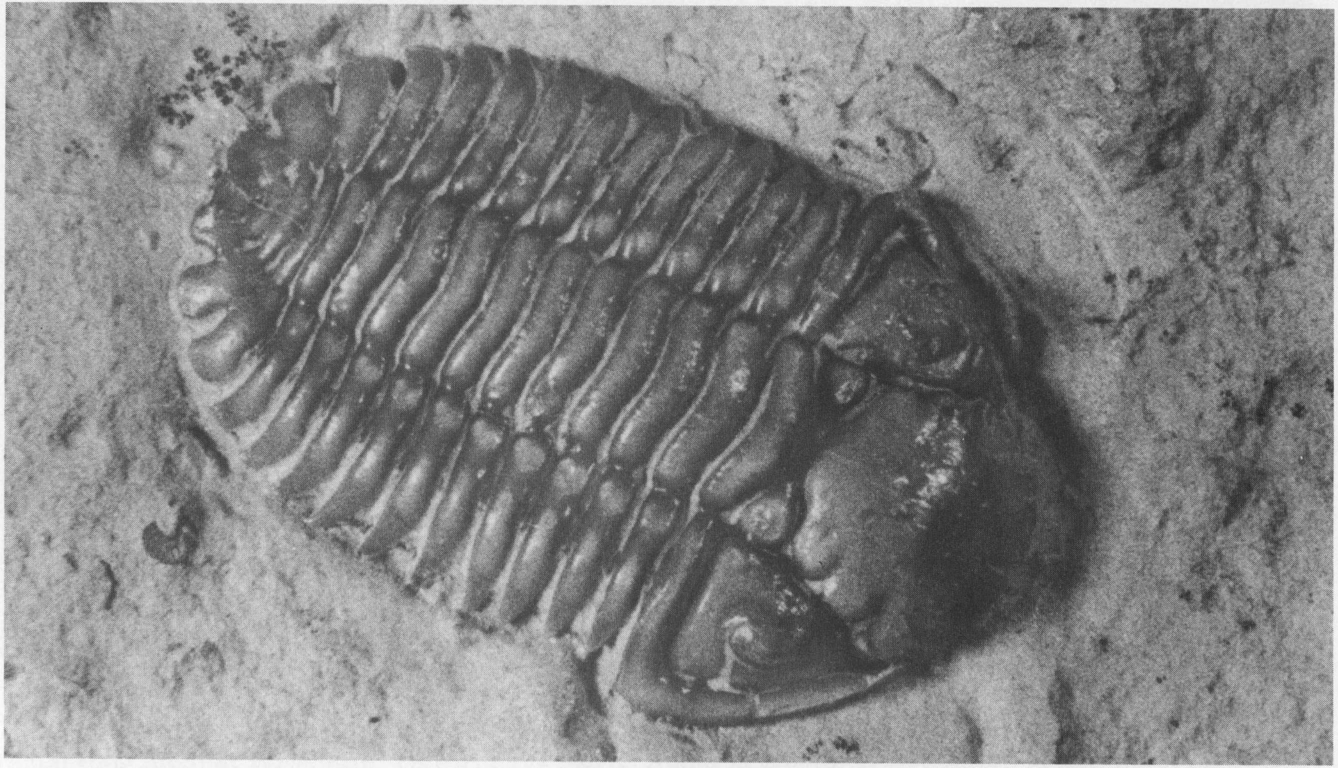
This is the actual specimen of Eurypterus remipes used in the line illustration. Specimen measures five and one-half inches and was found in Herkimer, New York. (Ken Karnes Collection)



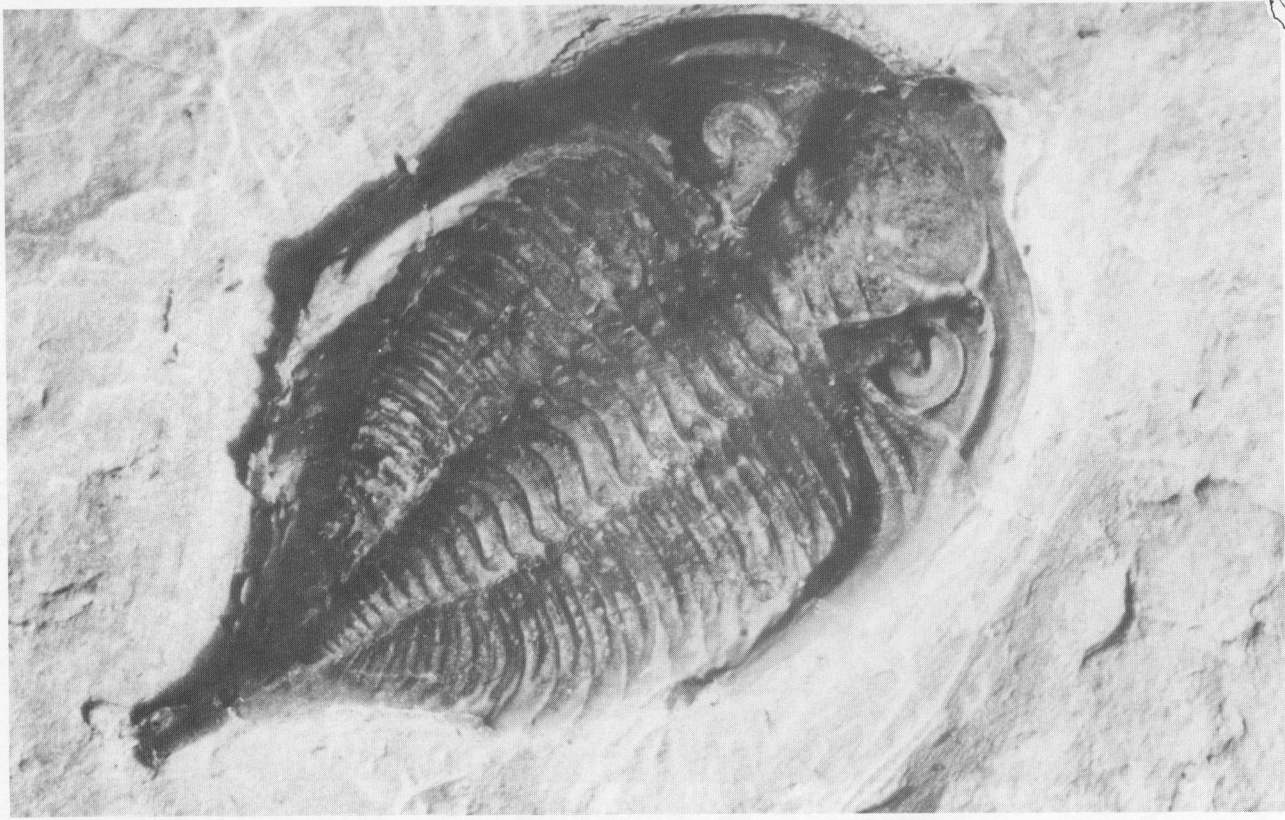
Pictured here is a Calymene celebra from Grafton, Illinois: the Calymene has been named the official state fossil of Wisconsin. This trilobite can be found in several Mid-Western States and is considered common, maximum size of two and one-half inches. This trilobite is the internal cast which consists of dolomite; the calcite exoskeleton did not preserve (Middle Silurian).



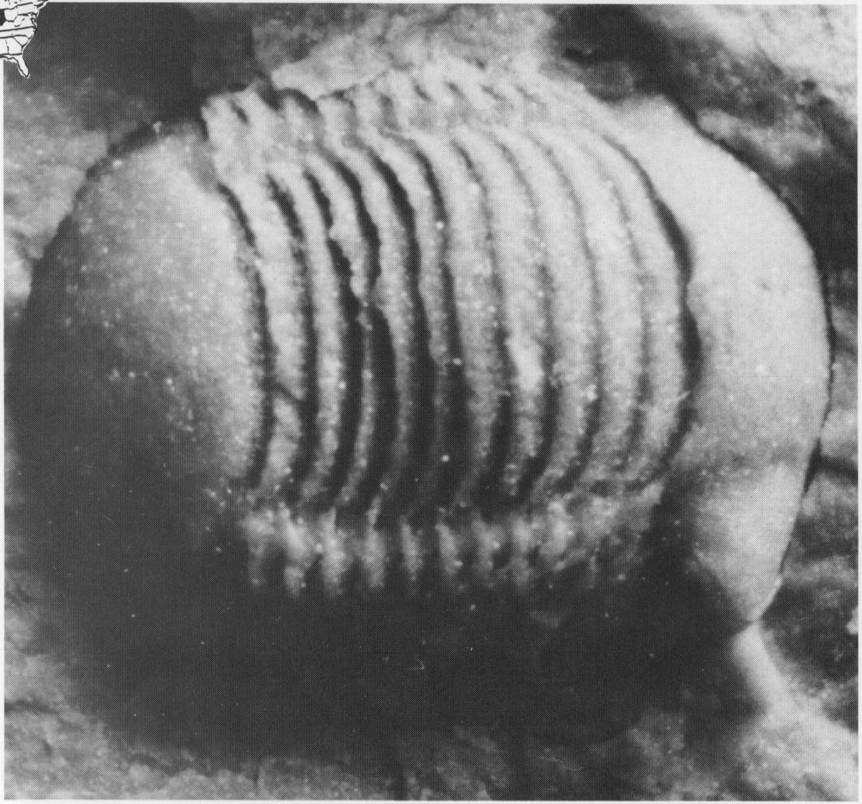
Here are two Calymene breviceps from Waldron, Indiana. The exoskeleton of this trilobite has been preserved. Maximum length for this species was two inches and was considered common (Middle Silurian).

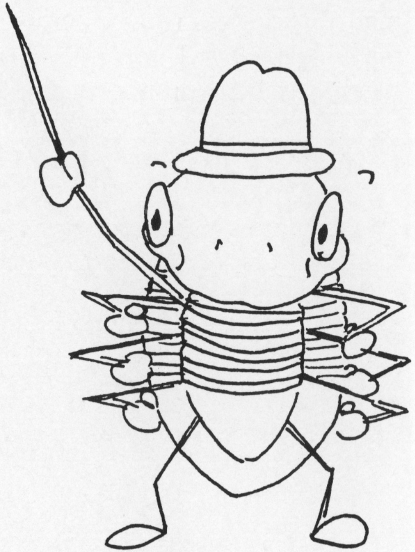


This Anasobella asper from Oklahoma was rare and measured one inch in length (Upper Silurian).



This Dalmanites verrucosus is from Indiana. Rarely found complete,this trilobite measured two inches. Dalmanites grew to lengths of eleven inches or more and had schizochroal eyes (Middle Silurian).

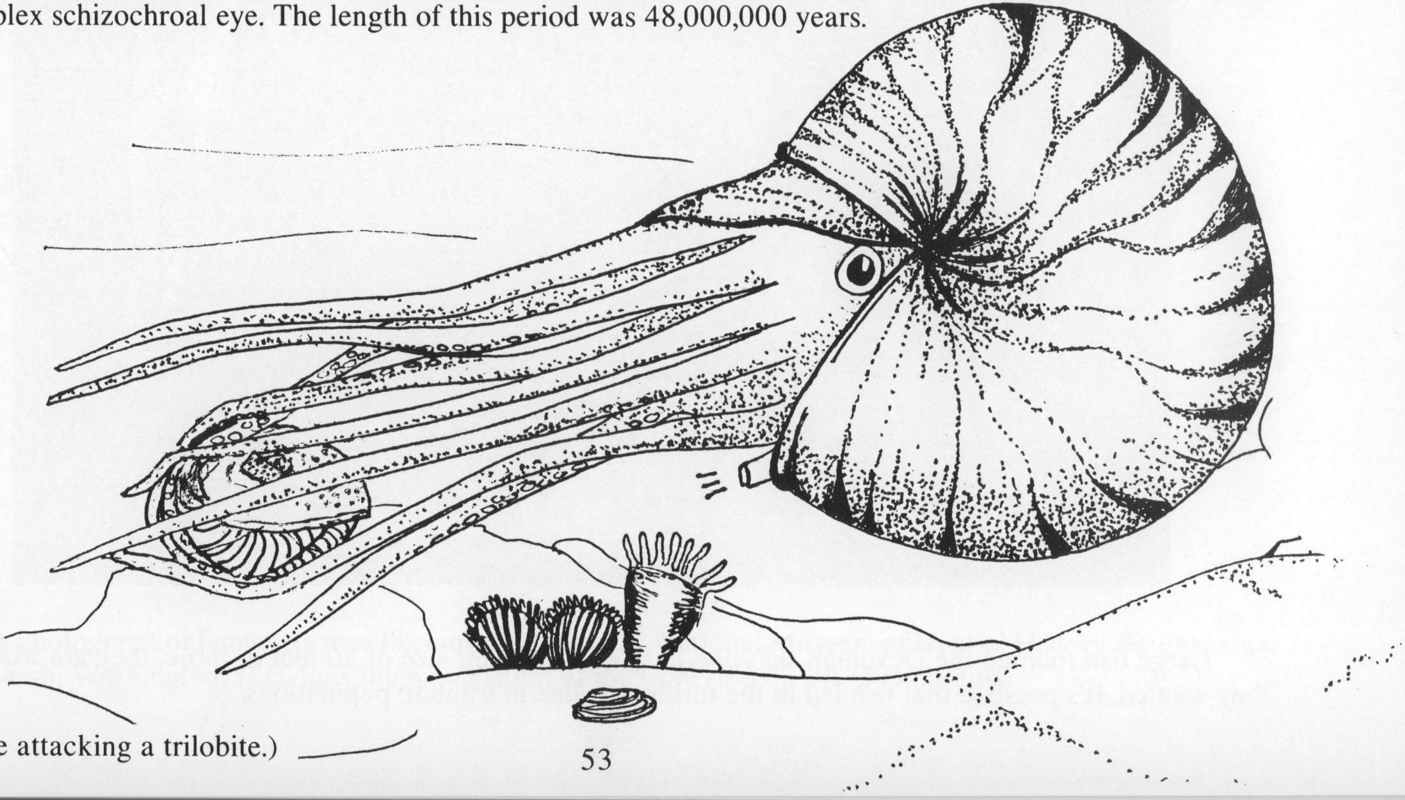




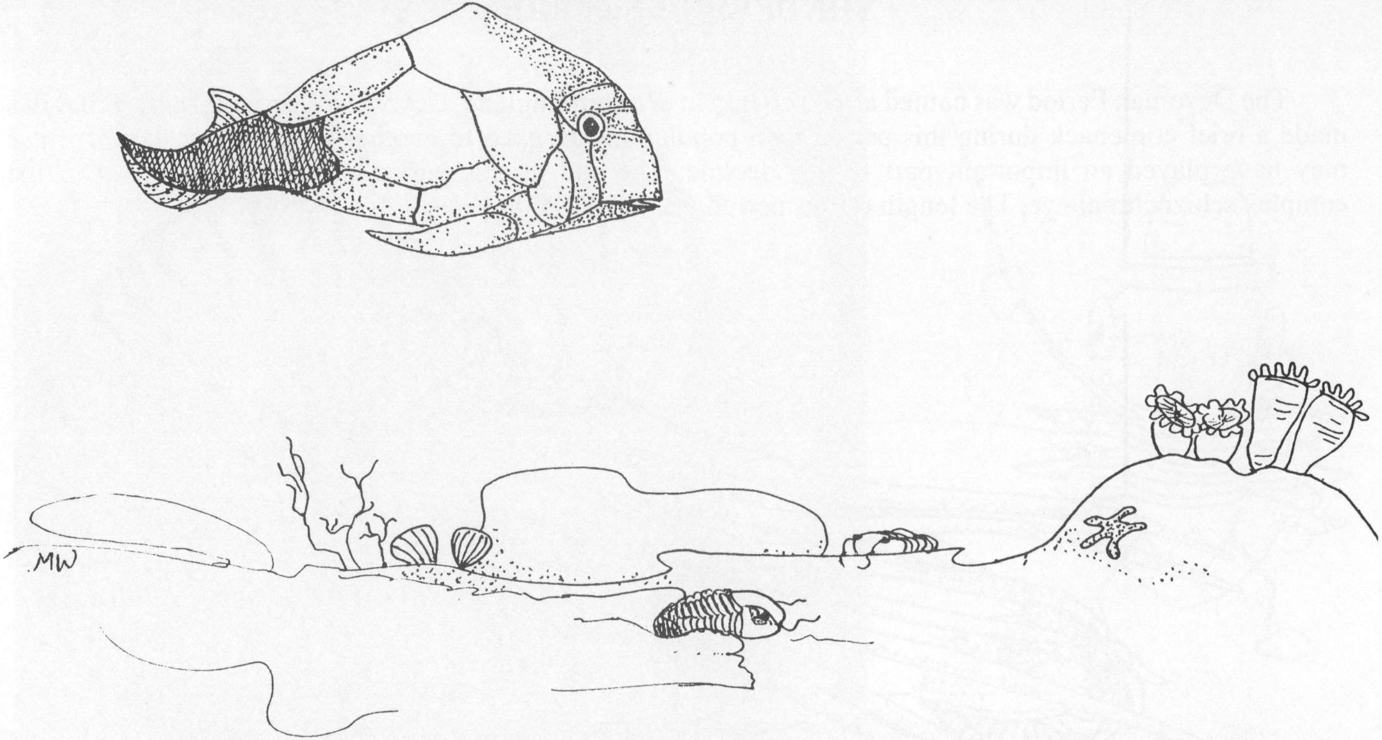
Hey that's me ! Tom Trilobite, a Bumastus niagarensis from Indiana. This trilobite was considered rare and grew to two inches in length (Lower Silurian).

THE DEVONIAN PERIOD

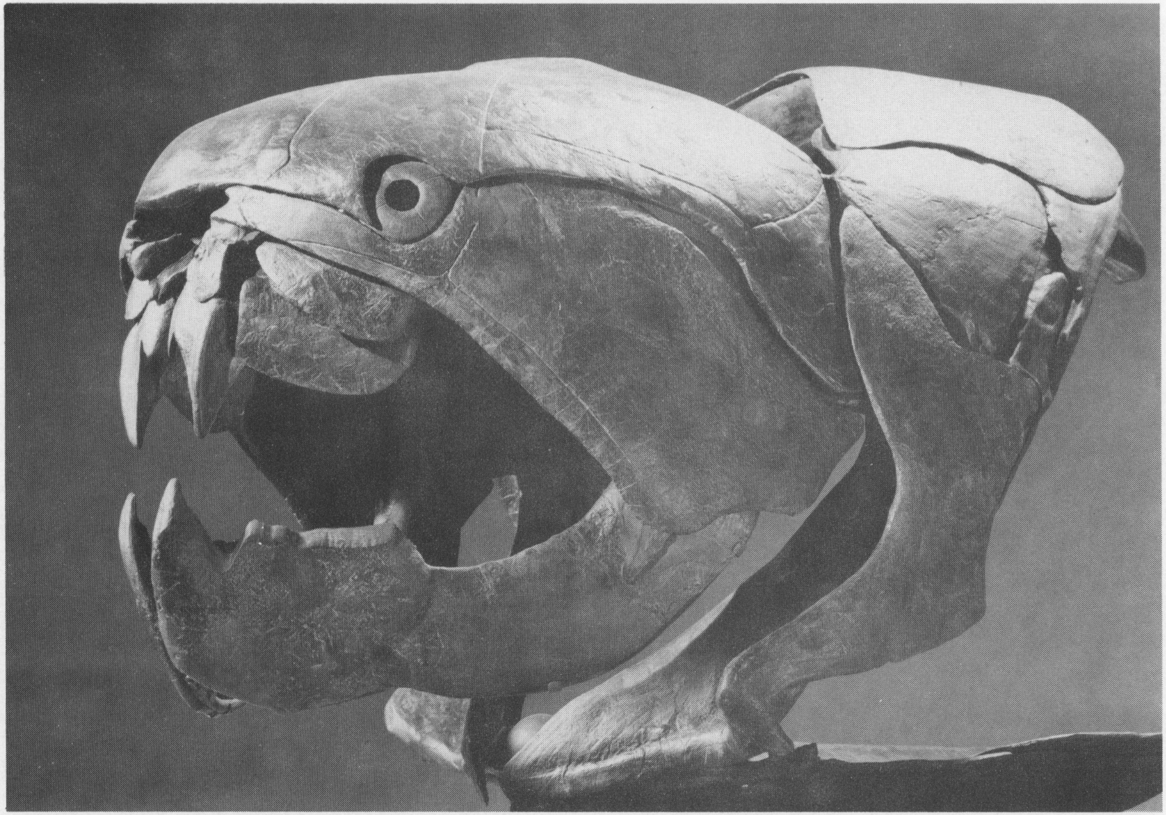
The Devonian Period was named after a county in Western England, Devonshire, around 1840. Trilobites made a brief comeback during this period then populations dropped to another all time low. Jawed fishes may have played an important part in this decline. The end of this period also marked an end to the complex schizochroal eye. The length of this period was 48,000,000 years.



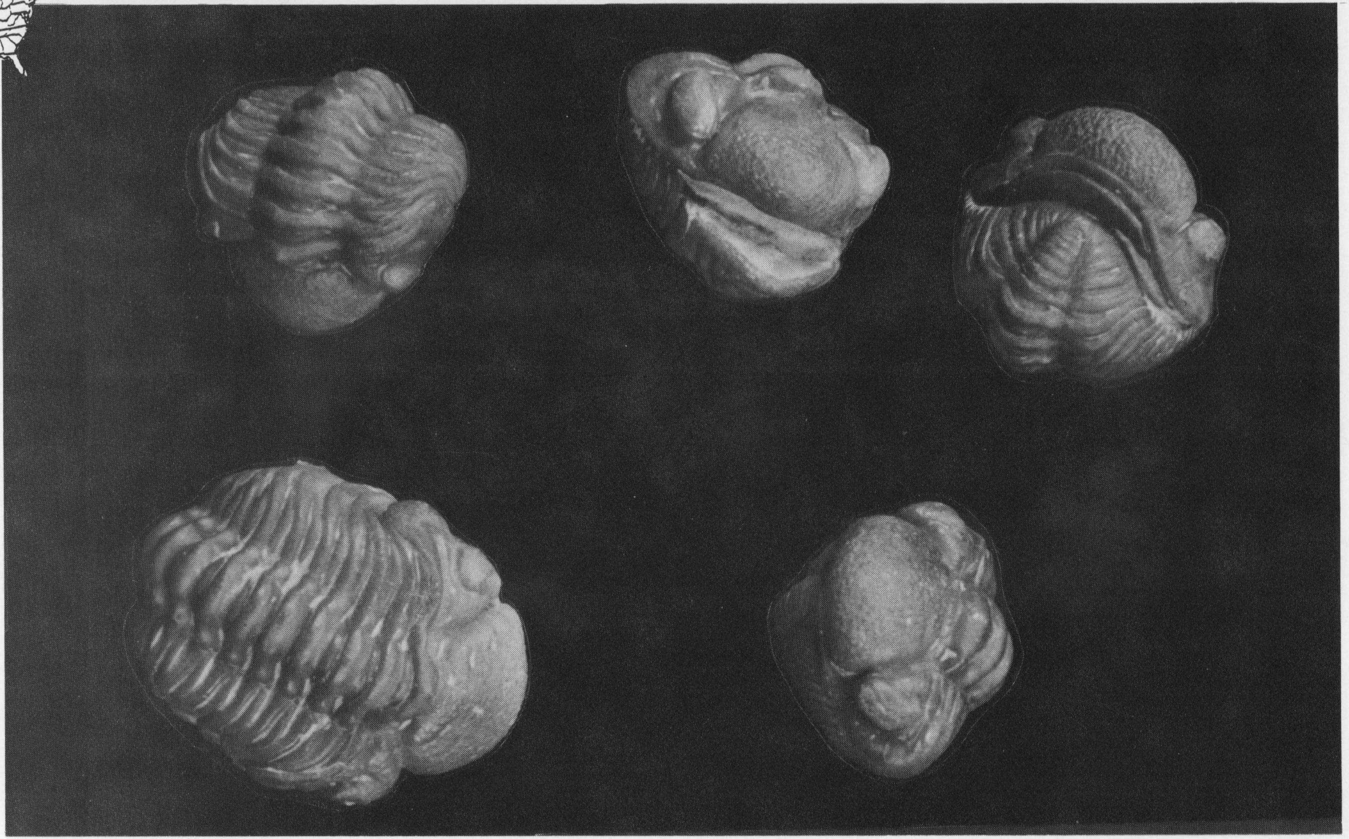
(Ammonite attacking a trilobite.)



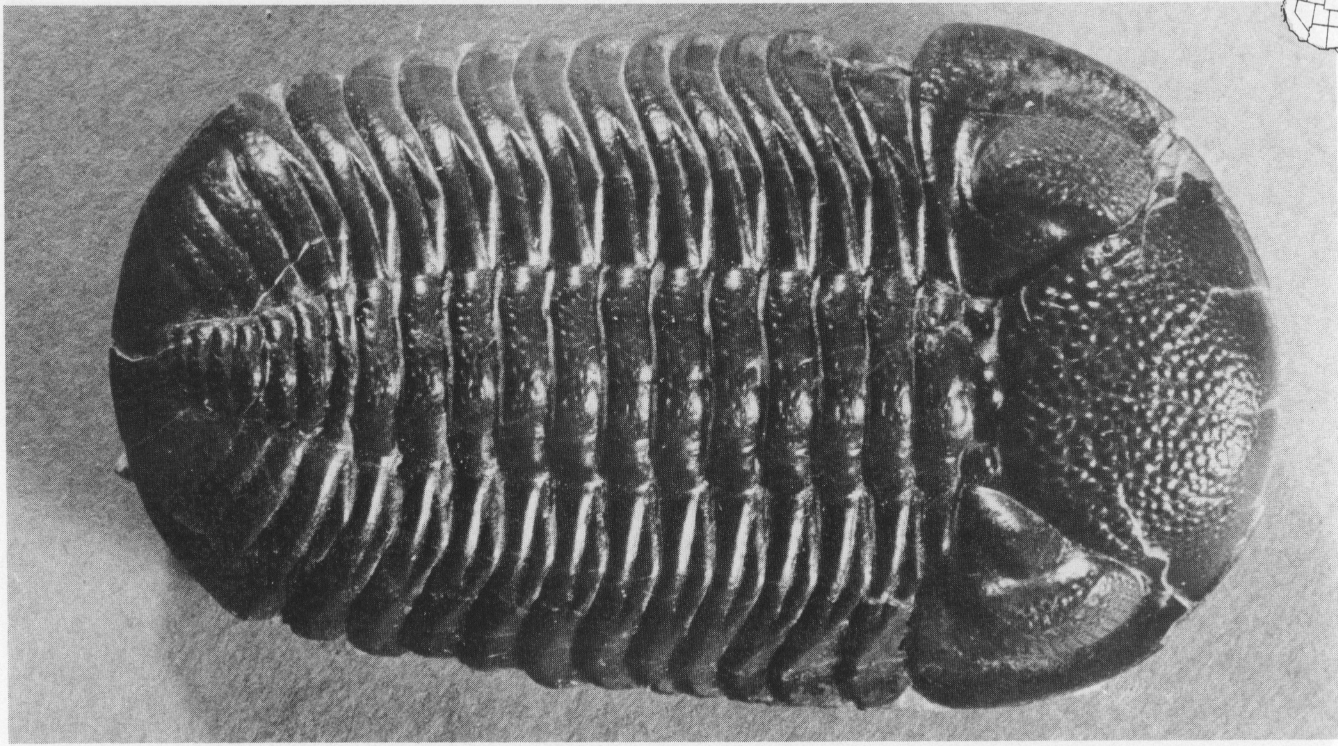
Large fish roamed the Devonian seas and judging from their size of 30 feet or more, they ate whatever they wanted. It's possible that fish led to the further decline in trilobite populations.



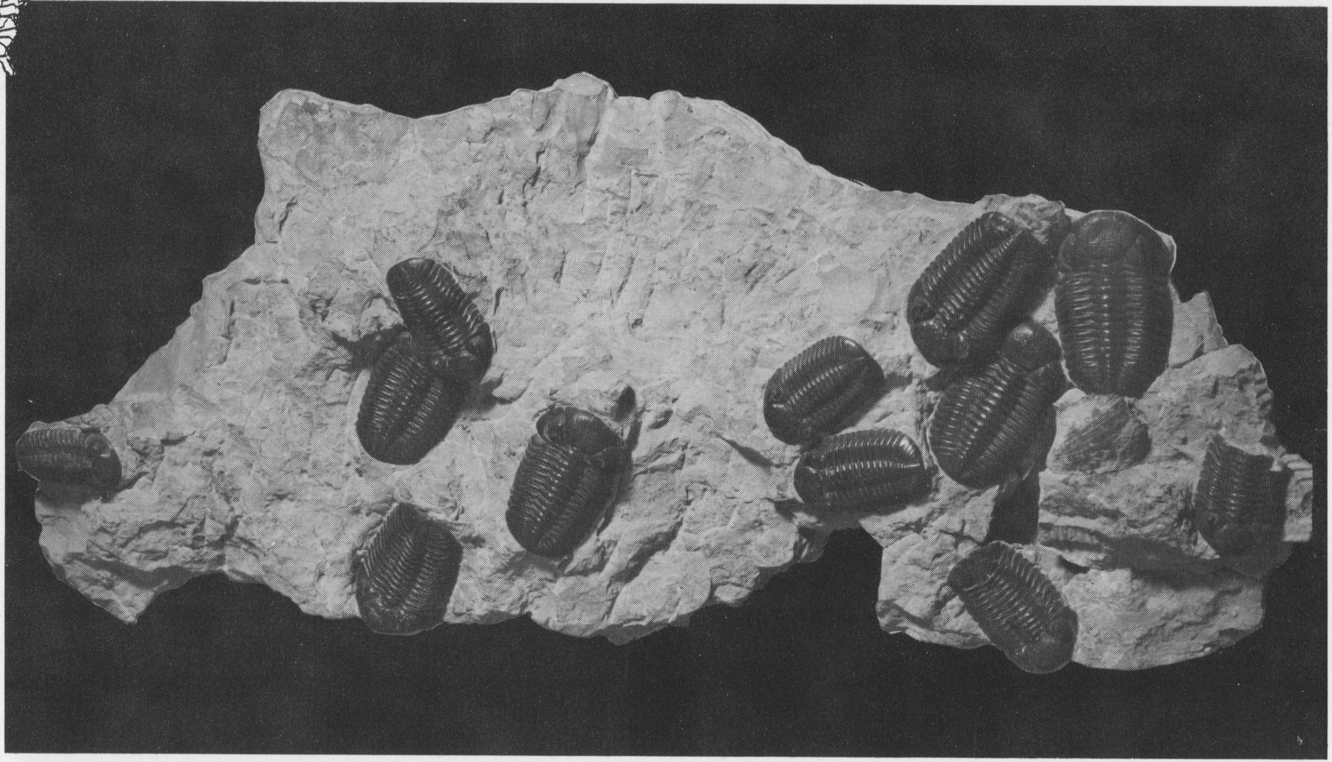
A photograph of Dinichtys terrelli courtesy of the U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C. Specimen on exhibit at the front of the Hall of Dinosaurs.



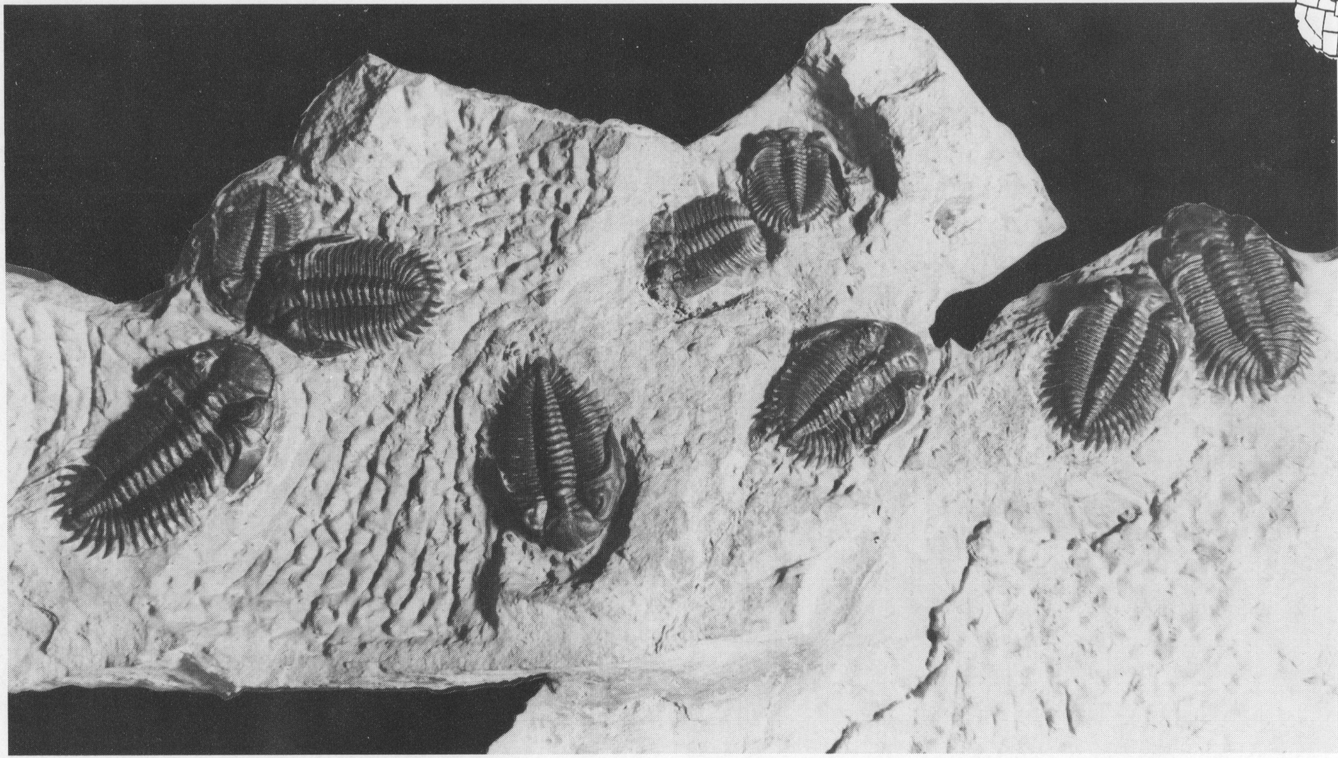
This Paciphacops raymondi from Oklahoma was considered common. Specimens measured three-quarters of an inch across the cephalon and has schizochroal eyes (Lower Devonian).



This is a Phacops rana milleri from Ohio. The Phacops of Ohio are prized by collectors throughout the world. This specimen measured two and one-half inches and had schizochroal eyes (Middle Devonian).



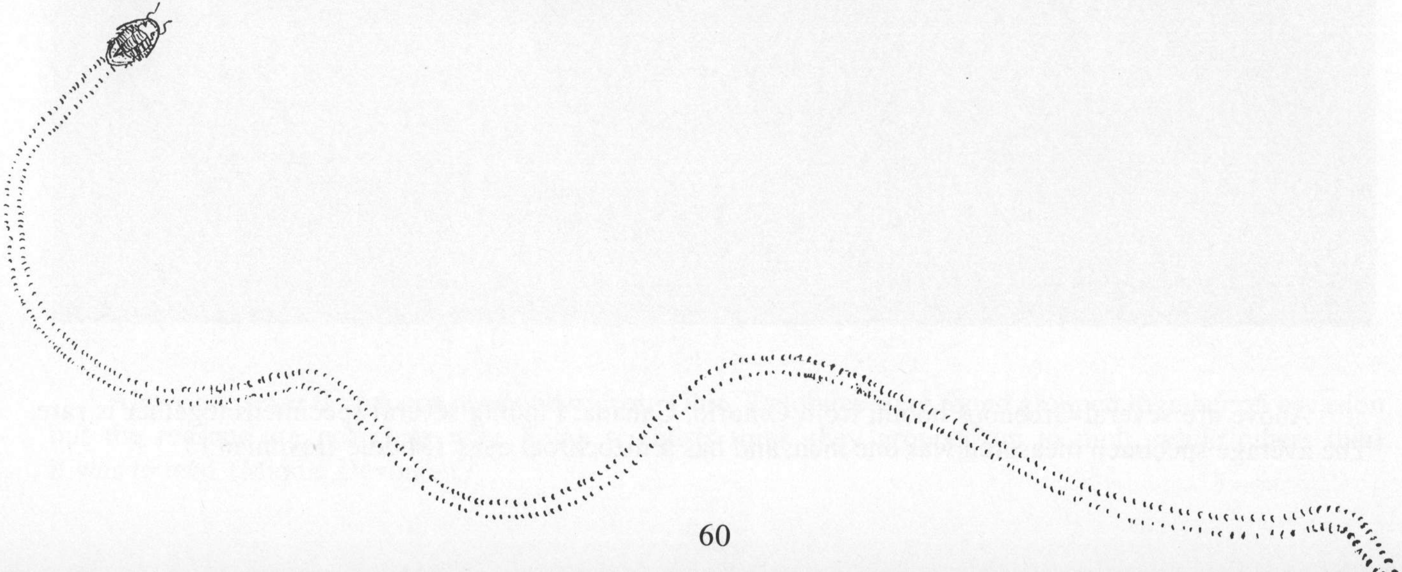
Above are several Phacops rana milleri from Ohio. Trilobites were found grouped together on occasion, but the reasons are not clear why. Some scientists think they grouped up to molt, while others think it was to feed (Middle Devonian).

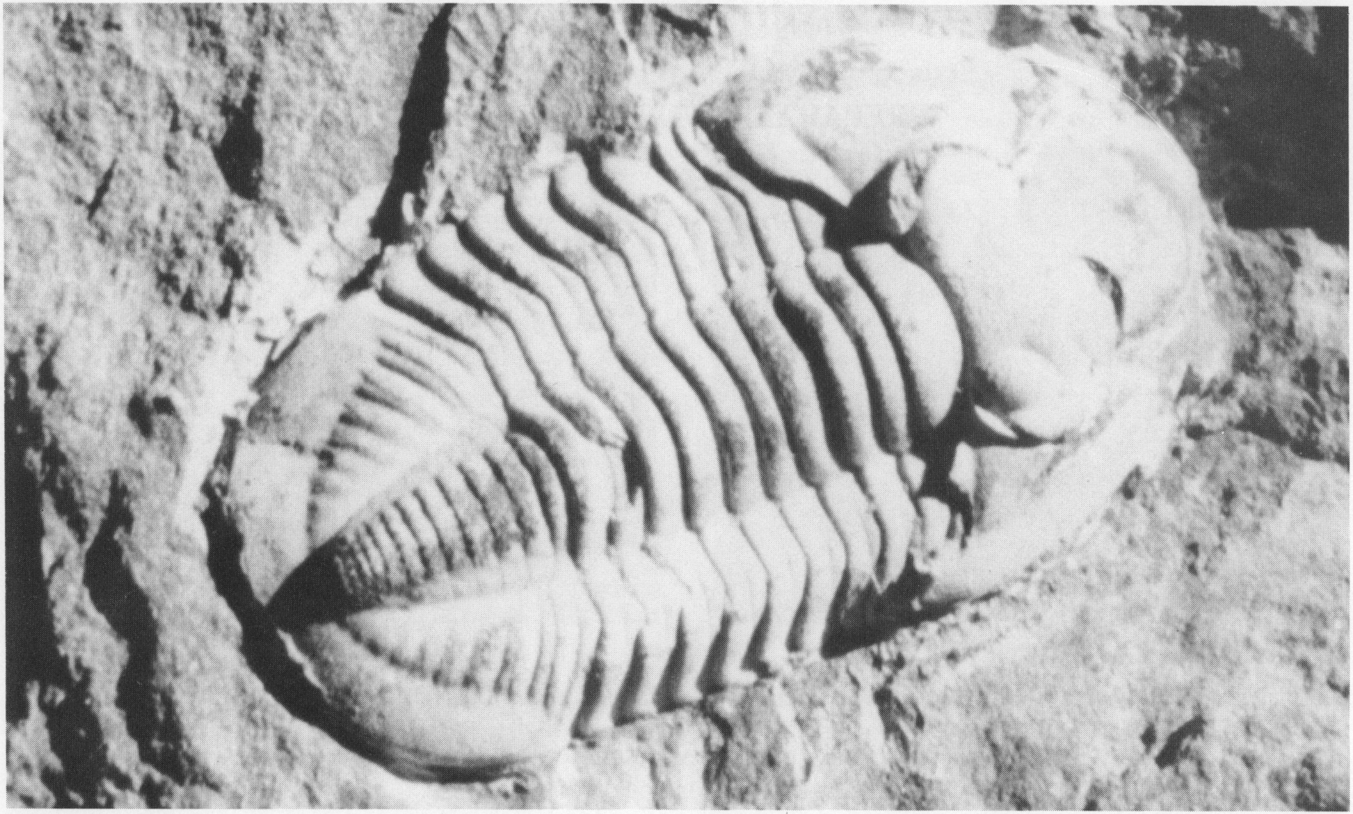


Above are several Greenops boothi from Ontario, Canada. Finding several specimens together is rare. The average specimen measured was one inch, and has schizochroal eyes (Middle Devonian).

THE MISSISSIPPIAN PERIOD.

The Mississippian Period was named in the early 1890's for exposures of rock throughout the Mississippi Valley. Trilobites remained at a constant low throughout the period. The length of the period was 40,000,000 years. Trilobites survived through two more periods, the Pennsylvanian and Permian, (75,000,000 years total). Trilobites are so rare in the last two age periods, this author has yet to find a single complete specimen. The close of the Permian Period brought trilobites to their end. Although extinct, trilobites are still a lot of fun to collect and study.

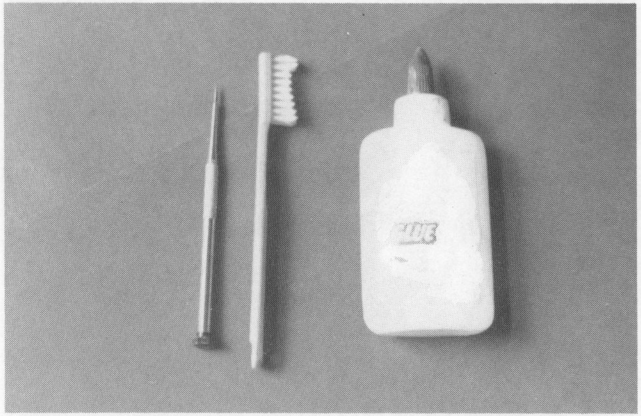




Griffithides globiceps from Belgium. This trilobite measured three-quarters of an inch and was common for a trilobite in this period.

CHAPTER IV

PREPARATION OF TRILOBITES

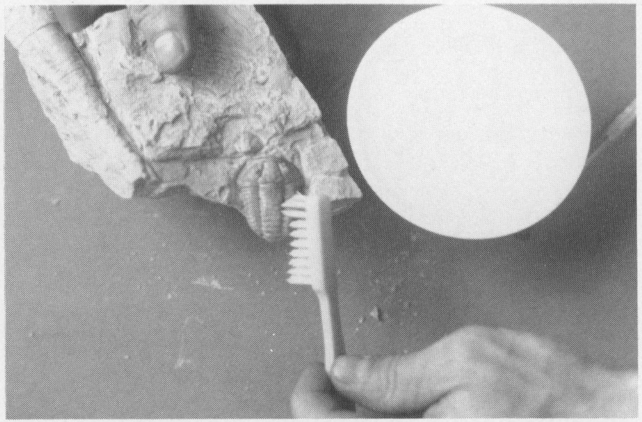


1.

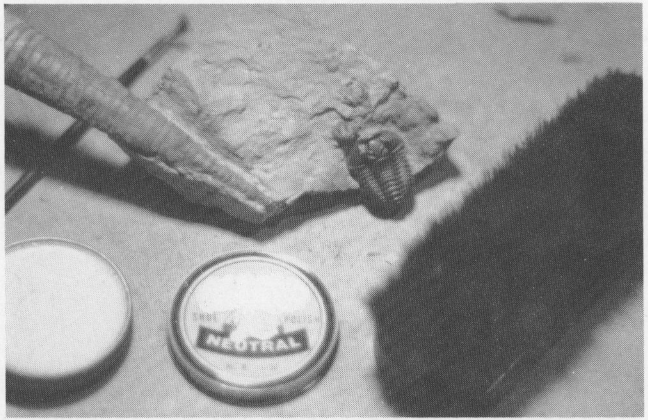
2.

There are several ways to clean trilobites. Always remember to take your time, and be careful. Cleaning a trilobite can be a real challenge. Three basic tools are needed to begin:

1. White glue is used in case the trilobite breaks; a small hand scriber or other sharp instrument for removing soft sediment from the trilobite; tooth brush to remove fine particles from between the segments.
2. Removing sediment from between the thoracic segments of the trilobite. A Flexicalymene and Treptoceras are pictured here. Be careful not to scratch the trilobites exoskeleton.

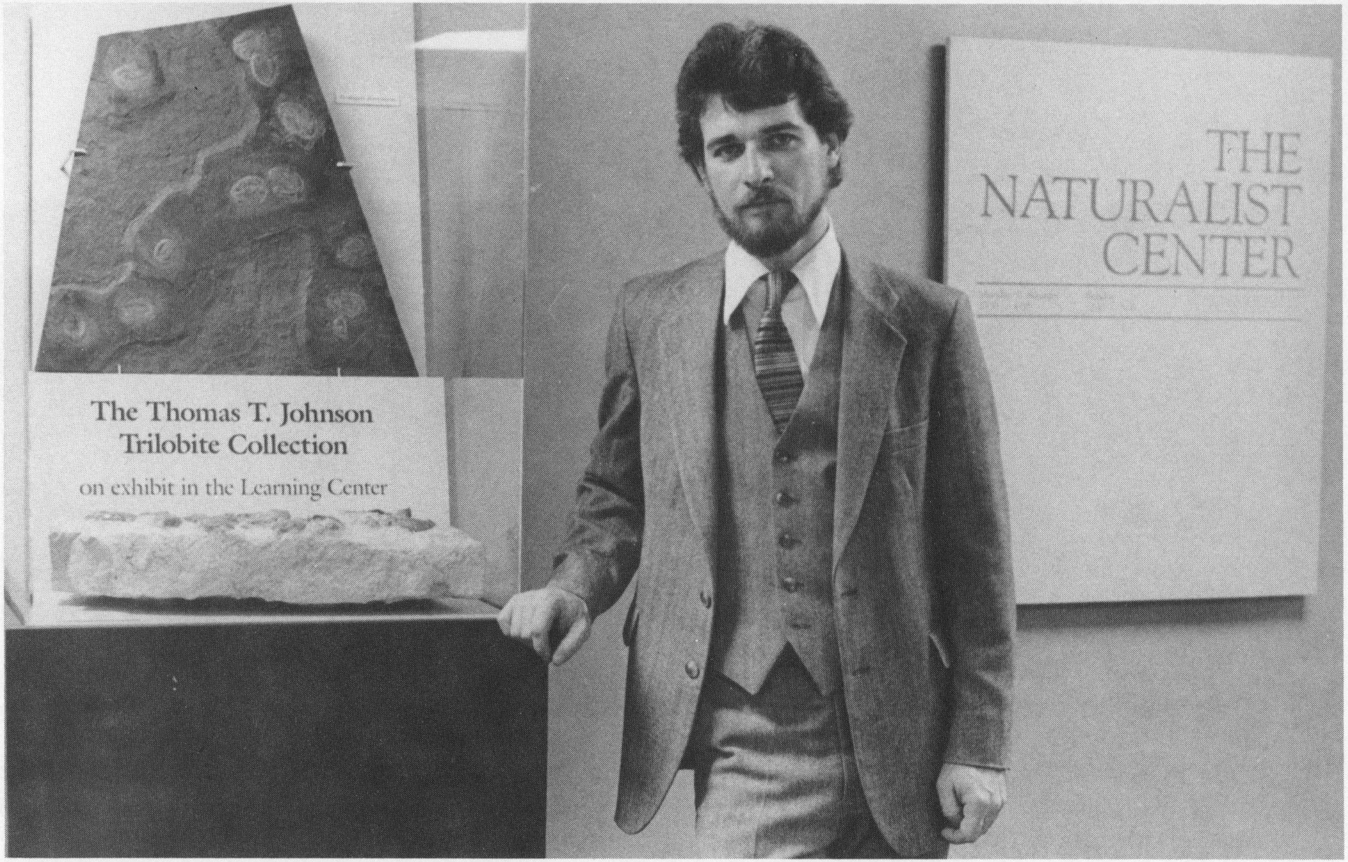


3.

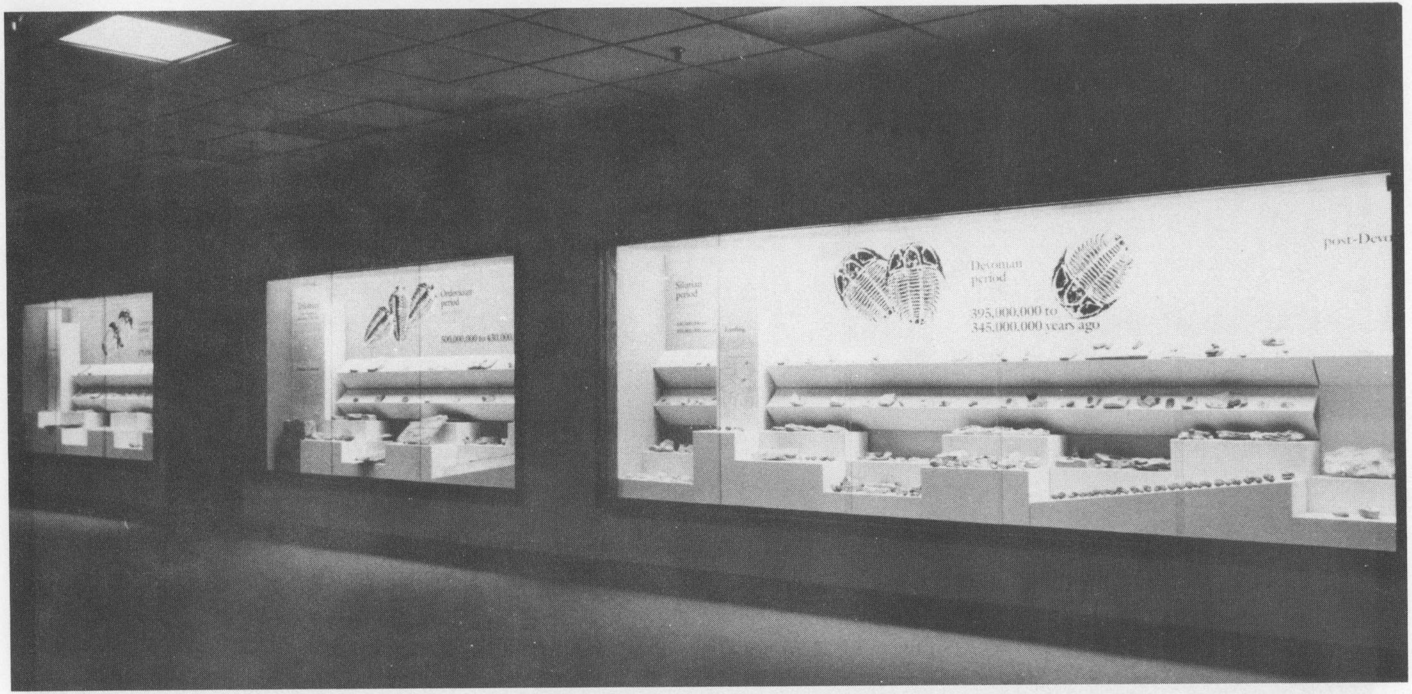


4.

3. Use the toothbrush only after sediment is removed from the segments and furrows of the trilobite. Water can be used with the toothbrush, but use sparingly. Let dry before next step.
4. Using a thin coat of clear neutral shoe wax, cover the specimen and brush off with soft clean shoe brush. This method can be used on any type of small fossil. When in doubt about preparation always consult a professional. Its better to under clean a fossil than to over clean one. The fossil is now ready for exhibit.

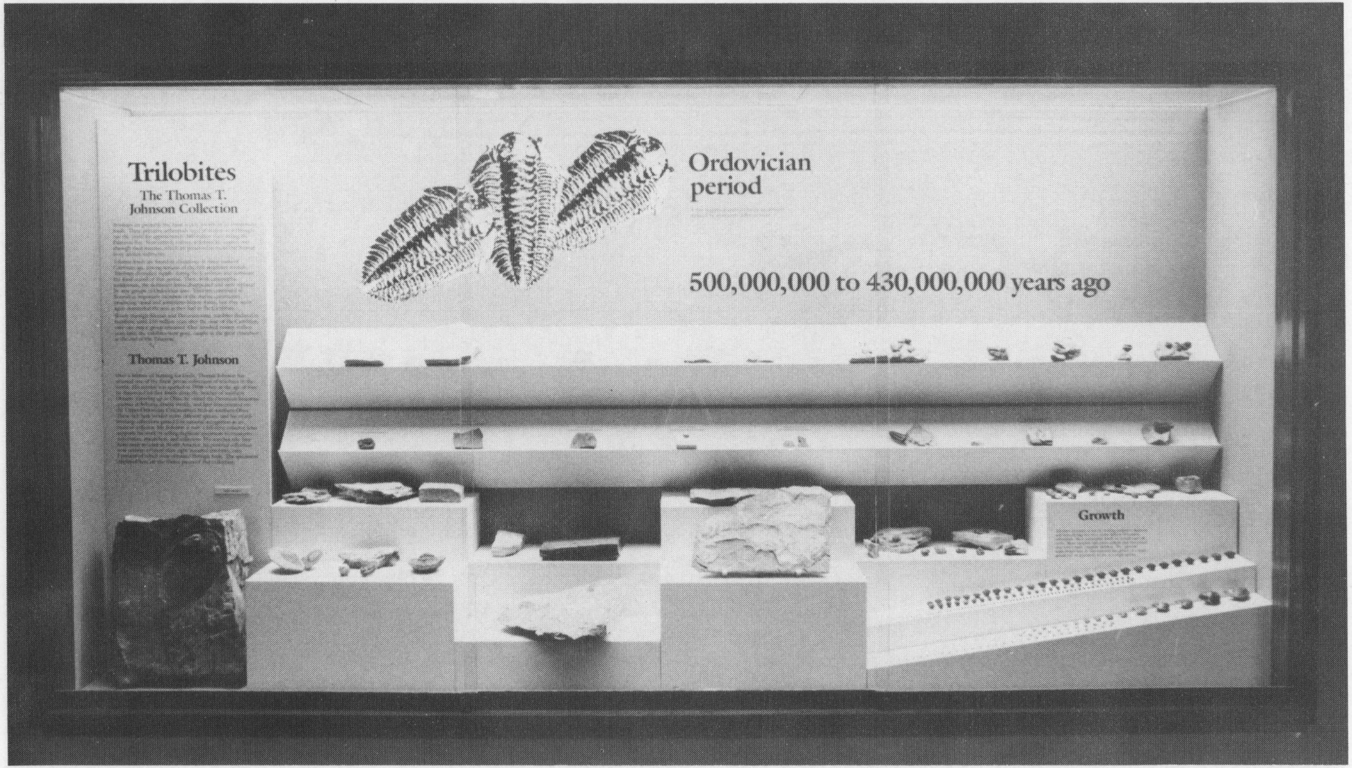


Author with exhibit located in the foyer leading to the Learning Center in the National Museum of Natural History, Smithsonian Institution.

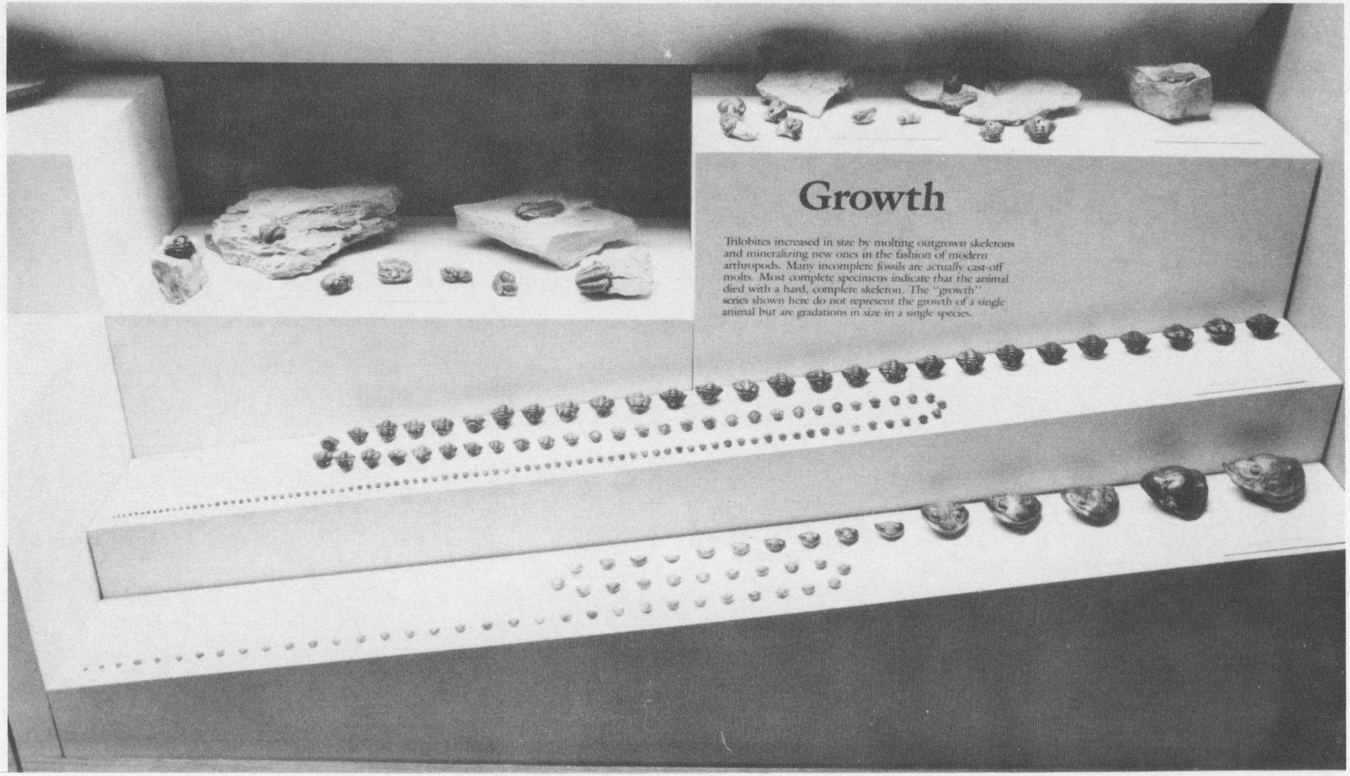


Gallery of trilobites located in the Learning Center of the U.S. National Museum of Natural History, Smithsonian Institution Washington D.C. Over 800 trilobites make up this exhibit. Thomas T. Johnson collection.

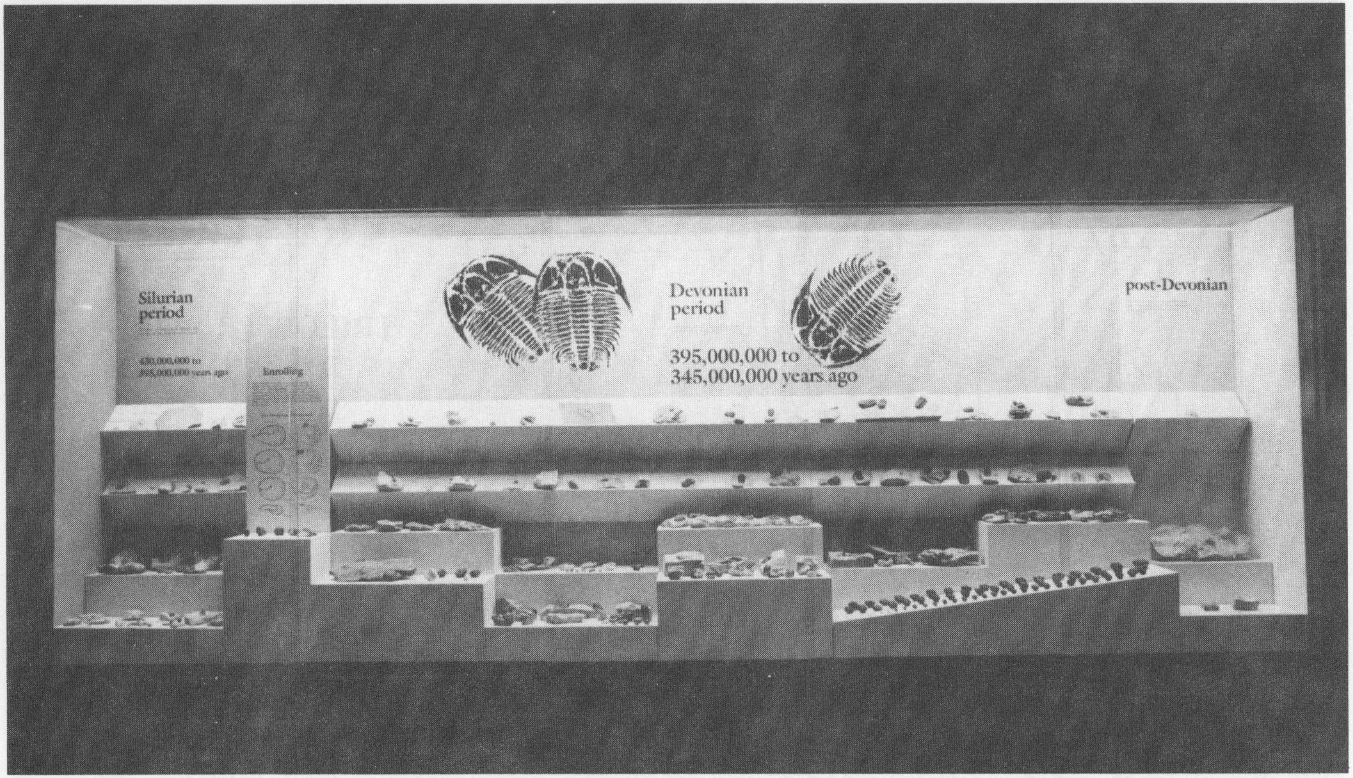
Cambrian Exhibit case from the Learning Center Gallery. U.S.N.M.N.H. This exhibit case measures about ten feet in width.



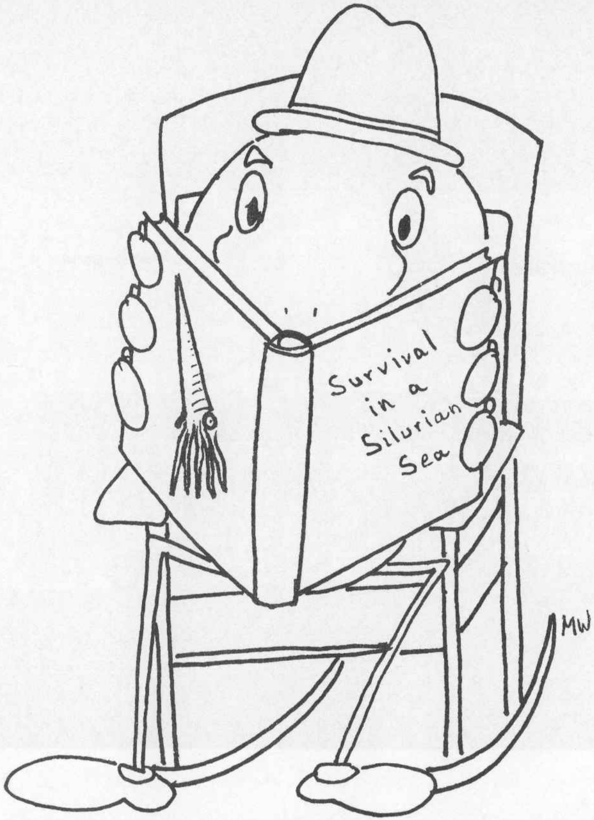
Ordovician Exhibit case from the Learning Center Gallery, U.S.N.M.N.H. This exhibit case measures about ten feet in width.



Growth series from the Ordovician Exhibit, U.S.N.M.N.H. Most specimens pictured here are from the Caesar Creek Region near Waynesville, Ohio.



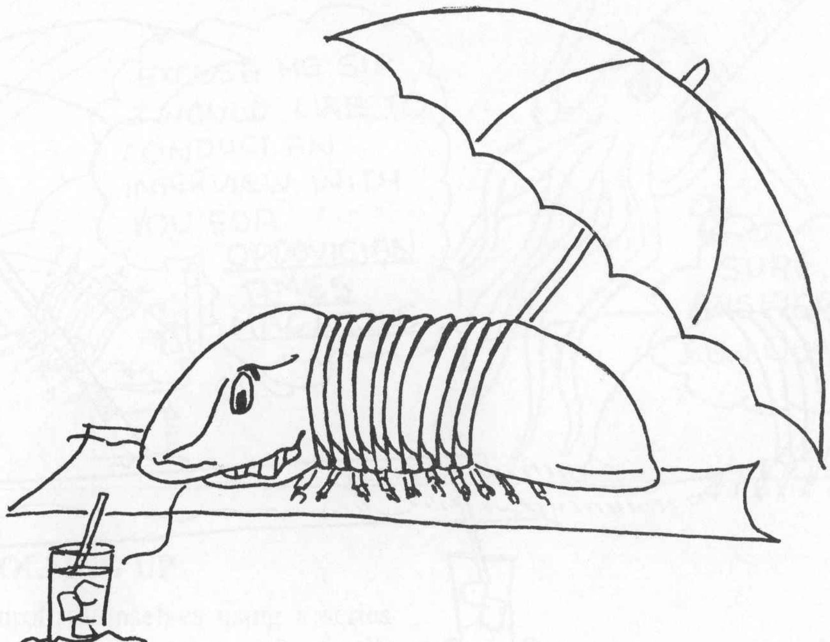
Display case of Silurian, Devonian and Post-Devonian trilobites from the Learning Center Gallery, U.S.N.M.N.H. This exhibit case measures almost twenty feet in width.



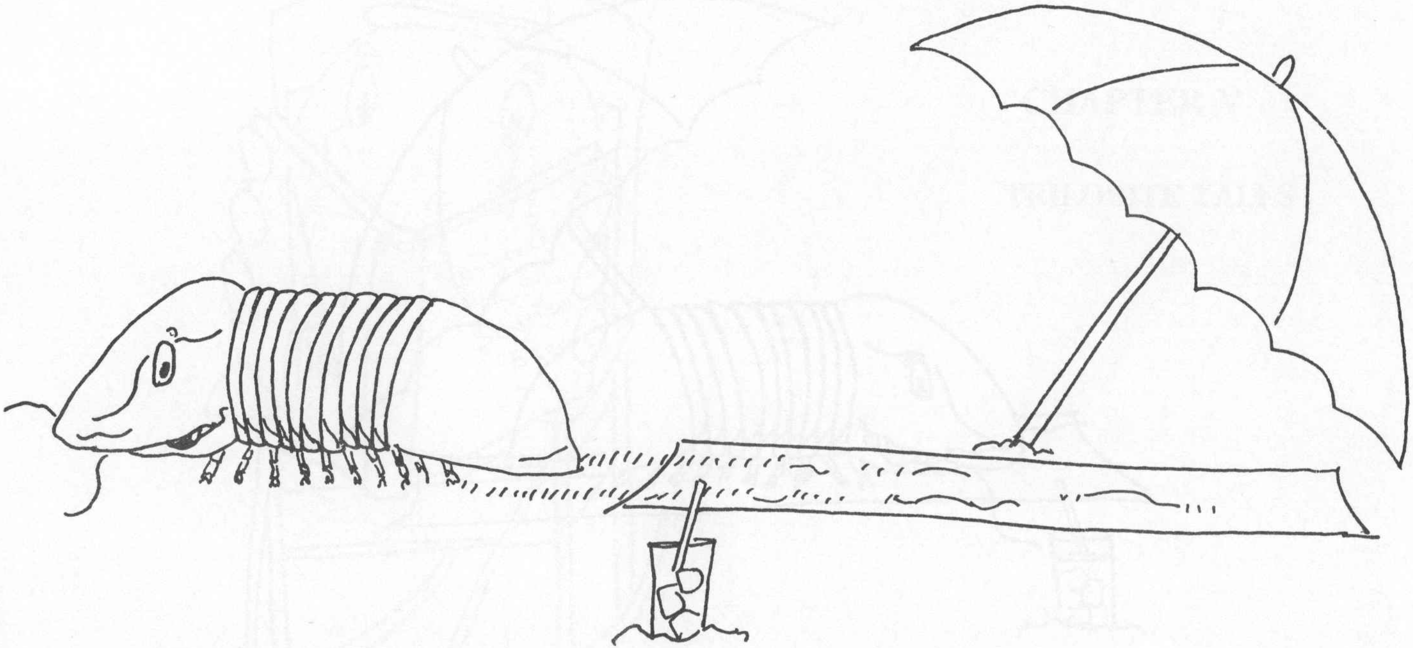
CHAPTER V

TRILOBITE TALES

Trilobite Tales "Just for Fun": This chapter may be just for fun; however, a lot can be learned from it. Starting on Page 73, Tom Trilobite begins the process of rolling up. Take the pages and flip through till the cycle is complete.

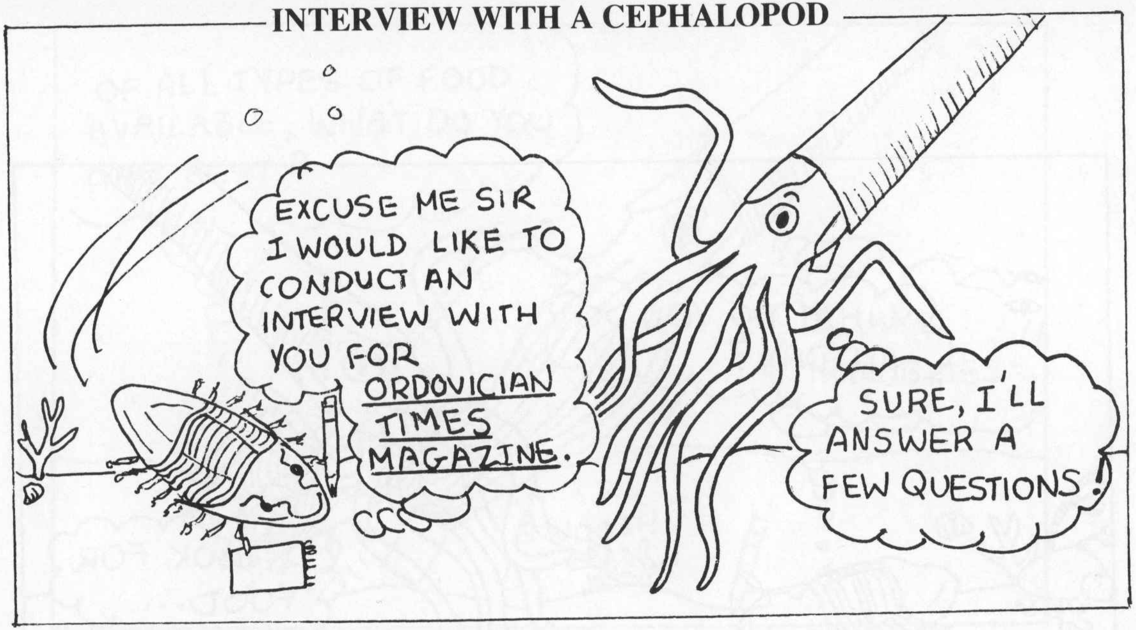


"Ah, such a nice day for sunning on the beach."



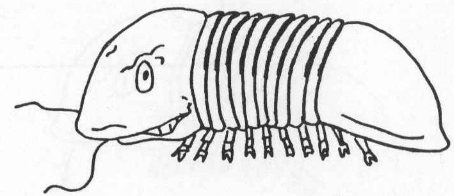
“Looks like the groups having some fun down on the beach. I think I’ll have a look, perhaps I can join in on the fun.”

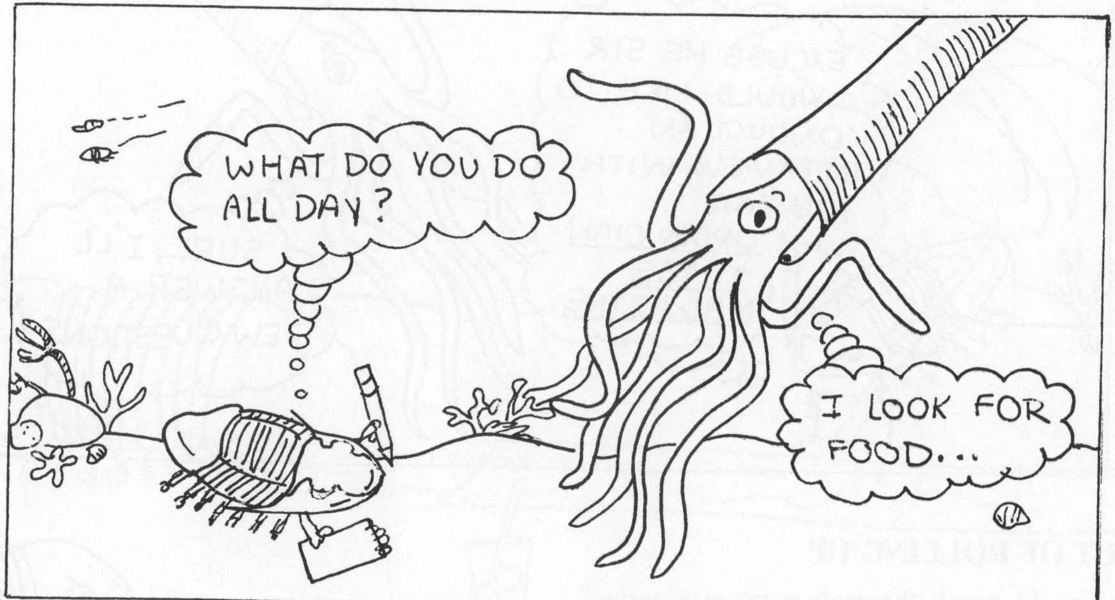
INTERVIEW WITH A CEPHALOPOD

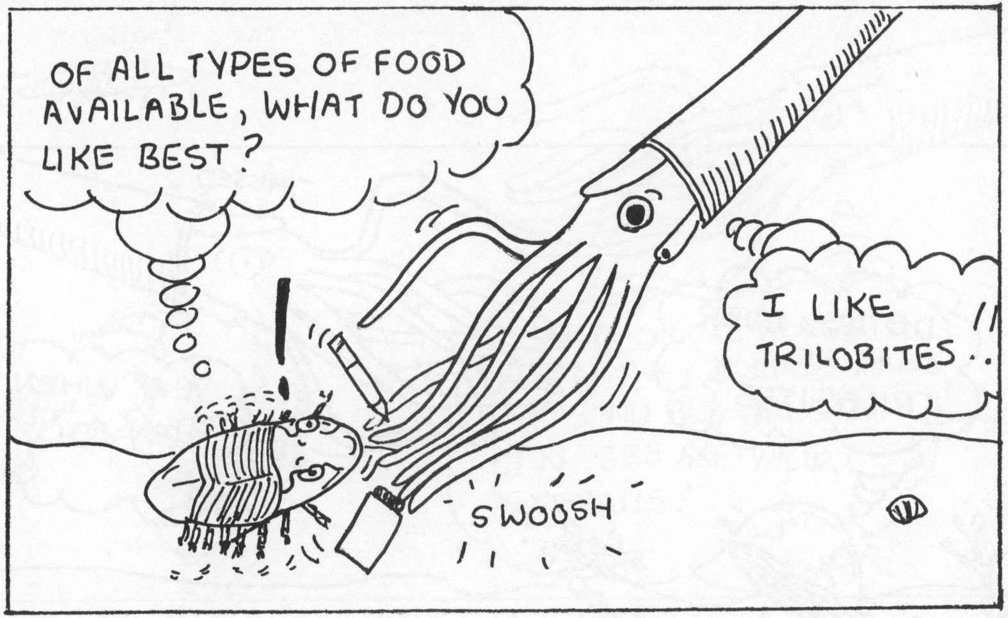


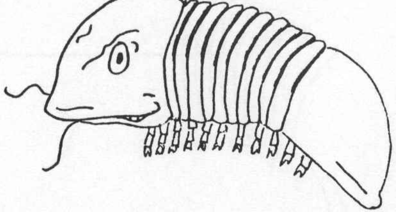
THE ACT OF ROLLING UP

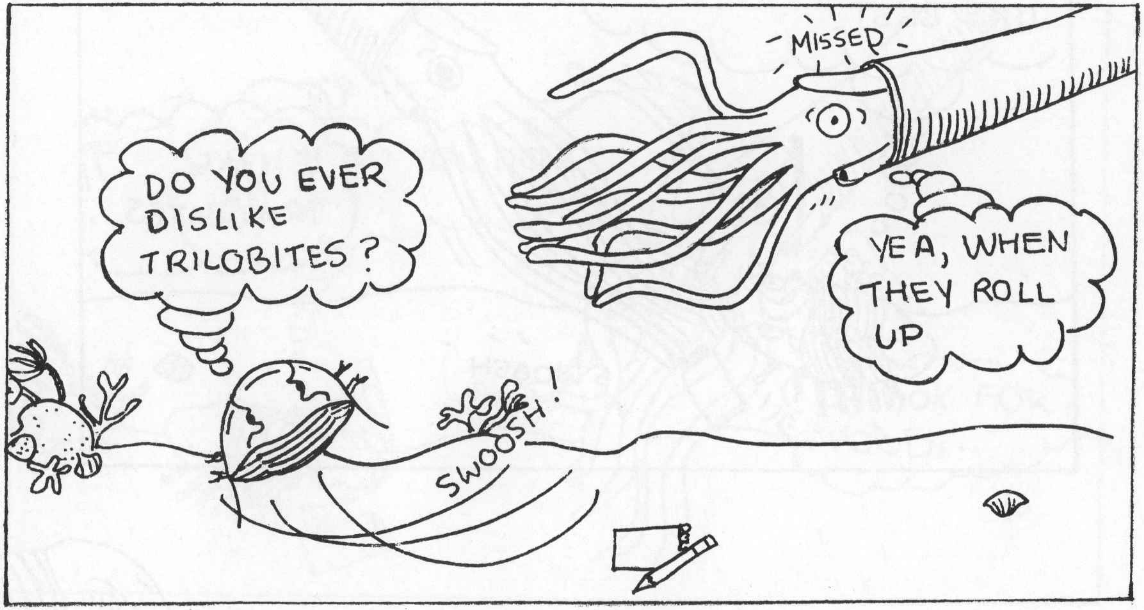
Trilobites could enroll themselves using a series of muscles in the thorax. This same act of rolling up can be found today in your garden. Look under a rock or rotting board and you will find the Oniscus osellus commonly called "sow bug" or "rolly-polly" bug.

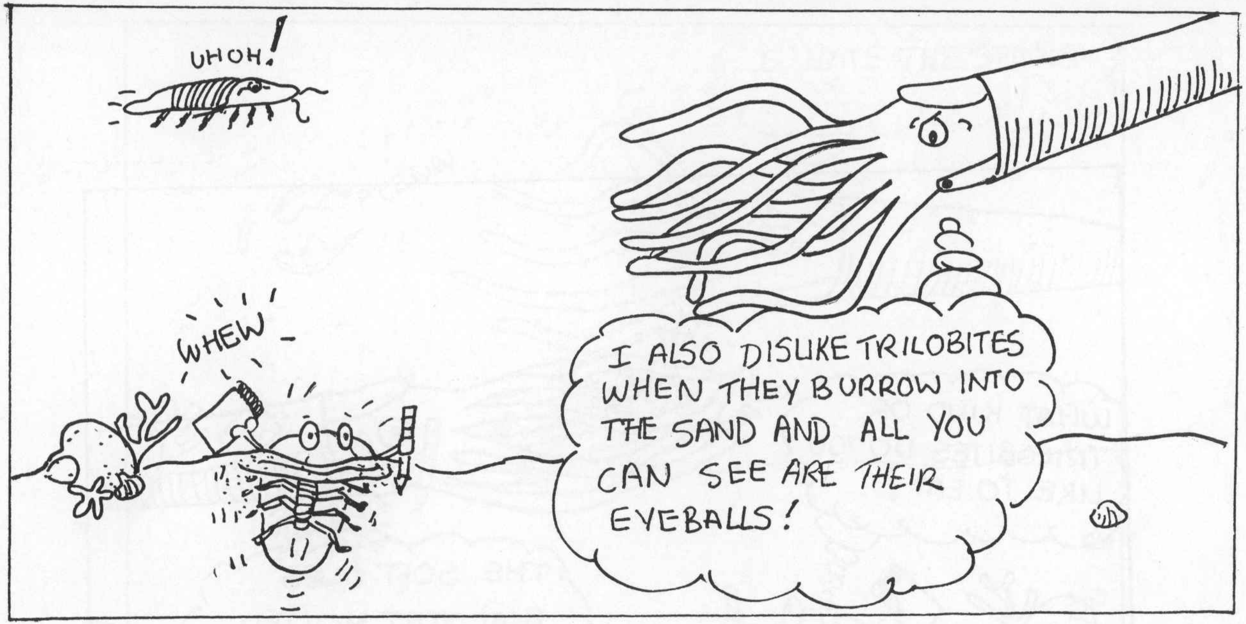


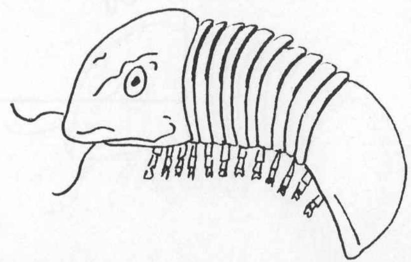

WHAT DO YOU DO ALL DAY?
I LOOK FOR FOOD...

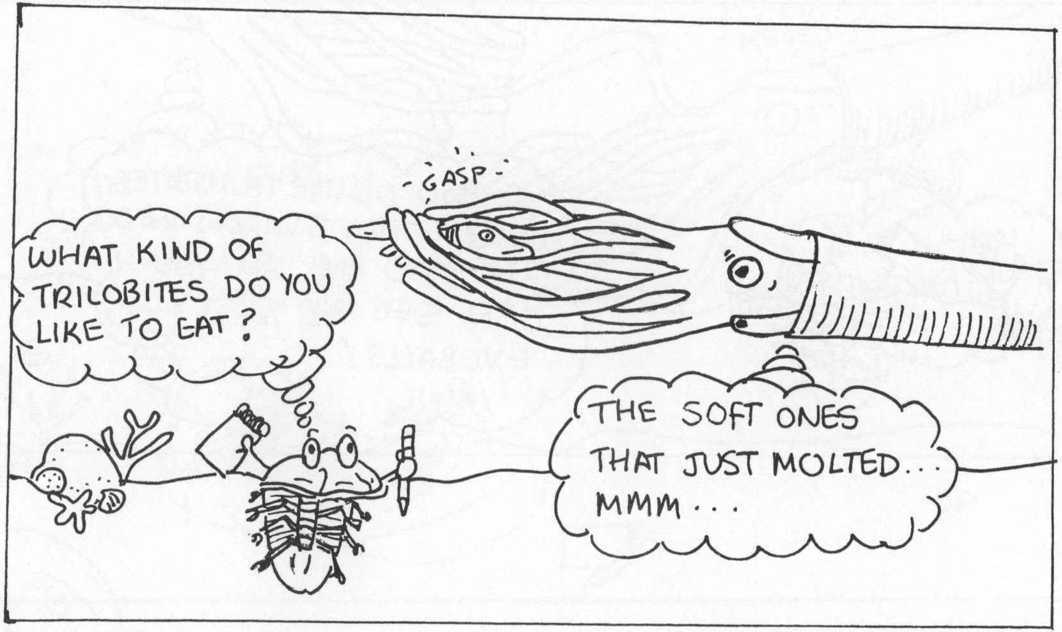

OF ALL TYPES OF FOOD AVAILABLE, WHAT DO YOU LIKE BEST?
I LIKE TRILOBITES..
!
SWOOSH

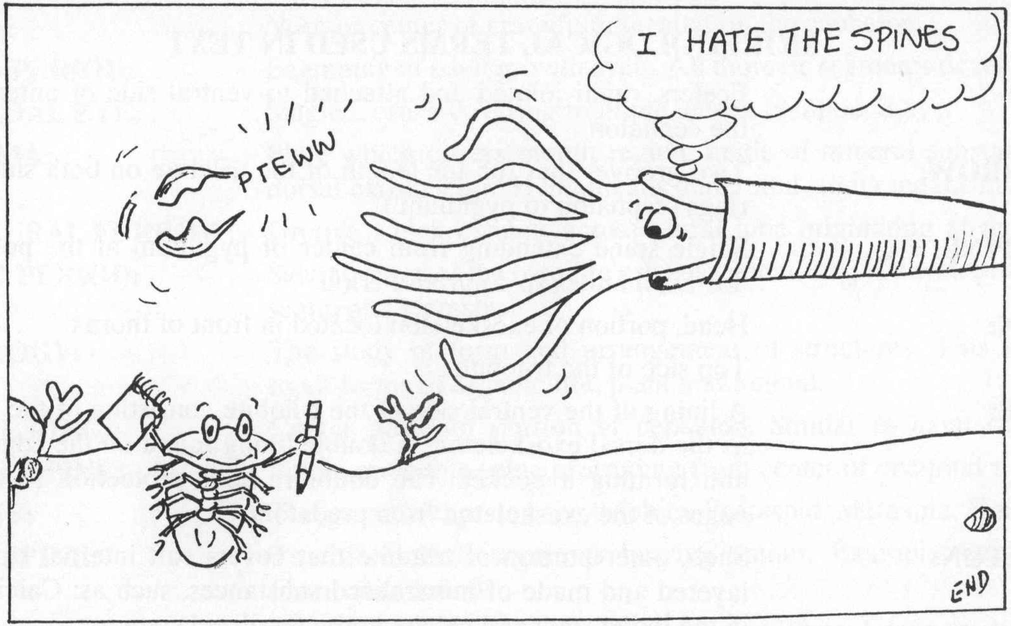


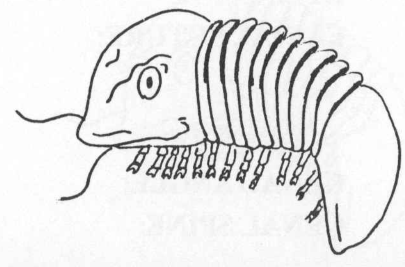

DO YOU EVER DISLIKE TRILOBITES?
MISSED
YEA, WHEN THEY ROLL UP
SWOOSH!


UHOH!
WHEW
I ALSO DISLIKE TRILOBITES WHEN THEY BURROW INTO THE SAND AND ALL YOU CAN SEE ARE THEIR EYEBALLS!




WHAT KIND OF TRILOBITES DO YOU LIKE TO EAT?
GASP
THE SOFT ONES THAT JUST MOLTED... MMM...


I HATE THE SPINES
PTEWW
END



MORPHOLOGICAL TERMS USED IN TEXT

ANTENNA:	Feelers, multi-jointed and attached to ventral side of anterior portion of the cephalon.
AXIAL FURROW:	Two grooves that run the length of the trilobite on both sides of the axial rings (cephalon to pygidium).
CAUDAL SPINE:	Single spine extending from center of pygidium at the posterior border. See Dalmanites sp. Silurian Period.
CEPHALON:	Head, portion of exoskeleton located in front of thorax.
DORSAL:	Top side of the trilobite.
DOUBLURE:	A lining of the ventral side of the trilobite consisting of the same material as the dorsal exoskeleton. A double lining found on the edge or perimeter and forming a pocket. The doublure adds protection to the vulnerable edges of the exoskeleton from predators.
EXOSKELETON:	Shell, outer portion of trilobite that covers soft internal structure. Multi-layered and made of mineralized substances, such as: Calcium carbonate in the living state and calcite in the fossilized state.
EYE:	Used for vision and positioned on dorsal side of cephalon.
FACIAL SUTURE:	Suture which extends from anterior portion of cephalon across top of eye and back to the posterior portion of cephalon. Used for the purpose of molting. Suture means seam or line where two parts come together and join.
GENAL ANGLE:	Corner of cephalon bordering anterior portion of thorax.
GENAL SPINE:	Projection extending from genal angle. See Isotelus sp. Ordovician Period.

GLABELLA: Nose or center of cranidium located on the cephalon.

HOLASPID PERIOD: Beginning of adult growth cycle. All thoracic segments developed. Holaspis.

HOLOCHROAL EYE: Single Cornea covering multiple lenses, compound eye.

HYPOSTOMA: Plate which covers mouth region, made of mineral substances similar to dorsal exoskeleton. Hypo means under and stoma means mouth.

INTERPLEURAL FURROW: Groove which extends across plural lobe originating at the axial furrow.

MERASPID PERIOD: Second stage of the trilobite's development. Major development of thoracic segments. Meraspis.

MORPHOLOGY: The study of form and arrangement of structures. This science applies to all forms of organic life, plant and animal.

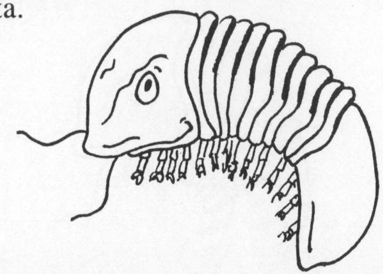
OCCIPITAL RING: Center posterior portion of cephalon. Similar to axial rings on thorax.

OCCIPITAL SPINE: Single or double spine protruding from center of occipital ring.

ONTOGENY: The growth stages on the trilobite, Protaspid, Meraspid, Holaspid.

PLEURAL SPINE: Tip of thoracic segments bearing spines. Example: see Olenoides sp. Cambrian Period.

PIT: Small hole or holes in exoskeleton of trilobite. Greenops boothi is perfect example. Some holes held small hairs called seta.



PROTASPID PERIOD:	First stage of developing trilobites. No thoracic segments present. (Protaspis)
PYGIDIUM:	Tail, posterior portion of exoskeleton joining thorax.
SCHIZOCHROAL EYE:	Eye exhibits individual lenses each covered with individual corneas. See Phacops sp., Devonian Period.
THORACIC SEGMENTS:	Individual portions making up the entire thorax. The number of segments differ with each family. Segments run transversely across thorax forming two pleural and one axial lobe.
SPINE:	Sharp projection usually pointed and probably used as a defense mechanism. Olenoides Cambrian, Isotelus Ord, Dalmanites Sil., Greenops Dev.
TELEPOD:	A jointed appendage, walking leg, attached to the ventral side of the trilobite.
THORAX:	Body, or main portion of trilobite bordered by cephalon and pygidium.
TUBERCLE:	Small bumps that appear on dorsal side of exoskeleton on some trilobites.
TRANSITORY PYGIDIUM:	Term used for pygidium during the meraspid period of development. Thoracic segments are fused together with pygidium.
VINCULAR FURROW:	A well defined groove extending along the ventral portion of the cephalon. The groove locks in the posterior portion of the pygidium upon enrollment. This name was derived from the Latin word vinculum, which means to lock or fasten.

STATE GEOLOGICAL SURVEY OFFICES:

This is a complete listing of the State Geological Survey Offices. Feel free to write to them for collecting information on fossil localities in your area. The State Geological Survey Offices can also be of help in fossil identification.

Geological Survey of Alabama
Ernest Mancini; Box O
Tuscaloosa, Alabama 35486-9780

Alaska Div of Geo & Geophysical Sur
Robert Forbes; 794 University Ave
Suite 200, Fairbanks, Alaska 99709

Arizona Geological Survey
Larry Fellows;
845 North Park Ave, Suite 100
Tuscon, Arizona 85719

Arkansas Geological Commission
Norman Williams;
Vardelle Parham Geology Center
3815 W. Roosevelt Road
Little Rock, Arkansas 72204

California Div of Mines & Geology
James Davis;
1416 Ninth St, Rm 1341
Sacremento, California 95814

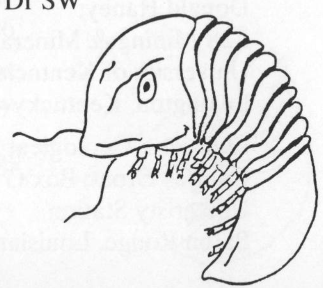
Colorado Geological Survey
John Rold;
1313 Sherman St, Rm 715
Denver, Colorado 80203

Connecticut Geological Survey
Hugo Thomas; State Office Bldg
165 Capitol Ave, Room 553
Hartford, Connecticut 06106

Florida Geological Survey
Walter Schmidt; 903 W Tennessee St
Tallahassee, Florida 32304-7795

Georgia Geologic Survey
William McLemore; Dept of Nat Res
Rm 400, 19 Martin Luther King Jr Dr SW
Atlanta, Georgia 30334

Hawaii Div of Water & Land Dev
Manabu Tagomori; Box 373
Honolulu, Hawaii 96809



Idaho Geo Sur; Robert Bartlett;
Morrill Hall, Rm 332, Un of Idaho
Moscow, Idaho 83843

Illinois Geo Sur, Morris Leighton;
Nat Res Bldg, 615 E. Peabody Dr
Chanpaign, Illinois 61820

Indiana Geological Survey
Norman Hester; 611 N. Walnut Grove
Bloomington, Indiana 47405

Iowa Geological Bureau
Donald Koch; Iowa Dept of Nat Res
123 N. Capitol St
Iowa City, Iowa 52242

Kansas Geological Survey
Lee Gerhard; 1930 Constant Ave
West Campus, Un of Kansas
Lawrence, Kansas 66046

Kentucky Geological Survey
Donald Haney;
228 Mining & Mineral Res Bldg
University of Kentucky
Lexington, Kentucky 40506-0107

Louisiana Geological Survey
Charles Groat; Box G
Univeristy Station
Baton Rouge, Louisiana 70893

Maine Geological Survey
Walter Anderson;
Department of Conservation
State House Station 22
Augusta, Maine 04333

Maryland Geological Survey
Kenneth Weaver; 2300 St. Paul St
Baltimore, Maryland 21218

Michigan Geo Sur Div
Thomas Segall; Box 30028
Lansing, Michigan 48909

Minnesota Geo Sur, Priscilla Crew;
2642 University Ave
St Paul, Minnesota 55114-1057

Mississippi Bur of Geo & Land Sur
Conrad Grazzier; Box 5348
Jackson, Mississippi 39216

Missouri Div of Geology & Land Sur
James Hadley Williams; Box 250
Rolla, Missouri 65401

Montana Bureau of Mines & Geology
Edward Ruppel;
Montana College of Mineral Sci & Tec
Butte, Montana 59701

Nebraska Conservation & Survey Div
Perry Wigley;
113 Nebraska Hall, Un. of Nebraska
Lincoln, Nebraska 68588-0517

Nevada Bureau of Mines & Geology
State Geologist, Un of Nevada
Reno, Nevada 89557-0088

New Jersey Geological Survey
Haig Kasabach; CN-029
Trenton, New Jersey 08625

New Mexico Bur of Mines & Mineral Res
Frank E. Kottlowski; Campus Station
Socorro, New Mexico 87801

New York State Geological Survey
Robert Fakundiny; 3136 Cultural Ed Ctr
Empire State Plaza
Albany, New York 12230

North Carolina Dept of Nat Res & Com Dev
Stephen Conrad; Div of Land Res
Box 27687, Raleigh, North Carolina 27611

North Dakota Geological Survey
Sidney Anderson; University Station
Grand Forks, North Dakota 58202-8156

Ohio Division of Geological Survey
State Geologist; Fountain Sq, Bldg B
Columbus, Ohio 43224

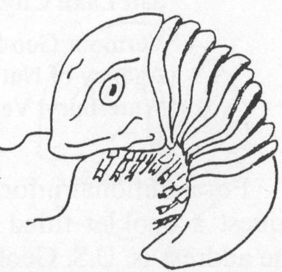
Oklahoma Geological Survey
Charles Mankin;
30 Van Vleet Oval, Room 163
Norman, Oklahoma 73019

Oregon Dept of Geo & Mineral Ind
Donald Hull;
910 State Office Bldg
1400 SW 5th Ave
Portland, Oregon 97201-5528

Pennslyvania Bur of Topo & Geo Sur
Donald Hoskins; Dept of Envir Res
Box 2357, Harrisburg
Pennslyvania 17120

Puerto Rico Dept of Nat Res
Ramon Alonso; Geo Sur Div
Box 5887, Puerta de Tierra
San Juan, Puerto Rico 00906

Rhode Island State Geologist
Allan Cain; Dept of Geology
University of Rhode Island
Kingston, Rhode Island, 02881



South Carolina Geological Survey
Norman Olson; 5 Geology Rd
Columbia, South Carolina 29210

South Dakota Geological Survey
Merlin Tipton; Science Ctr
Un of South Dakota
Vermillion, S.Dakota 57069-2390

Tennessee Division of Geology
William Hill;
Custom's House, 701 Broadway
Nashville, Tennessee 37219-5237

Texas Bur of Economic Geology
William Fisher; Un of Texas
Box X, University Station
Austin, Texas 78712-7508

Utah Geo & Mineral Survey
Genevieve Atwood;
606 Black Hawk Way
Salt Lake City, Utah 84108-1280

Vermont Geo Sur, Charles Ratte;
Agency of Nat Res, 103 So Main St
Waterbury, Vermont 05676

Virginia Div of Mineral Res
Robert Milici; Box 3667
Charlottesville, Virginia 22903

Washington Div of Geo & Earth Res
Raymond Lasmanis; Dept of Nat Res
Olympia, Washington 98504

West Virginia Geo & Economic Sur
Robert Erwin;
Mont Chateau Res Center, Box 879
Morgantown, W.Virginia 26507-0879

Wisconsin Geo & Nat History Sur
Meredith Ostrom;
3817 Mineral Point Road
Madison, Wisconsin 53705

Wyoming Geological Survey
Gary Glass; Box 3008
University Station, Un of Wyoming
Laramie, Wyoming 82071

For additional information contact the United States Department of the Interior and receive free upon request a booklet titled "Guide to Obtaining USGS Information, U.S. Geological Survey Circular 900". The address is: U.S. Geological Survey, Federal Center, Box 25425, Denver, Colorado 80225.

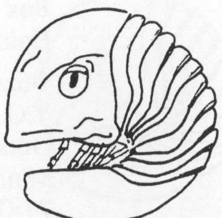
FOREIGN SURVEY OFFICES

Alberta, Jan Boon; Alberta Geo Sur
Alberta Research Council
Box 8330 Postal Station F
Edmonton, Alberta T6H 5X2

Diana Purdy; Mineral Res Div
Dept of Energy & Natural Res
Petroleum Plaza
South Tower 9915-1083
Edmonton, Alberta, T5K 2C9

British Columbia, W.R. Smyth;
Geological Survey Branch, Mineral Resources Division
Ministry of Energy, Mines & Petroleum Resources
Parliament Buildings
Victoria, British Columbia V8V 1X4

Manitoba
Dave McRitchie;
Geological Servies Branch, Manitoba Energy & Mines
555-330 Graham Ave.
Winnipeg, Manitoba, R3C 4E3



New Brunswick
J.L. Davies;
Geological Surveys Branch, New Brunswick Department of Natural Resources
Box 6000
Fredericton, New Brunswick E3B 5H1

Newfoundland
B.A. Greene;
Mineral Development Division, Department of Mines & Energy
Box 4750
St. John's, Newfoundland A1C 5T7

Northwest Territories
W.A. Padgham;
Geology Division
Northern Affairs Program
Box 1500
Yellowknife, Northwest Territores, X1A 2R3

Nova Scotia
Peter S. Giles;
Nova Scotia Department of Mines & Energy
Box 1087
Halifax, Nova Scotia, B3J 2X1

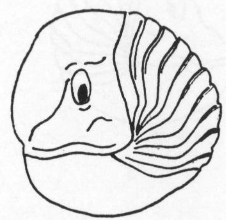
Ontario
V.G. Milne;
Ontario Geological Survey, Mines & Minerals Division
Ministry of Northern Development & Mines
77 Grenville St., Room 1121, Toronto, Ontario M7A 1W4

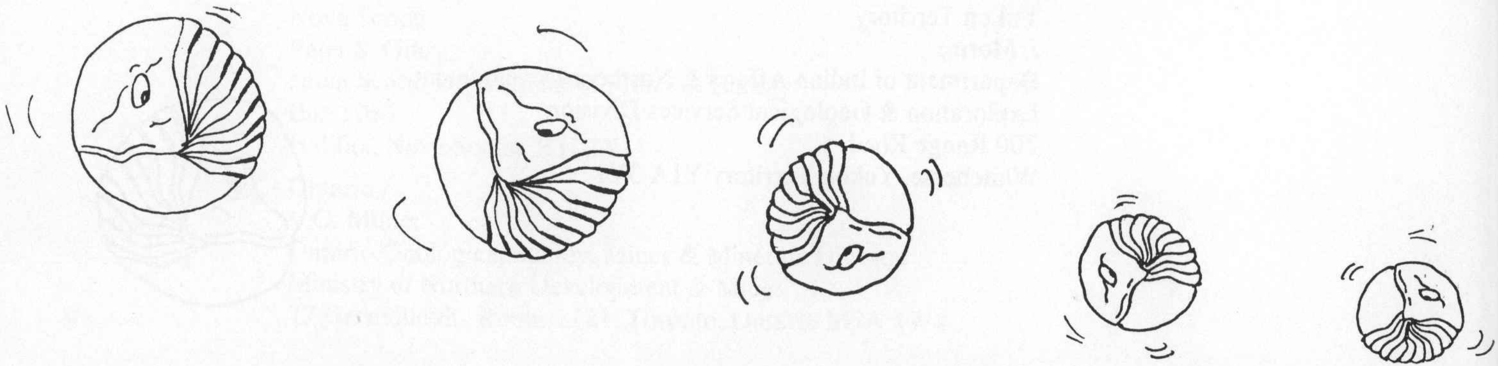
Prince Edward Island
Wayne Mac Quarrie;
Department of Energy & Minerals
Box 2000
Charlottetown, Prince Edward Island, C1A 7N8

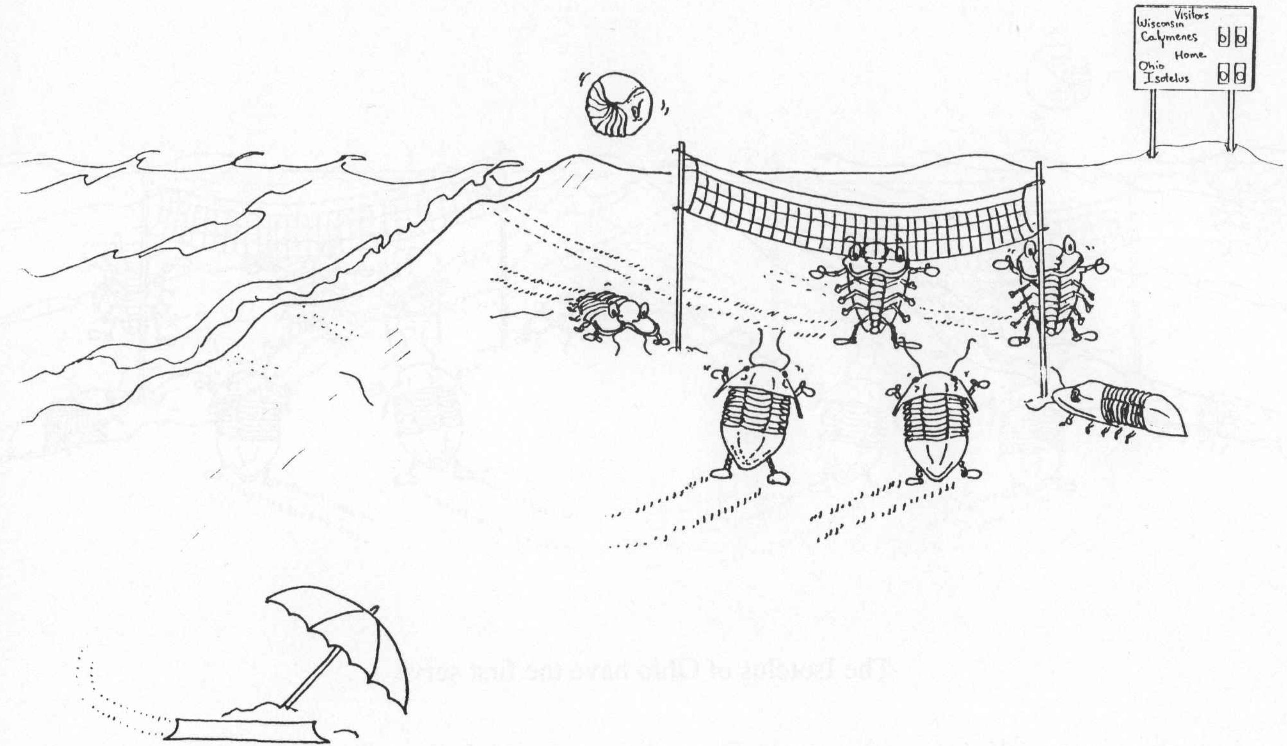
Quebec
Robert Y. Lamarche; Direction generale
Exploration geologique et minerale
(Mines), Ministere de l'Energie et des Resources
Gouvernement du Quebec
1620 Boul. de l'Entente, Quebec, G1S 4N6

Saskatchewan
L.S. Beck;
Geology & Mines Division, Saskatchewan Energy & Mines
Toronto Dominion Bank Bldg., 1914 Hamilton St.
Regina, Sakatchewan S4P 4V4

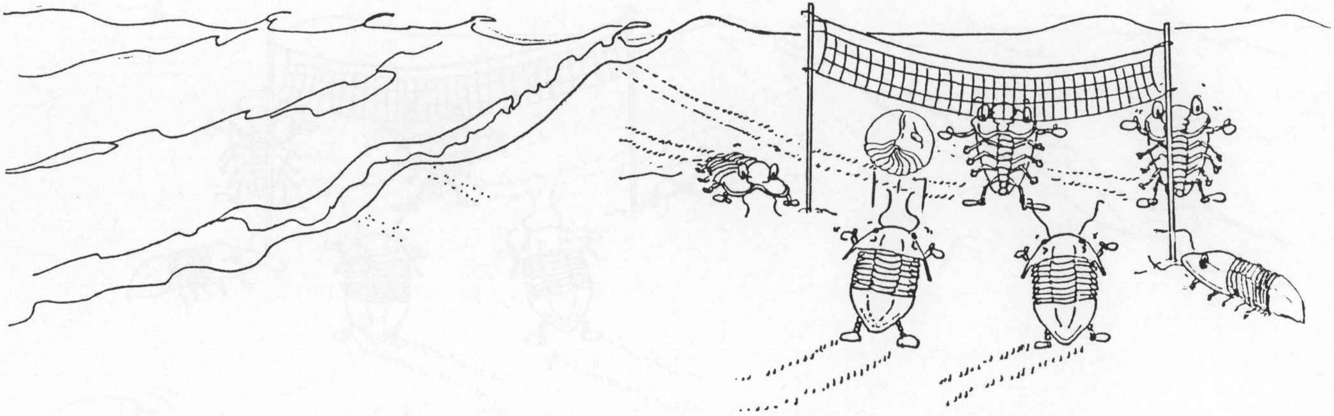
Yukon Territory
J. Morin;
Department of Indian Affairs & Northern Development
Exploration & Geological Services Division
200 Range Road
Whitehorse, Yukon Territory Y1A 3V1



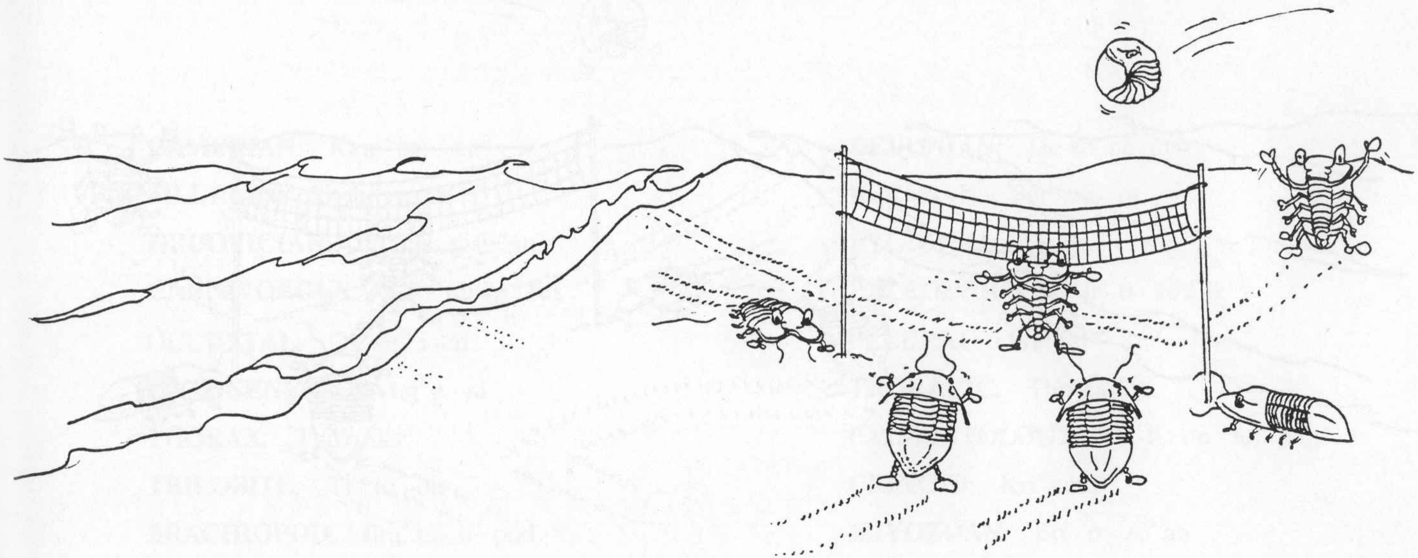




As Tom Trilobite bounces into the volley ball game . . . .



The Isotelus of Ohio have the first serve . . .



Bouncing over the net, Tom Trilobite is met by a Calymene from the Wisconsin side and is hit back over the net . . .

The Isotelus of Ohio runs for Tom Trilobite to save the point. But what is the point of the game? The point is that the Isotelus is the official state fossil of Ohio and Calymene is the official state fossil of Wisconsin. Both have been named state fossils since 1985. In both instances a group of young students wrote letters to officials in their state government and expressed their views about their favorite fossils. Student do have power; these students sought sponsors in the government to get fossils designated as their state fossils. Get together with your teachers and find out how a small group of students can make a difference. When Isotelus was designated the state fossil of Ohio, a search was made to explore and find the largest example possible. Three years later a 16 inch specimen was found (See p.43).

WORD PRONUNCIATIONS

CAMBRIAN: Kam′ bri . an

SILURIAN: Sī · lū′ ri · an

ORDOVICIAN: Or′ dō · vish″an

CARNIVOROUS: Kär · niv′ o · rus

OCCIPITAL: Ok sip′ i ·tal

ONTOGENY: On · toj′ e · ni

THORAX: Thō′ raks

TRILOBITE: Trī′ lo · bīt

BRACHIOPOD: Brā′ ki · o · pod

CORAL: Kor′ al

MORPHOLOGY: Mor · fol′ o · ji

DEVONIAN: De vō′ ne an

PERMIAN: Pėr′ mi · an

PYGIDIUM: Pī ′ jid′ i · um

PALEOZOIC: Pā′ li · o · zō ″ ik

PLEURAL: Plu′ ral

THORACIC: Thō ·ras′ ik

PALEONTOLOGY: Pā′li · on · tol″ o · ji

CRINOID: Krī′ noid

BRYOZOAN: Brī · o · zō′ an

CORNEA: Kor′ ni · a

HYPOSTOMA: Hī′po . stō′ ma

Additional word descriptions can be found on pages 80- 82
Above words and pronunciations are from Webster's dictionary.

REFERENCES

Campbell, K.S.W. 1975	"The Functional Anatomy Of Phacopid Trilobites: 1975 Musculature and eyes". J. Proc. Roy. Soc., New South Wales. 109: 168-188
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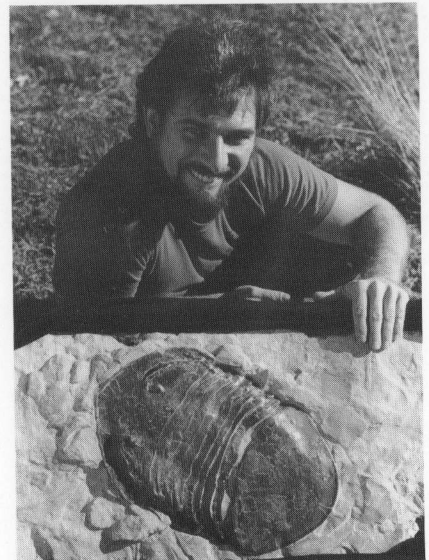
Ludvigsen, R. 1979	"Fossils of Ontario, Part 1: The Trilobites". Ontario Museum Life Sciences Miscellaneous Publications.
Miami University, Oxford, Ohio 1977	"Biostratigraphy and Paleoenvironments of the Cincinnati Series", Southeastern Indiana.
Moore, R.C. 1959	Arthropoda I. In Moore, R.C. Treatise on invertebrate paleontology, Part O. Geological Society of America and University of Kansas Press, Lawrence, Kansas.
Shimer and Shrock 1944	Index Fossils of North America. The Massachusetts Insititute of Technology.
Towe, K.M. 1973	Trilobite eyes; calcified lenses. Science 179, pgs.1007-1009.

ABOUT THE AUTHOR:

In 1956 at the age of four, Thomas Johnson began collecting rocks and fossils along the beaches of Lake Erie. Thanks to a grade school teacher and understanding parents, he continued to pursue his passion for trilobites and assembled a large collection. The best part of that collection is on exhibit in Washington, D.C. at the National Museum of Natural History, Smithsonian Institution. Other trilobite exhibits may be viewed at the Caesar Creek Lake Visitor Center, U.S. Army Corps of Engineers Project near Waynesville,Ohio.



ABOUT THE ARTIST:

Mary Ann Webster received a Bachelor of Science degree in Natural Resources from Ohio State University in 1985. She has been drawing pictures and serving as a park ranger for the U.S. Army Corps of Engineers for three years and is a full time ranger at Clarence J. Brown Dam and Reservoir in Springfield, Ohio.