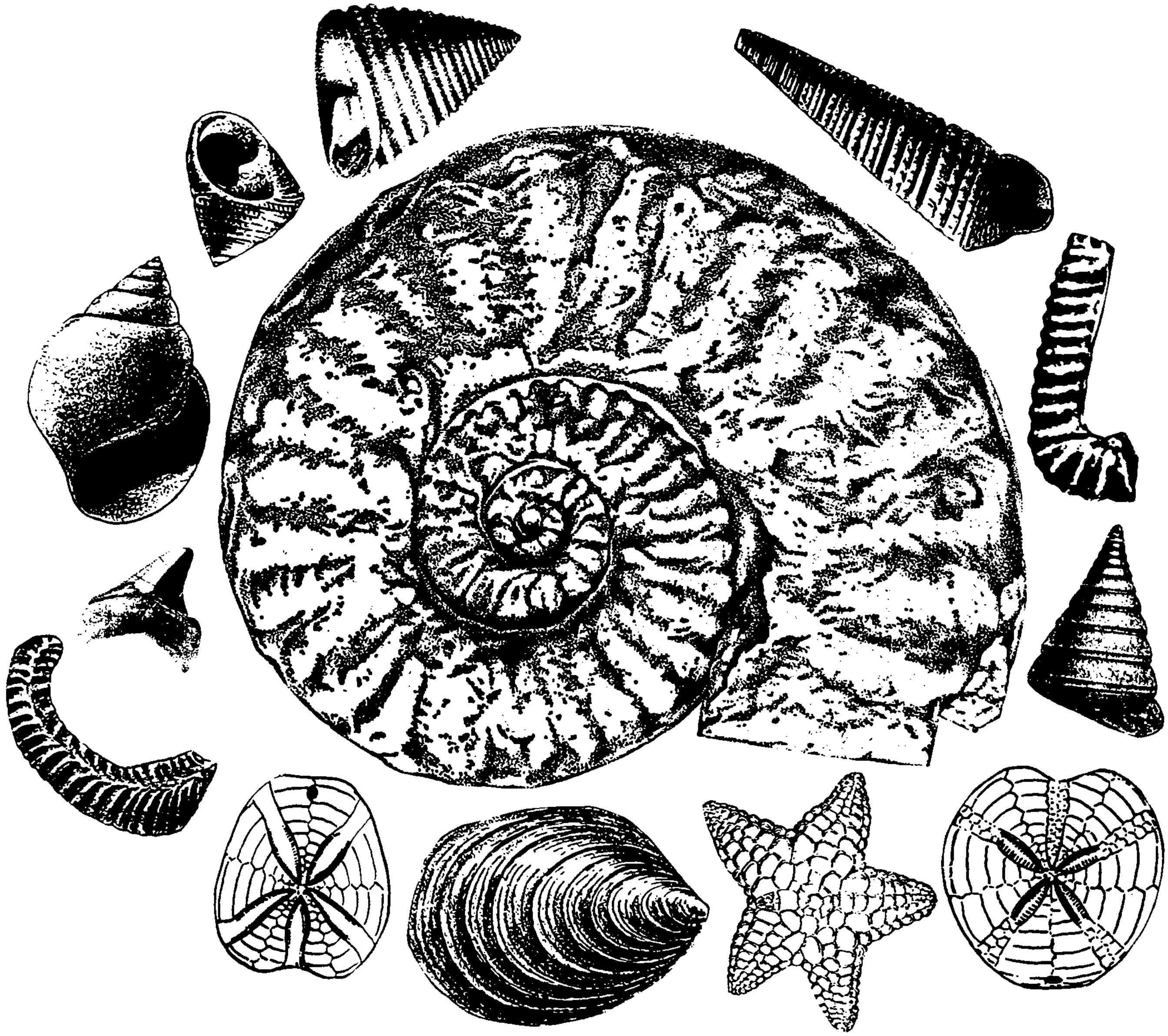
Open-File Report 2-95

THE AIPG OKLAHOMA SECTION CONVENTION FIELDTRIP

THE FOSSIL HEAVEN TRIP
in the Lower Cretaceous around Lake Texoma

REVISED EDITION



by Larry C. Simpson

AIPG FIELD TRIP, APRIL 23, 1995

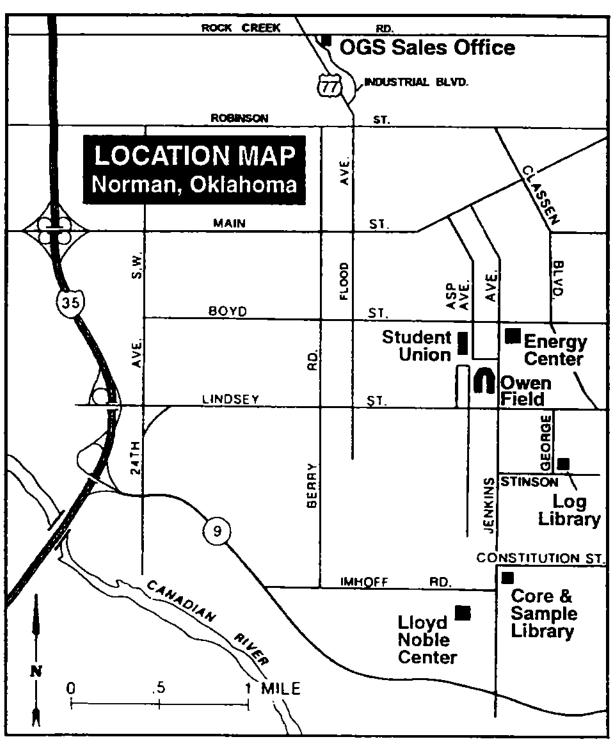
Leave from: Sarkeys Energy Center , east parking lot. The Energy Center is a fourteen story building at the northeast corner of the University of Oklahoma campus (Body and Jerkins).
The Energy Center should be visited prior to any field trip in Oklahoma. The Oklahoma Geological Survey, Geology Department and Library are housed at the Energy Center. The OGS has published over 50 books that describe Oklahoma fossils and fossil locations in almost all 77 counties. The OGS can also supply detailed geologic and topographic maps covering all of Oklahoma. Thousands of fossil locations are described in these publications.

Suggested Equipment for a Cretaceous Fossil Trip:

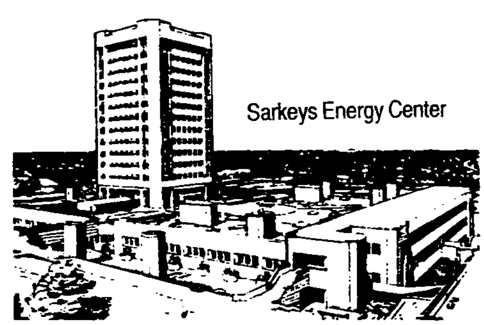
Lunch, water and money.
A hat and jacket is often useful in the morning.
Old shoes or high boots and a change of clothes for everyone.
First aid kit and clorox (to remove poison ivy or skunk fluid)
Rock hammer, shovel, pry bar, even a wheel barrow for the big ones.
Newspaper and tape or old towels to wrap the fossils. Unwrapped fossils will abrade each other.
OFF or Cutters bug spray. Always apply from top of shoes up past the waist.
Long pants and shirts will help reduce scrapes, bug bites, sun burn and poison ivy.
Consuming Vitamin E for a few days before the field trip has been shown to reduce bug bites.

Fossil Sites

Most fossil sites are on private land and written permission is required prior to collecting.
However, these fossils can be collected along creeks and the hundreds of miles of shoreline in the west, north and southeastern portions of Lake Texoma. The shore can be reached by land or boat and collecting after floodwaters have receded is particularly good.

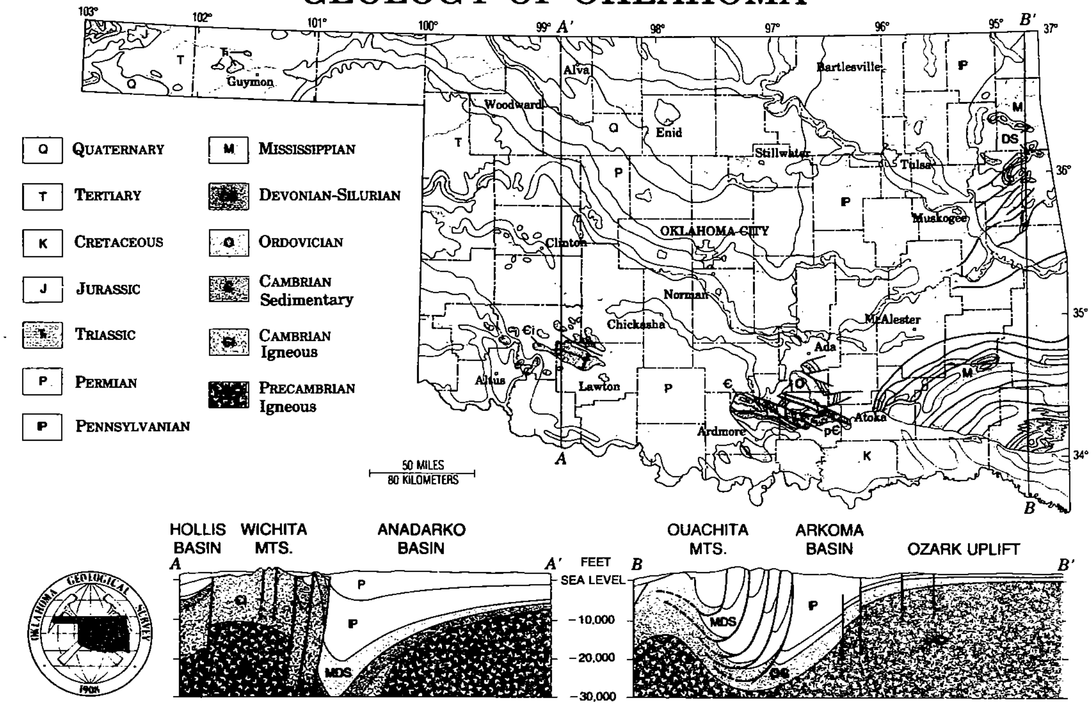


Books on Oklahoma fossils can be purchased from the Oklahoma Geological Survey Publication Sales Office, located in the northeast corner basement level of Sarkeys Energy Center, 100 E. Boyd, Norman. After May 1, 1996, a second OGS Sales Office will be located at 1218-B W. Rock Creek Road in Norman (see location map). Many book prices are less than $6.00!



The Sarkeys Energy Center parking lot is located on the east side of the building. A visitor parking section is provided at the north end of the parking lot. Visitors also may park in the Student Union parking garage, located on Asp Ave. one block west, or at the Lloyd Noble Center, which provides a courtesy shuttle-bus service.

GEOLOGY OF OKLAHOMA



OKLAHOMA GEOLOGICAL SURVEY, UNIVERSITY OF OKLAHOMA, NORMAN, OK 73019

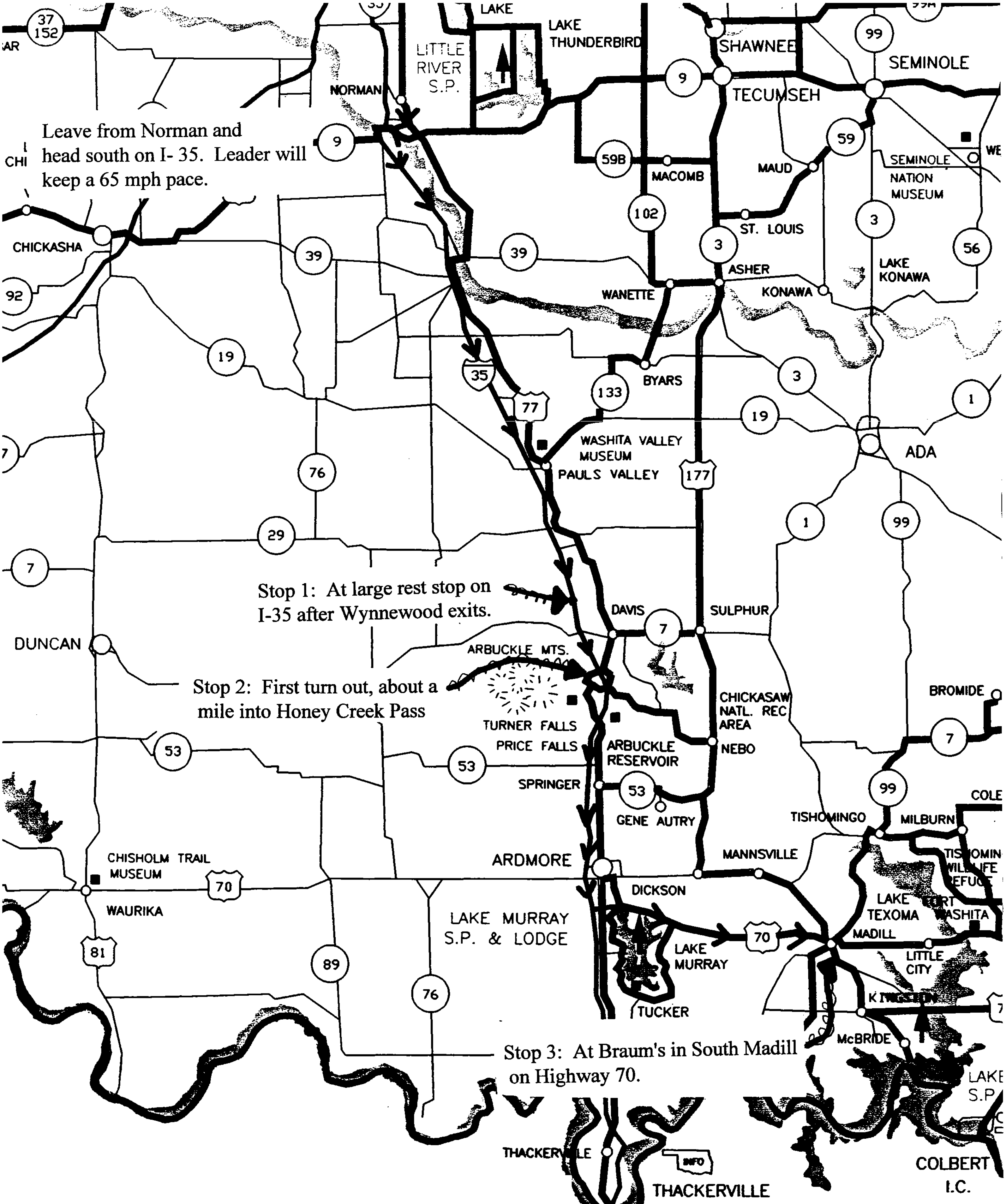
Scheduled stops on this fieldtrip. Use the following three maps for reference.

Stop 1: A fifteen minute or less pit stop at the road side park ten miles north of the Arbuckle Mountains.

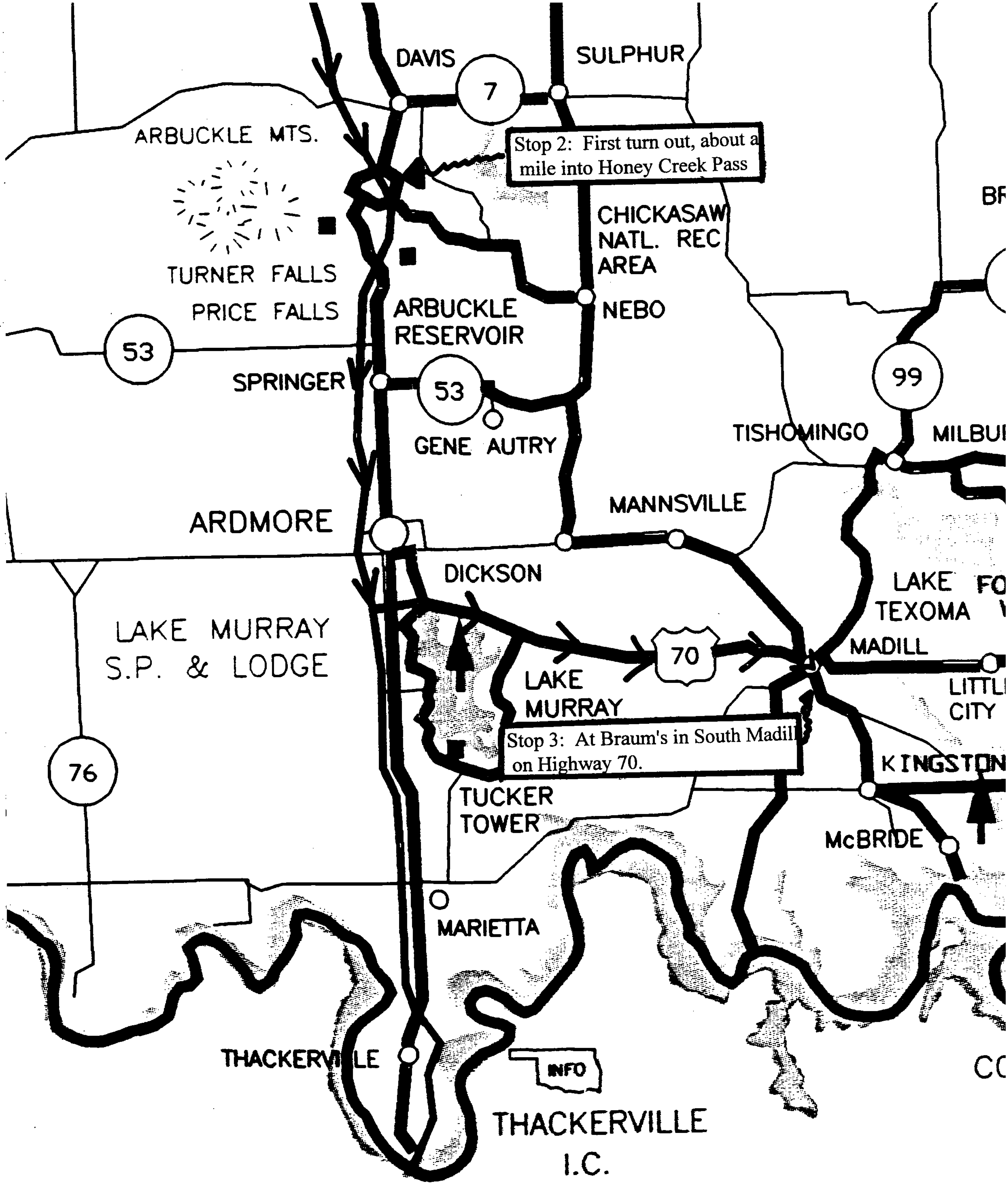
Stop 2: Turn off I-35 and up into the parking lot off the highway at the first turnoff in the Arbuckle Mountains. This is a mile into the mountains on the north side of this vast and awesome range. Arrive 8:30 and leave by 8:50. The impending glacial period, destruction of our prairie environment by the cedar tree, and proper use of the cedar tree in planetary climate control will be discussed. Then proceed down I-35 for 30 minutes to the Highway 70 east exit which is south of Ardmore. Take Highway 70 east to Madill, observing the white Antlers Sandstone in some of the roadcuts .

Stop 3: Proceed through Madill on Highway 70 to the Braum's on the south end of town (east side of road). A pit stop and ice cream break is in order after the rigors of the morning. The hellish drive and vast size of the cedar forests may have left you disoriented. Five dips of yuppy yogart per person will correct these problems.

Stop 4: Caravan south to the prairie and pasture near Lake Texoma. Four miles of dissected shales and limes will produce 100's of 1\4 to 1\2 inch hematite and limonite preserved ammonites and gastropods. Also small to large shark teeth and vertebrae and a progressively larger spectrum of pelecypods, echinoids, and ammonites. I do most of my collecting by laying on my stomach in the grass and carefully retrieving the small metallic beautiful specimens. Massive bug spray should be used. Small boxes and tissue are useful for such collecting. Walking over the area will reveal larger specimens. The appropriate splints and backbraces will be required in later years.

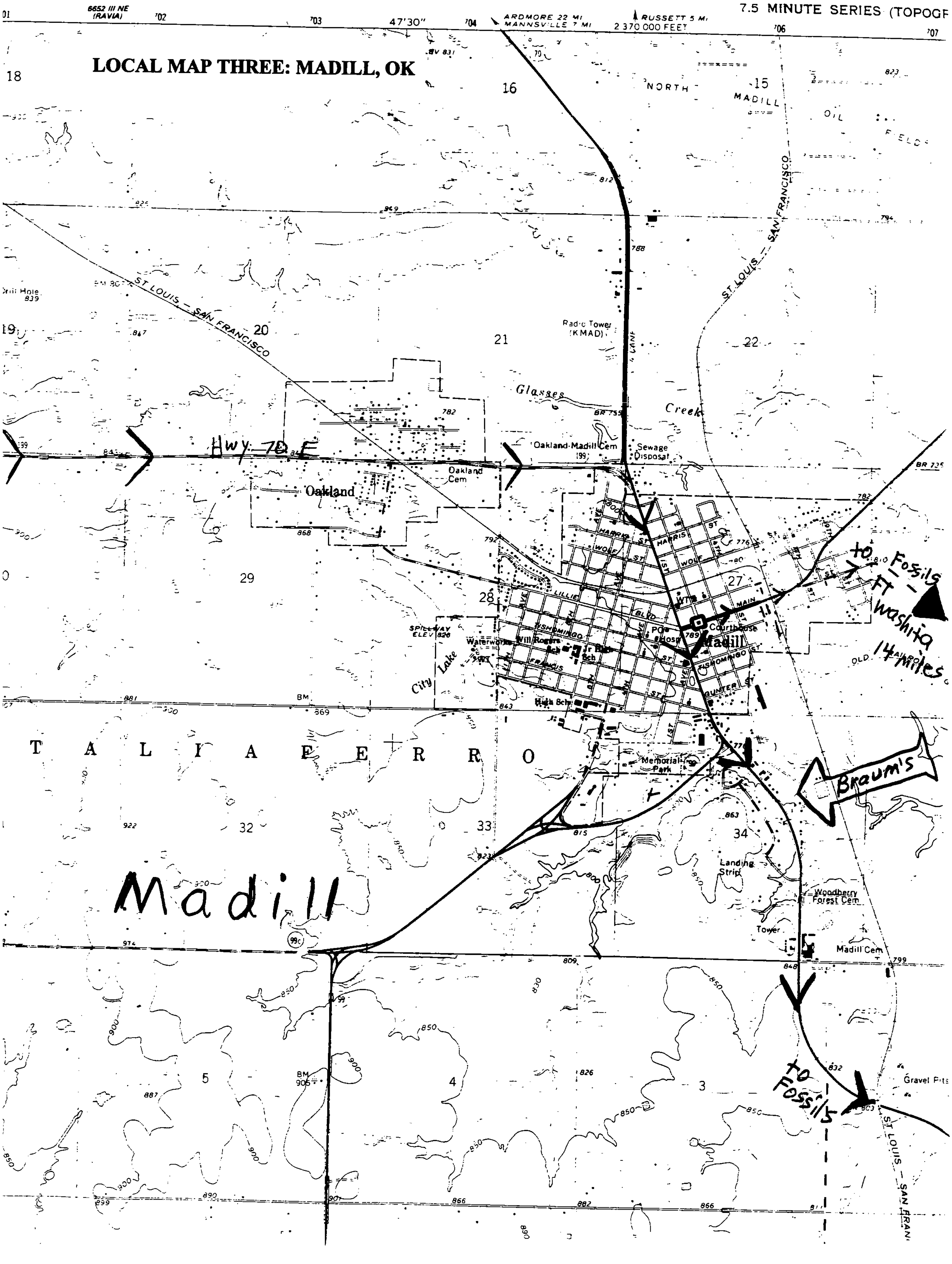


REGIONAL MAP ONE: ENTIRE FIELDTRIP ROUTE.



REGIONAL MAP TWO :ARBUCKLES TO MADILL

LOCAL MAP THREE: MADILL, OK



BRIEF HISTORY OF THE ARBUCKLE MOUNTAINS

Southern Oklahoma was dominated by a quiet depositional basin, the Old Oklahoma Rift, until Pennsylvanian times (Fig. 1, 2). During the early Pennsylvanian, continental drift caused South America to crash into North America. This compressive event produced the four mountain ranges that are in Oklahoma. The collision produced extensive strike slip movement along the faults bounding the Old Oklahoma Rift, which is a failed arm of the Dallas Triple Junction. The huge segment of rock that supported the bottom of the old rift was pushed west. However, there appears to have been a kink in the major faults at the present location of the Arbuckle Mountains. As one block of rock was pushed past the other, vertical sections of rock were shaved off and squirted to the surface in thin (1000-2000 foot thick) sheets (Fig. 3). Erosion during Pennsylvanian, Lower Permian, Cretaceous and Tertiary periods produced todays truncated flower structure(Fig. 4).

The lower Paleozoic rocks exposed in the Arbuckle Mountains are not basement attached!
A deep wildcat well drilled along I-35 at the top of the Arbuckles verified seismic interpretations that had been made years earlier. This mid 1980s well began drilling in highly dipping lower Arbuckle limestone rocks at the surface. At 5300 feet they drilled through these highly dipping sediments and entered flat lying Pennsylvanian shales. They continued drilling in flat lying beds until they reached 18320 where they encountered the same lower Arbuckle rocks that they had encountered at the surface!

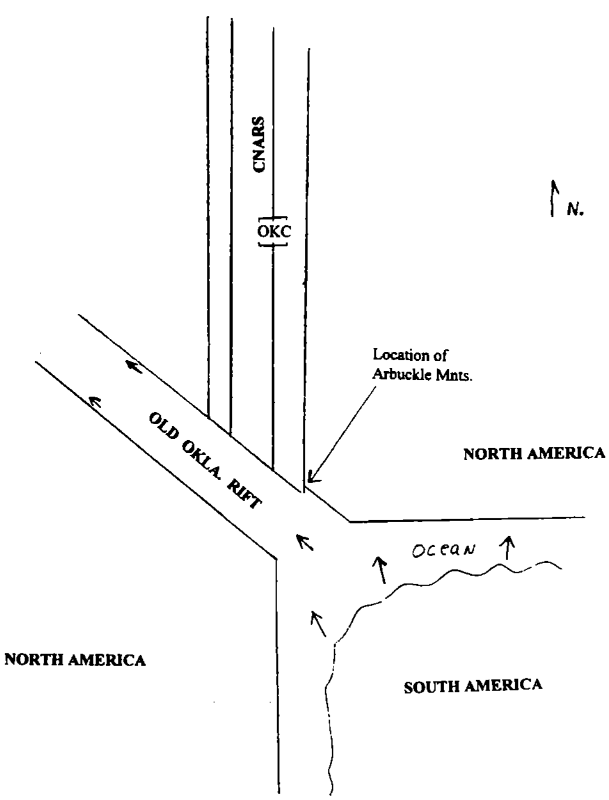


FIGURE 1: Miss. Times

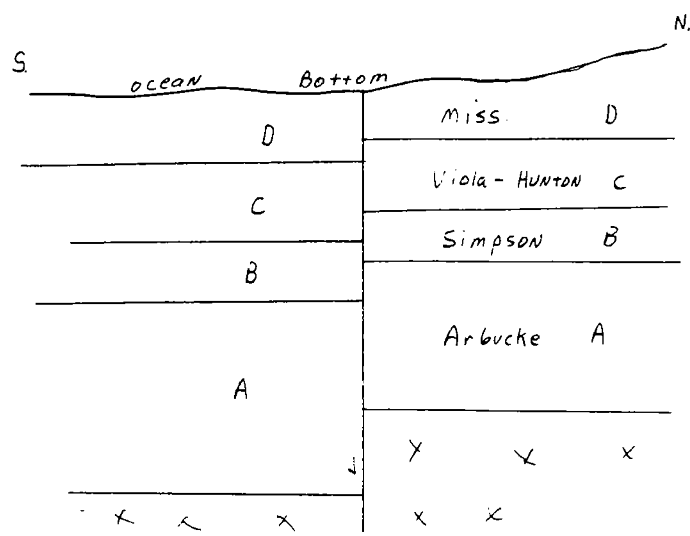


FIGURE 2: L. Miss.Times N - S Crossection

at the Arbuckles

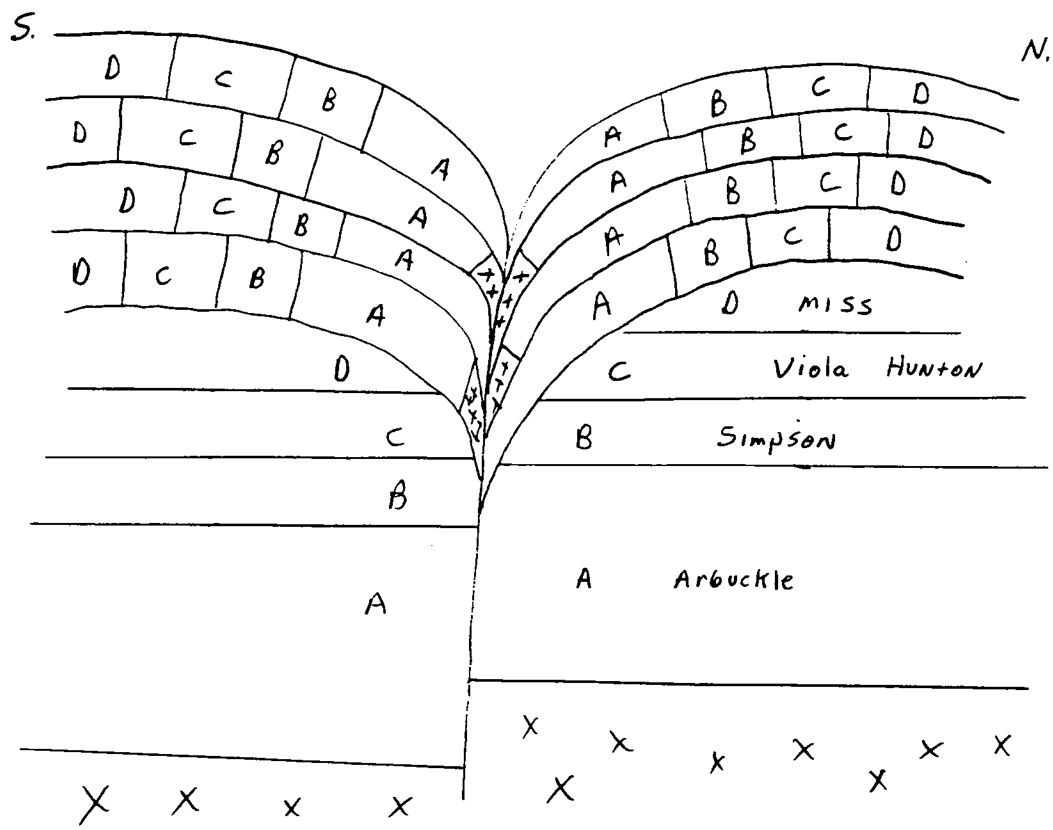


FIGURE 3: Lower Penn. Times N - S Crossection at the Arbuckles

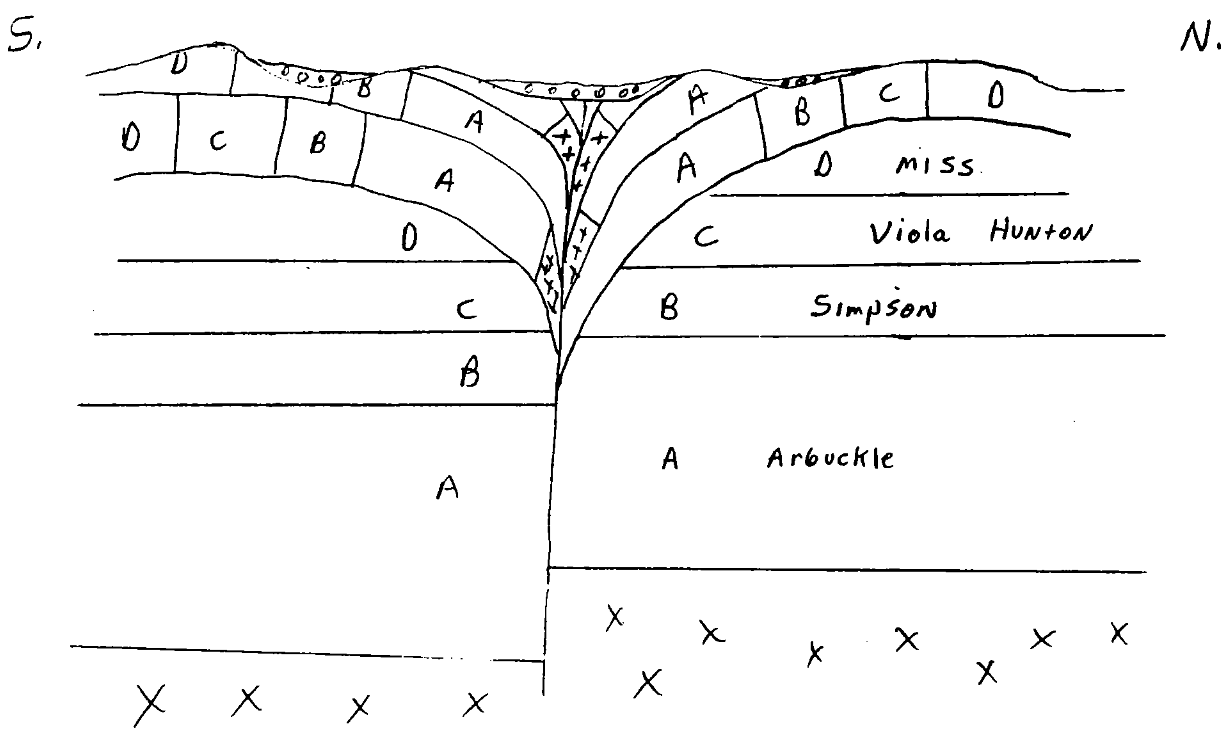


FIGURE 4: Present Day N - S Crossection at the Arbuckles

INVASION OF THE PRAIRIE SNATCHERS

I think that I shall never see
A cedar that does not hate me
It stands in beauty like the night
And on this earth it leaves a blight

It sheds it s sickly, acidic bones
And upon the ground they pile up
They are so putrid and so foul
Even fungus can't break them up

The vast plains once were clean
When fire swept the prairie
Man has stopped the cleansing flame
Now the cedar's growth is hairy

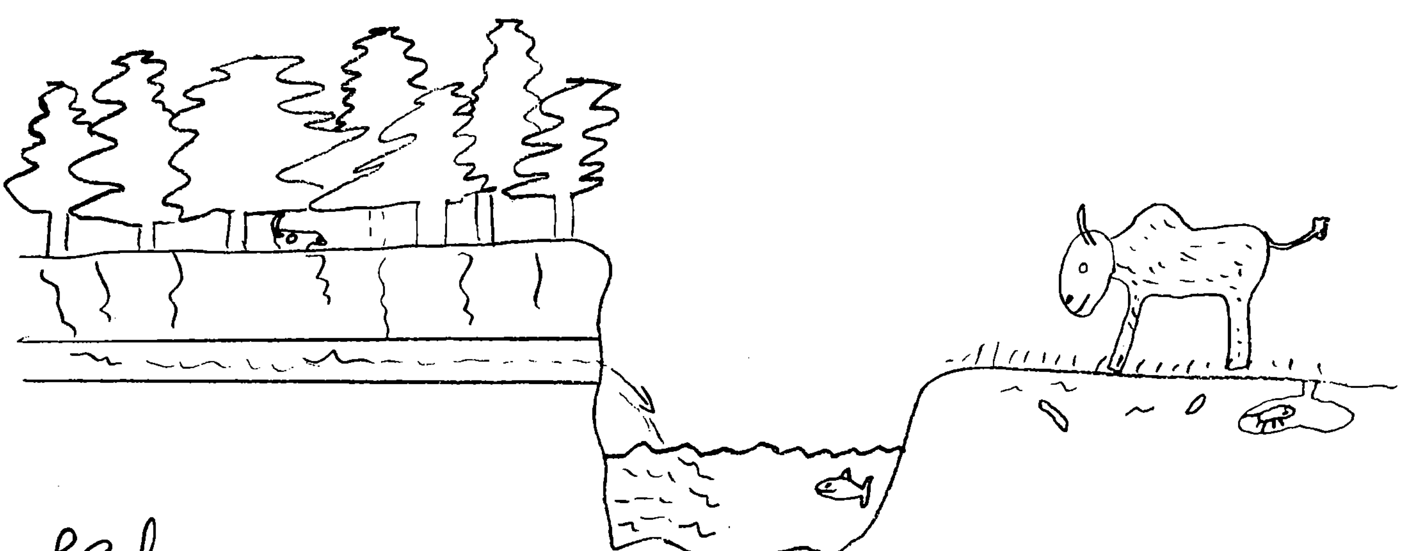
And when they spread across the land
Good land cannot be found
No grass will grow, no plow can cut
This green evil stinky mound

When it's established in a pretty place
The soil becomes acidic and dies
Organisms that once lived there
Their souls fly to the skies

These foul evergreen plants also
Acidify the surface and groundwater
The acid frees metals from the rocks
And the pollution gets even hotter

Like a destructive alien invasion
All prairie life is gone
And what is left is a smelly hell
Where only cedars can live on.

The Poet Larryett



LCL

OUR ROLE IN THE IMPENDING GLACIAL PERIOD

by L. C. Simpson

The magnificent Arbuckle Mountain Range, which once reached 1000's of feet in height, displays dead and **living** evidence of ancient life on earth.

Over the next 20 to 50 years is there going to be a glacial period or is global warming going to control earth's climate? A glacial period is characterized by ice accumulating at the poles and deserts expanding along the equator. During the last glacial period, ice accumulated at the north pole and great glaciers moved south into this country destroying everything in their path. The climate became colder over the entire country and drier near the equator. When the glacial period ended an interglacial period began and the climate in the median latitudes became warm and wet.

There are living relics of the last ice age **and** the earlier portion of the present interglacial that may be ending. At Fittstown, a town just south of Ada, there is an unusual creek that contains coapapods and crustaceans and other creatures that now are only found along the Gulf of Mexico 700 miles south. They may represent creatures left behind from the height of the interglacial period approximately 4000 years ago.

Turner Falls has liverworts, ferns, sages, bushes and small trees that only live there and in southern Canada 900 miles to the North. They are remnants of the plant life that existed here during the last glacial period 10,000 years ago (L. R. Wilson, oral. comm. 1971).

WHAT BAD THINGS ENVIRONMENTALLY HAVE WE DONE LATELY.

The Sahara Desert is growing south at 25,000 square miles a year. The press says that man's bad agricultural practices caused this disaster (CBS Evening News, 1991-1994)..

The Atlas Mtns. in the central Sahara Desert have been a favorite ski resort area for 50 years. These resorts are abandoned because it hasn't snowed appreciably over the last 15 years (Semora Al'Sahib, oral comm. 1994). Overdevelopment by man changed the climate and stopped the snow (French National News, 1990's).

The Congo, south of the Sahara, was a vast jungle fifty years ago. Now certain species of trees are dying out and open spots are forming in the jungle. Some believe that this is the first evidence of major forest destruction from air pollution (PBS, 1989).

Much of the north half of Russia cannot now support agriculture! However, wheat was planted almost into Siberia as late as the 1930's. The northern limit of wheat production has moved hundreds of miles south in the last 60 years. Coincidentally, the northern boundary for rice cultivation in China has fallen south 350 miles since 1930. Now many Chinese have to subsist on wheat rather than rice which has been a staple crop for a thousand years (PBS, Asian Agriculture, 1990). What have the Communists done to our planet?

The Ozone layer around the earth is deteriorating at the poles. Manmade chemicals are blamed for this disaster (PBS, 1994; Yulsman, 1993; Fields and Flanagan, 1994).

An increase of CO_2 gas in the atmosphere has been documented for decades over much of the earth. The proponents of "The Greenhouse Effect" believe that this atmospheric change is due to human produced air pollution (Parks, 1994). They have "proven" to their followers by a questionable series of "scientific" studies that we are facing global warming in the near future.

It was discovered in 1991 that vast numbers of microorganisms in the sea, called foraminifera, were dying. Some species in the Florida Keys are on the verge of extinction. Beaches on south Pacific islands, that were once made of coral fragments, are now predominantly made of foraminiferal sand (Elliott, 1993; Mirsky, 1994).

Finally the magnetic field of the earth is at a very low point. It has been measured since 1890 and in the last 100 years, the earth's magnetic field has dropped 70%! Some speculate that it is at only 5% of maximum (PBS, 1984). The press is confused as to how man altered the earth's magnetic field.

HOW CAN ALL THIS BE EXPLAINED.

Man had nothing to do with it!

Let's look at some historical records that may show similar patterns between the present and the past. There was a Little Ice Age from 1400 to 1600 A.D. in the northern hemisphere. The Vikings had colonies on Greenland beginning in the 1300's. These colonies were cut off by ice sheets that advanced across the North Atlantic from 1390 - 1550. The last of the early Viking ships visited this area in 1491. Recent archeological studies have shown that all of the residents of these colonies died from complications to cold and starvation between 1400 - 1500. The Vikings returned in the 1600's but could not find their towns which were buried under ice. However, these towns became ice free and were reconstructed during the 1800's. In the last 15 years these same Viking towns are again being covered by ice (PBS, Voyage of the Vikings in America, 1995) .

In 1426 the Portuguese reached the Congo in Africa. At that time, during the Little Ice Age, the Congo was bald prairie. There were only a few trees along the major rivers. The Congo became a dense jungle only a few hundred years later. The forestation of the Congo corresponds with the end of the Little Ice Age.

NEW SCIENTIFIC DISCOVERIES

Cores have been cut in the bottom of the Pacific ocean. At these deep ocean depths, 20,000 years of deposition is just a few feet thick. There are semi-pyramid shaped magnetite crystals in these pink to grey ocean muds. Magnetite crystals exhumes from these sediments will point toward magnetic north. The orientation of the crystals in the core, has changed direction periodically during the last million years. These deep ocean sediments can be dated and correlated to terrestrial sediments. The orientation of the magnetite crystals has changed at the beginning and end of every glacial period. This and other data from young lava flows reveals that earth's magnetic pole has changed from north to south pole at the beginning of each glacial period. This pole switching corresponds with massive extensions of foraminifera.

Some of the strongest evidence of the "greenhouse effect" is increasing CO2 in the atmosphere. Co2 levels in the atmosphere which rose from 1958 to 1992 are now dropping! Recent ice core studies in Greenland have indicated high CO2 peaks occur and are followed by CO2 decline **prior to large glacial periods** (Bell, 1994; Parks, 1994). Greenhouse effect or glacial effect?

INESCAPABLE CONCLUSIONS

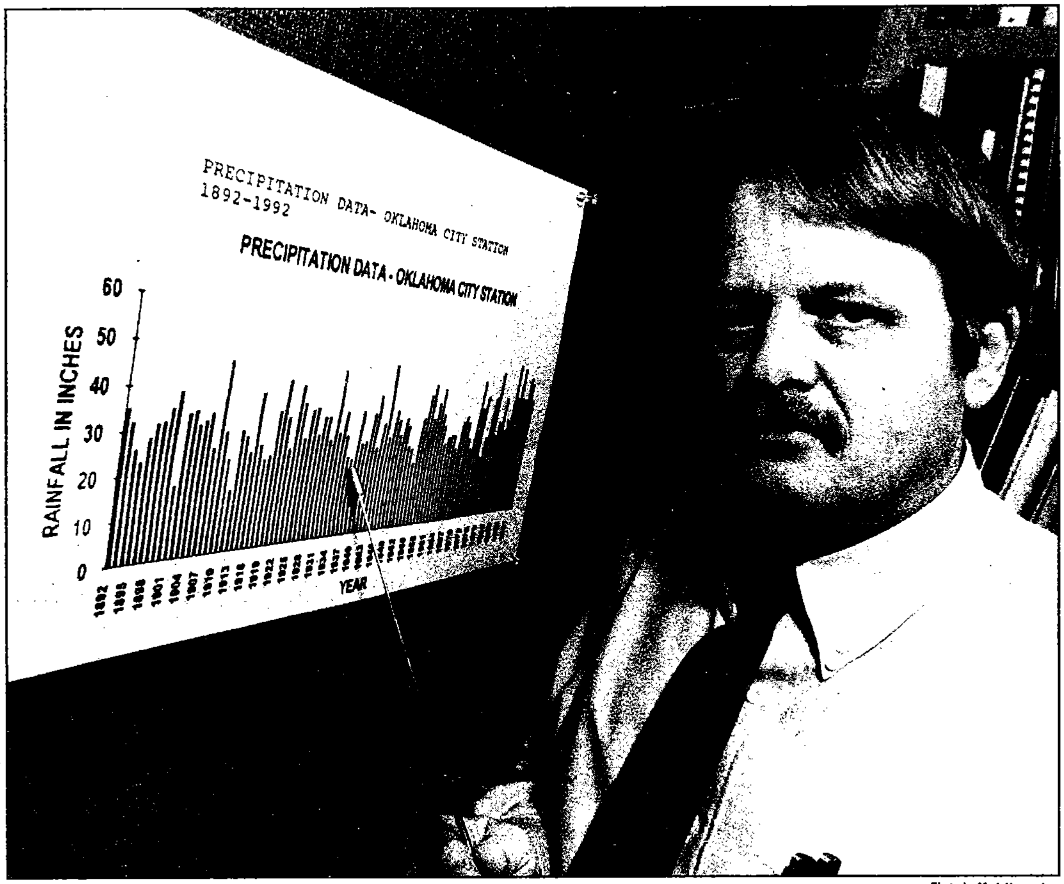
The most recent glacier periods produce deserts at the equator and thick ice at the north pole. Equatorial Deserts world wide are presently expanding rapidly and at least the Greenland ice sheet is growing.

The Sahara desert in Africa and the Sonoran and Chihuahan deserts in the US are growing rapidly. Trees are dying in the Congo and the area is becoming more open and grassy. This vegetation and climate change will return the Congo to the grasslands viewed by the Portuguese during the last Little Ice Age. The Greenland ice sheet is growing and covering the Viking villages as it did during the last Little Glacial Period of the 1400 -1600's. Progressively colder climates in Asia have shifted wheat and rice cultivation areas 350 miles south over the last 60 years!

The earth's magnetic field is at a very low level. Perhaps when the magnetic field reaches zero, the poles will shift. Does this mean that the poles are going to shift soon? If so, the foraminifera should start dying out as they have during the last five pole shifts. Prior to 1991, foraminifera worldwide began dying out and some species are **already** approaching extinction. Could the decrease of the earth's magnetic field be the cause of ozone holes over the poles?

We have experienced an increase in CO2 levels in the atmosphere for thirty- five years. It is now believed that this CO2 peak is a precursor to a large glacial period as we have seen in Greenland ice cores from 100,000 years ago. The Greenland ice core studies also showed that the last glacier period began and ended during a ten to twenty year period (PBS, Mammoth, 1995). Therefore, the next glacial period could begin very early in the twenty-first century. We could be entering a glacial period that will begin in our lifetime!

I do not believe that we are experiencing a greenhouse gas - global warming event. Everything points to a glacier period starting **NOW.** Fortunately, the residents of Oklahoma will be less impacted than most of the country. During the previous glacial periods the glaciers nor their associated equatorial deserts reached Oklahoma. Therefore, Oklahoma land will be prime property in a few tens or hundreds of years.



– Photo by Mark Hancock

Larry Simpson of the Association of Central Oklahoma Governments has been studying rainfall patterns and concludes the region could be in for a drought within the next few years.

Nor a drop to drink

After nine years of rain, is it time for a drought in central Oklahoma?

BY JONATHAN NICHOLSON

For a state 60 years removed from the Dust Bowl, the word "drought" still has a jarring effect on state residents. Though not many people living in Oklahoma today were around to witness the dust storms and subsequent out-migration, we've been taking a beating for it ever since, first with Steinbeck, then with parental parables of dust storms that obscured the sky for days.

Even now it can be argued that Oklahomans take more than a casual interest in rainfall levels.

So maybe that's why hydrologist Larry Simpson's warnings about an impending dry spell seem to strike such a chord. After all, central Oklahoma has been enjoying wet weather for the past few years, and we've got to pay for it sometime. Think of it as divine retribution.

"This stuff is common sense," says Simpson, who is on staff with the Association of Central Oklahoma Governments.

"For the last nine years, we've averaged about 42 inches of rain. That's the wettest nine years in 100. It's been raining like all get out."

The average is 32 inches annually. Simpson's figures show a certain amount of up-and-down regularity to rainfall totals over the past 100 years. And with the upswing over the Eighties and early Nineties, the curve can only seem to go one way – down.

That downturn is supposed to occur between 1995 and 1998. How bad it will be, Simpson isn't sure.

"We've had the wettest nine years in history. Will that result in a nine-year drought? No one's willing to go that far," Simpson said.

Simpson argues that a 75-year sunspot cycle has a definite effect on weather. When the sunspots subside in 1995, weather events associated with them, such as hurricanes, also will die down, bringing drier weather.

But drier weather also offers opportunities, according to Simpson. This is the perfect time for cities to upgrade their aging water supply systems and to see about capitalizing on an increase in future demand.

"Those suggested a number of alternatives for additional water supply. One thing we're trying to do is diversify the sources of water we utilize."

Berry said Norman is in the process of negotiating with Oklahoma City "with the thought of becoming a partner in the eastern Oklahoma reservoirs they operate."

By becoming a partner, Berry said Norman would be better off than if it bought water from the city and risked being squeezed out should water run short.

"We don't want to be that kind of customer," he said.

> "This stuff is common sense," says Larry Simpson of the Association of Central Oklahoma Governments. "For the last nine years, we've averaged about 42 inches of rain. That's the wettest nine years in 100. It's been raining like all get out."

"Water sales could make central Oklahoma look like OPEC in the Nineties," he said.

About half of ACOG's member cities and towns are in the process of upgrading their available water supplies, and the rest are preparing, he said.

One of those cities is Norman. Though public works director Jim Berry said the city wasn't necessarily reacting to predictions of a drought, he said the city's water capacity is almost at the maximum.

"We recently completed revisions to our water master plan," Berry said.

"We would prefer to have a position of some sort."

Finding a new source of water is important for Norman.

"We don't have any excess water supply at present," Berry said.

With an average peak day running at about 19.5 million gallons last summer, Berry said the city had to ask residents to voluntarily conserve.

Berry said one reason why Norman has been so lax in keeping up with its water demand is a city charter provision that means rates can't be hiked without voter approval.

"Folks are just reluctant to call elections," he said.

If cities invest now in drilling for water, Simpson said they can make money in the dry months by selling water to other communities and also save money by cutting down on repair bills as older wells are given rest. Water sales used to be large sources of revenues for local governments in the Forties and Fifties and could be again, Simpson said.

But not everyone buys into the drought hypothesis. Ken Crawford, director of the Oklahoma Climatological Survey, said there's no reason the resurgent rains will mean a drought soon.

"Do I think there will be a dry period in my lifetime? Sure. A drought? I think we'll have a drought in the next 50 years, maybe," he said.

If and when it comes, Crawford said he doesn't think it will be as bad as in the past, in part because of the reservoirs the state has built since the Dust Bowl days.

Simpson sticks with his prediction. But what if he's wrong?

"I won't be wrong," he said.

"Even if I am, it will pay off anyway because a lot of cities won't end up rationing." ■

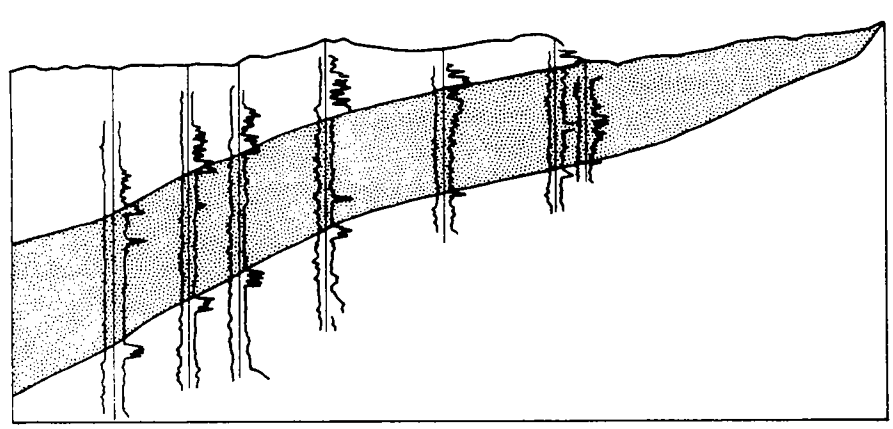
GENERAL GEOLOGY

The mountains of southern Oklahoma formed during the Pennsylvanian and Permian periods due to the collision of South America with North America. This topographic development allowed much of south and southeast Oklahoma to remain above sea level from Upper Permian through the Jurassic periods. However, during Lower Cretaceous times the seas advanced rapidly from the south, inundating the areas around and between the Arbuckle and Ouachita Mountains. The first Lower Cretaceous deposit is the Antlers (Trinity) Sandstone. The Antlers is composed of beach and nearshore sandstones and clays. The sandstones are white to tan with occasional red lenses. The red shales and sandstones are probably paleosoil zones along the terrestrial edges of some of the larger beach deposits. The clays have variable colors of yellow, tan, blue, and gray. This formation is 400-700 feet thick in the subsurface. It represents one of the major groundwater aquifers in the region (Hart and Davis 1981). Water quality is variable in this aquifer. I speculate that improper well construction and not geology has led to much of the poor municipal and domestic water produced form the Antlers. The Antlers sandstones can be viewed in a few road cuts, stream cuts and a quarry between Ardmore and Madill.

As the Cretaceous seas advanced northward, the Lake Texoma area was covered by a shallow sea. Fossil rich shales and limestones were deposited in this marine setting. Fossils can be collected in any Lower Cretaceous formation in the Lake Texhoma area. The best collecting is gnerally in the Kiamichi and Caddo (Duck CreekShale and Fort Worth Limestone) Formations. These sediments were probably deposited in water that was 10 - 100 feet deep. The shoreline was 20 - 30 miles to the north during this period. The terrestrial areas nearby were inhabited with lush vegetation and large dinosaurs. Unfortunately, most of these terrestrial deposits were not preserved. Dinosaurs have been collected from the basal Cretaceous beach deposits, the Antlers Sanstone. There have been Lower Cretaceous terrestrial dinosaur found that were washed out to sea. Large marine reptiles and large sharks have also been found in the Duck Creek Member recently.

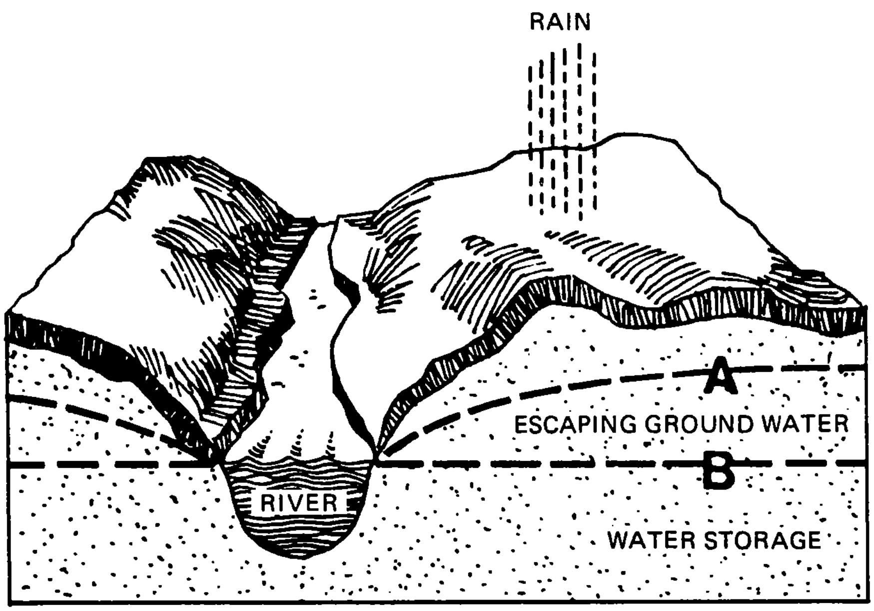
Fossiliferous deposits are exposed in erosional areas around the lake. Such exposures are along stream cuts and the shoreline of the lake. Enhanced collecting often occurs after large rains. As the stream and lake levels subside, erosion exposes new material. One can utilize the geology map of the area (Hart, 1974) and USGS topographic maps (sold at the OGS) to define collecting areas. Let me emphasize that collecting on private land is illegal without permission from the landowner. Politness will promote the collecting of fossils and rude, illegal actions will destroy the hobby for everyone.

North - South Cross-section of the Antlers Sandstone (Hart and Davis, 1981).



THE HYDROLOGY PRIMER

The Capture Of Escaping Groundwater



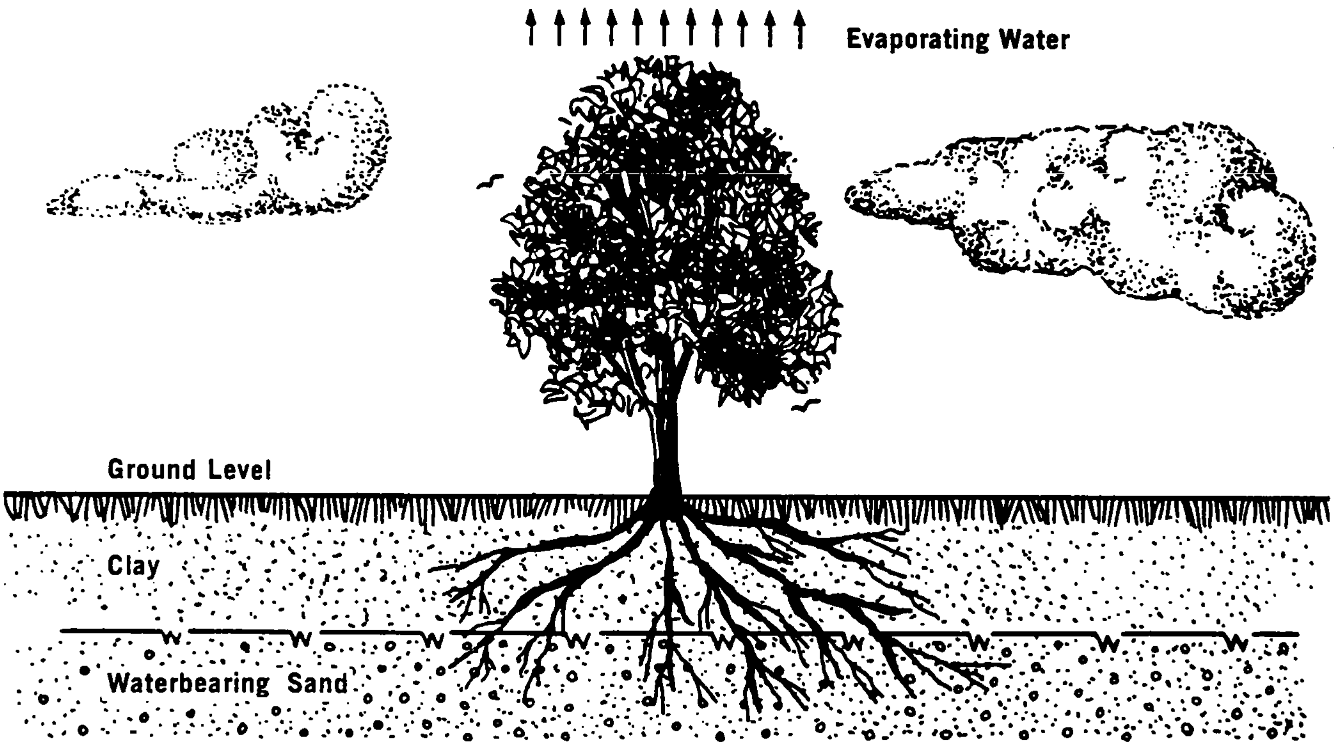
Water which falls upon the land surface immediately sets out on its long trip back to the sea. Man merely intercepts some of the surface water or ground water for his own use before allowing it to resume its journey.

Water level A shows a normal condition in which ground water is slowly flowing towards a river or lake. The source of this flow is the rain which falls upon the surrounding countryside. Level B is river level. If the water level A falls to level B, there can be no flow to the river. The water below level B is essentially in permanent storage.

The water flow which takes place because of the difference between levels A and B is continually escaping to the river and thence on to the ocean. Water wells may be installed, which by their pumpage could lower the water level from A to B. They would thereby capture this escaping water without taking water from permanent storage. Such a process of water use could go on indefinitely.

THE HYDROLOGY PRIMER

Transpiration



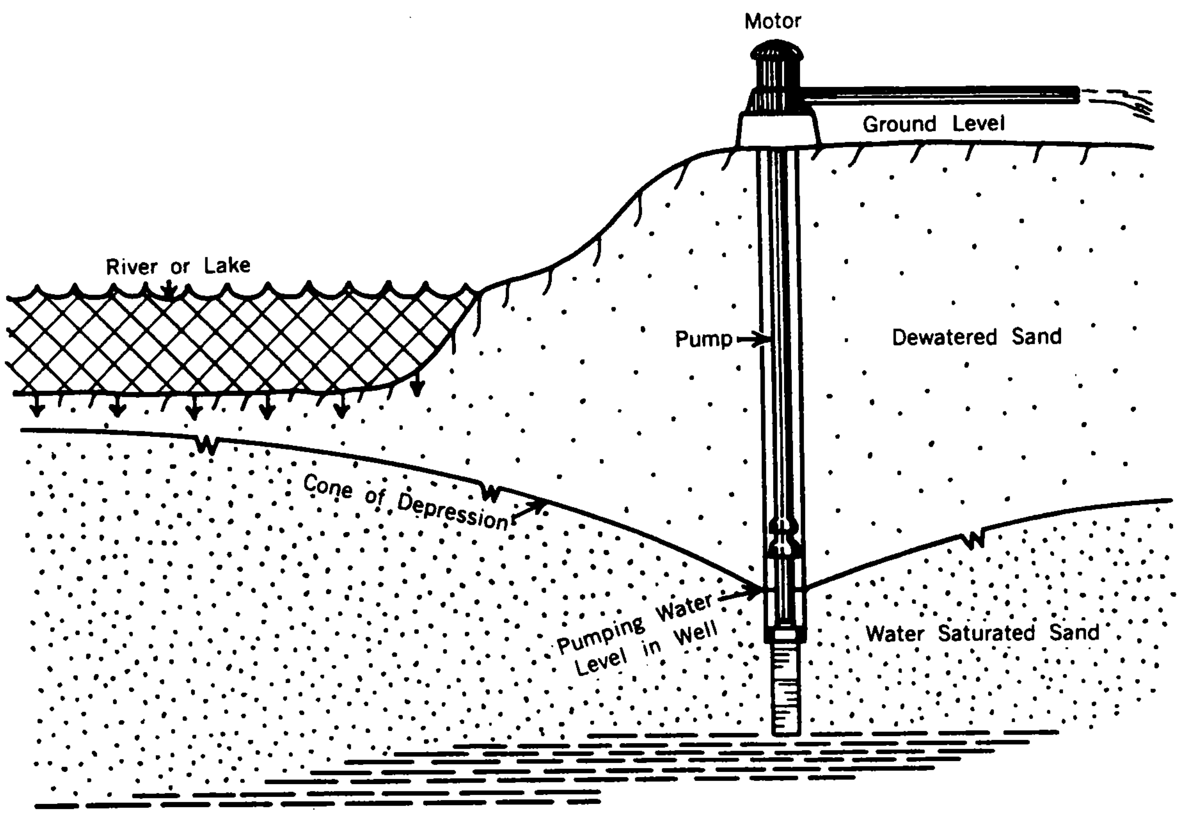
Almost everyone is acquainted with the fact that an aquifer is constantly losing some of its water by underground flow as a result of natural drainage. Not so well recognized is the fact that a considerable water loss takes place by transpiration. This term describes the process by which ground water passes up through the roots and stems of plants and trees and evaporates into the air. This effect is especially important in shallow aquifers or water bearing formations.

To maintain growth plants must continually absorb water through their roots and circulate it up through the plant. This water leaves that plant through its leaves by transpiration to the atmosphere. For desert plants this transpiration is quite small. However, for aquatic plants which grow in a swampy environment the quantity of water lost may be very large. These transpiration effects are most noticeable during the warm summer months.

Hydrographs from shallow wells clearly indicate that the water losses from transpiration take on significant proportions during the growing seasons. It has been estimated that in an area in southeastern Michigan water losses by transpiration are nearly six times the total withdrawal by pumpage.

THE HYDROLOGY PRIMER

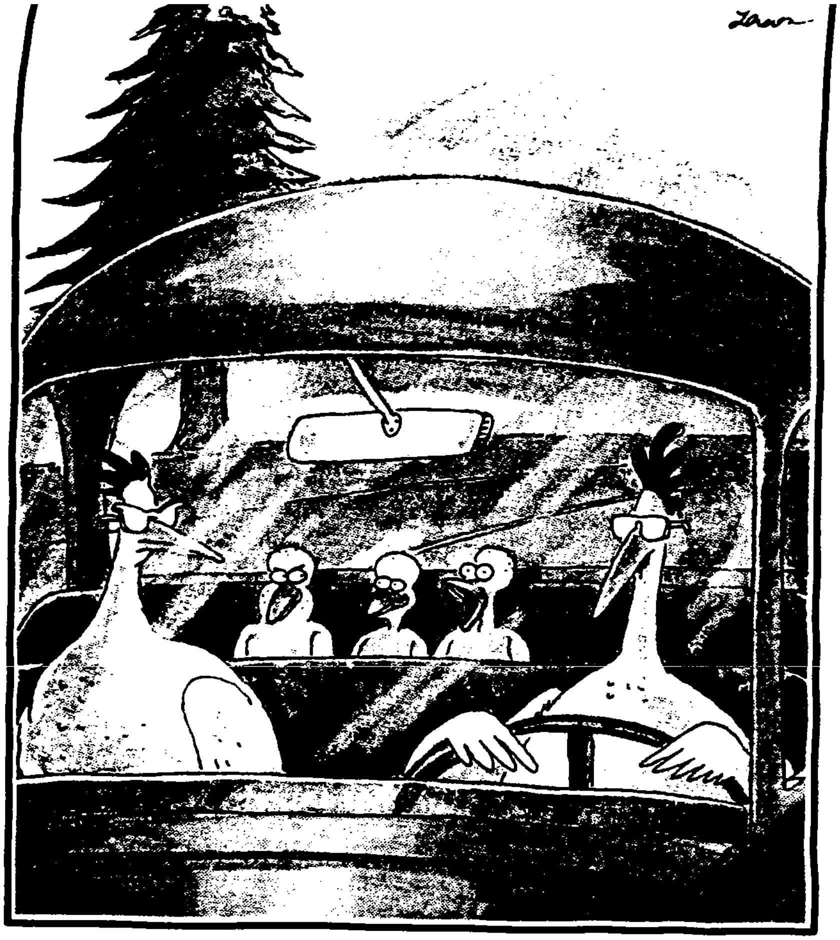
Induced Infiltration



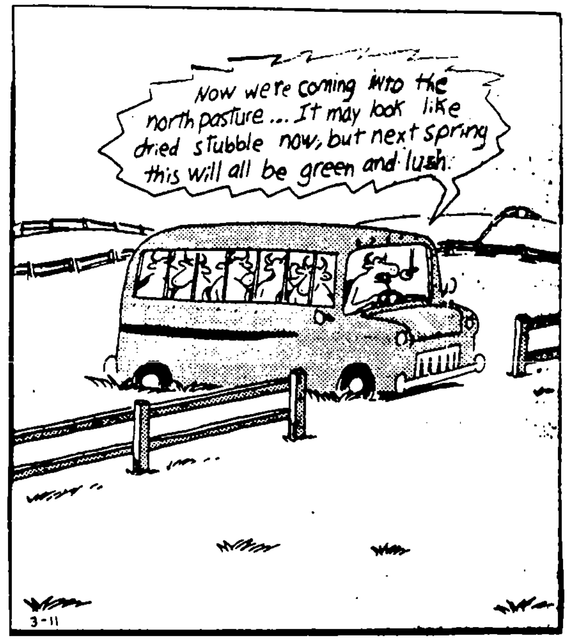
Many lakes and rivers are underlaid by water-bearing sands and gravel called aquifers. A pumping well in such an aquifer as illustrated develops a cone of depression which spreads out under the lake or river. The lowering of the ground water level or pressure head induces the surface water to flow into the aquifer. This is called "induced infiltration".

A water well installed in such an aquifer near open water has a higher sustained yield than a well placed some distance away. The surface water is available to recharge the aquifer and continually replace the water pumped out of the well. The aquifer also acts as a natural sand filter to supply the well with safe, clean, drinking water.

The Far Side

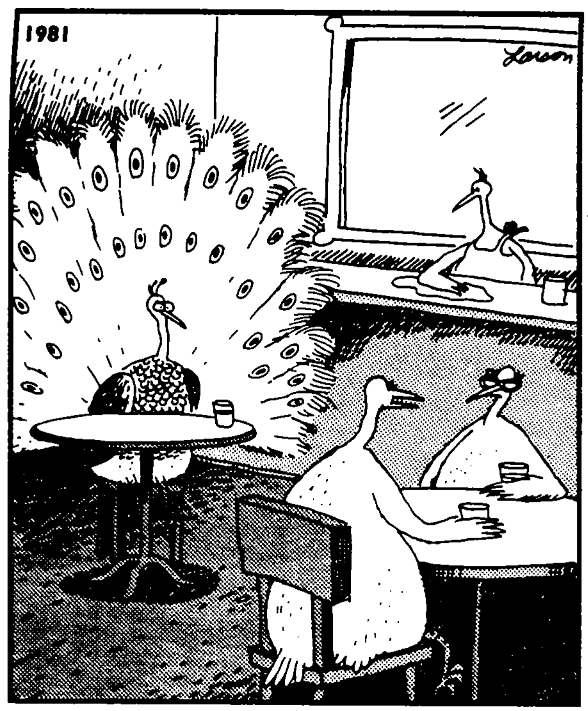


"Mom! We were all singing 'She'll Be Comin' Around the Mountain,' but Randy won't stop with the 'whack, whack' part!"



Basic field trips

"You know, I used to like this hobby. . . . But shoot! Seems like *everybody's* got a rock collection."

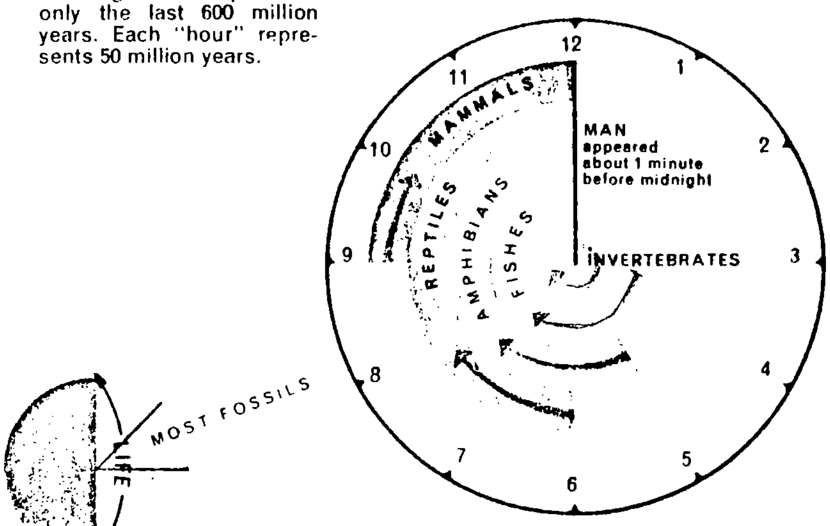


"Don't encourage him, Sylvia."

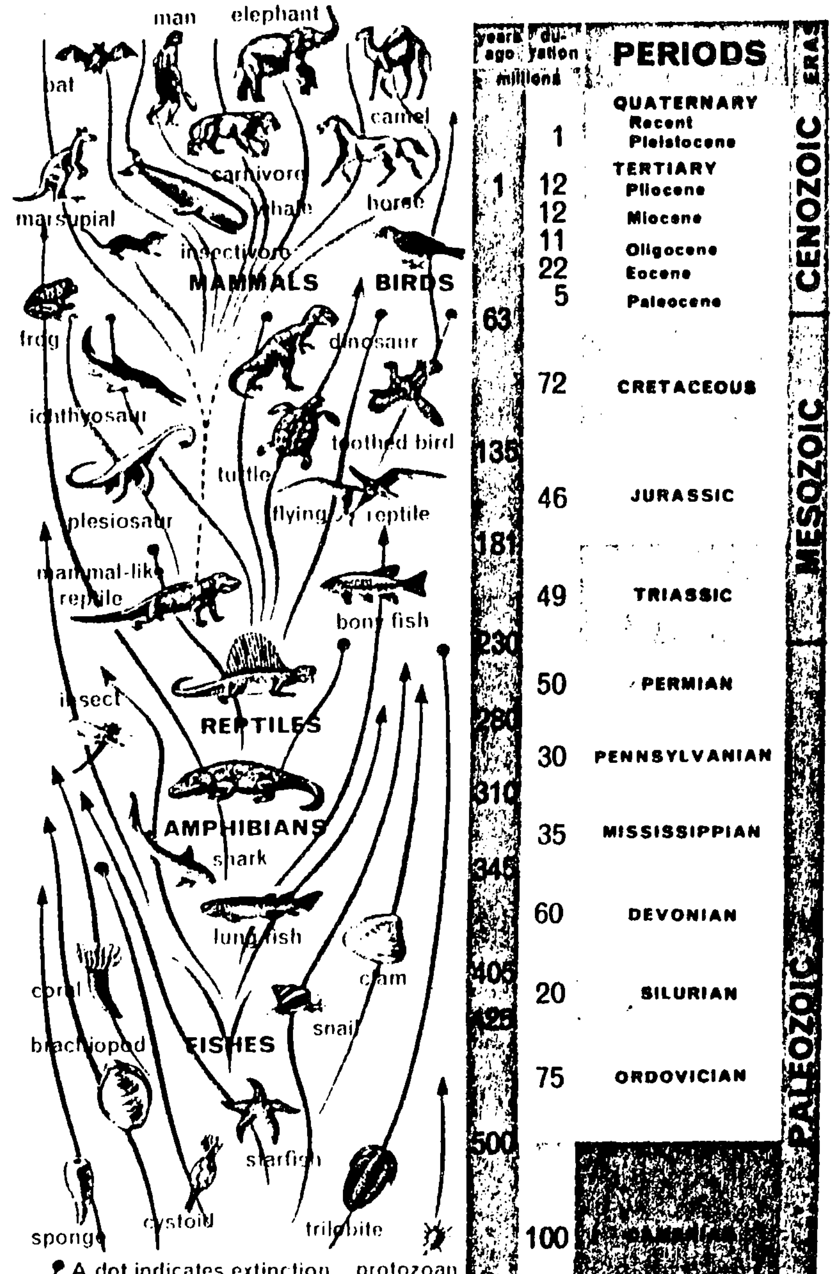
Even this time estimate falls short because there were long periods during which sediments were worn away. Yet despite these difficulties the study of unaltered, fossil-bearing sediments shows that they fit into three great eras of time. These eras, in turn, are divided into 12 geologic periods which also have been divided and redivided until each formation can be given a name and a place in the geologic time scale. This record goes back about 600 million years and provides a relative dating for fossils. Yet this time scale (see chart, p. 31) can be and is used every day. We speak of a Jurassic fossil just as we speak of a Colonial mansion and know roughly where both fit into history. Periods are divided and redivided when conditions permit until each strata is identified.

THE GEOLOGIC "CLOCK"

The larger circle represents only the last 600 million years. Each "hour" represents 50 million years.



The smaller circle represents the age of the earth, about 5 billion years. Life has existed about half that time and the small segment is 600 million years—the period of abundant fossils.



A dot indicates extinction.
An arrow indicates that the group persists to present.

MACRO INVERTEBRATE FOSSILS OF THE TEXOMA AREA

INTRODUCTION

Oklahoma is known as one of the most fossil rich states in the union. Oklahoma is blessed with rock outcrops of every geologic period from Cambrian to Quaternary. Geologists find fossils from every period and most sedimentary rock units in the state. The wide variety of environments represented in the geologic column results in an equally large variety of life forms preserved as fossils. The Lower Cretaceous sediments of the Lake Texoma region contain by far the largest volume of fossils per unit of rock of any period in the state.

PELECYPODS

Clams are the most widely distributed and common fossil in the Lower Cretaceous. The most common pelecypod is *Texigraphea.* Each formation has a destictive species of graphea. While grapea are generally one to three inches in length there are larger clams especially in the Duck Creek Shale and FortWorth Limestone. *Exogyra, Inoceramus,* and *Lopha* can reach six to eight inches in length. There are a dozen common pelecypods in the Lower Cretaceous (Finsley, 1989).

CEPHALOPODS

Cephalopods are a very long lived and successful group in Oklahoma. They can be divided into straight forms, the nautiloids and coiled forms, the ammonoids. The first fossil described in Oklahoma was a Mississippian ammonoid *Goniatites choctawensis* Shumark in 1863.

Straight nautiloids were the dominant life form during the Lower and middle Ordovician. They continued to be common through the Pennsylvanian in Oklahoma. The earliest ammonoids were from the Middle Ordovician. Small specimens flourished in some environments during the Mississippian and Pennsylvanian.

The pinnacle of coiled cephalopod development occurred during the Cretaceous period with the explosive development of the ammonites. Cretaceous limestones and shales of south central and southeastern Oklahoma have yielded over 40 genera of ammonites. There are not only a large variety of ammonites, but millions of specimens. Ammonites represent a large percentage of the fossil volume of these beds. The Duck Creek Shale and Fort Worth Limestone are so fossil rich that groups of 100 amateurs have collected 800 medium to large specimens in an afternoon.

The smallest ammonites are less than one centimeters in diameter and are preserved in dark hematite and limonite. They are most common in the middle of the Duck Creek Formation. There are three to seven centimeter specimens in most outcrops in the Lake Texoma area. These small ammonites are often overlooked. The larger ammonites are generally preserved as limestone casts although some are recovered with shell material attached. An average size for the larger ammonites in the Cretaceous of southern Oklahoma is 6 inches. The maximum size discovered by the author in the Fort Worth Limestone is 44 inches in diameter. That specimen's weight was estimated at 750 pounds.

GASTROPODS

Gastropods are widely distributed throughout almost the entire geologic history of Oklahoma, appearing in Ordovician through Recent deposits. Lower Devonian, Pennsylvanian, and Cretaceous sediments also contain large gastropod faunas. The largest specimens of these periods reach two to four inches in diameter.

Gastropods in the Lake Texoma area are usually solitary or in small groups. However, they are often large, impressive specimens. Snails are more common in the Middle and Upper Cretaceous of Texas.

ECHINODERMS

Starfish

Starfish are known from Middle Ordovician through Cretaceous sediments in Oklahoma. They are generally rare and best knon from Ordovician, Pennsylvanian and Cretaceous sediments. Occasionally large groups of starfish and brittlestars have been found around Lake Texoma. Many specimens are very high quality and some are pyritized. One group of six centimeter in diameter starfish was found in the Duck Creek Formation along the northwestern shore of the lake. The southeastern shore of Lake Texoma has provided large groups of small pyritized starfish.

Echinoids

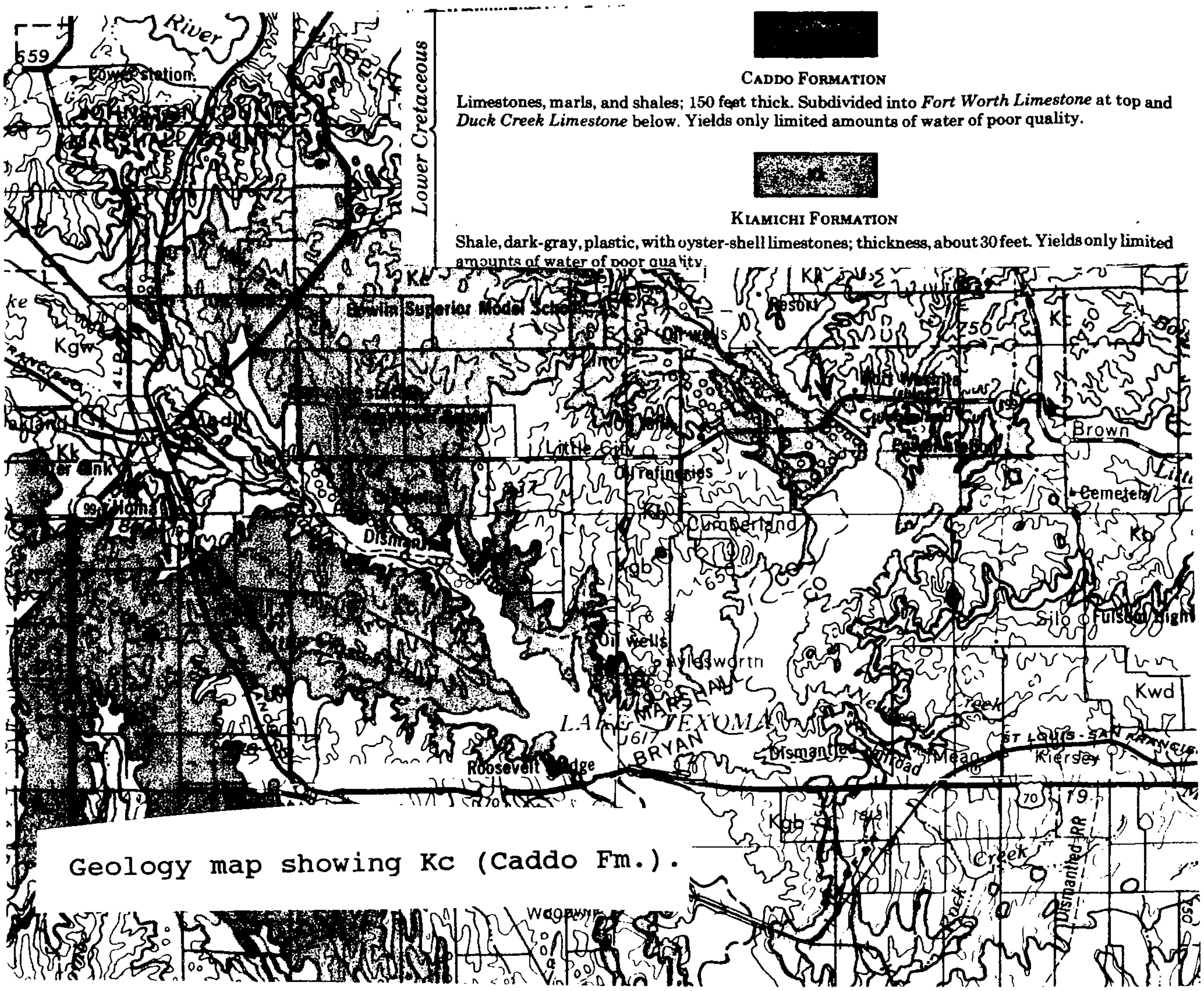
Echinoids are best known from the Ordovician, Mississippian, Pennsylvanian and Cretaceous sediments of Oklahoma. Like the ammonites, echinoids also reach their zenith in Oklahoma during the Cretaceous period. Large numbers of echinoids can be collected in the Lake Texoma area.

Some Lower Cretaceous echinoids are deposited in huge compact beds where they are stacked two to three layers deep. These echinoid "coquinas" are two to four inches thick and cover a few square yards to many acres in size. Some deposits undoubtedly hold millions of specimens. Unfortunately, most of the echinoids in these"coquina" deposits are crushed. Solitary specimens are also common in most Cretaceous rock units.

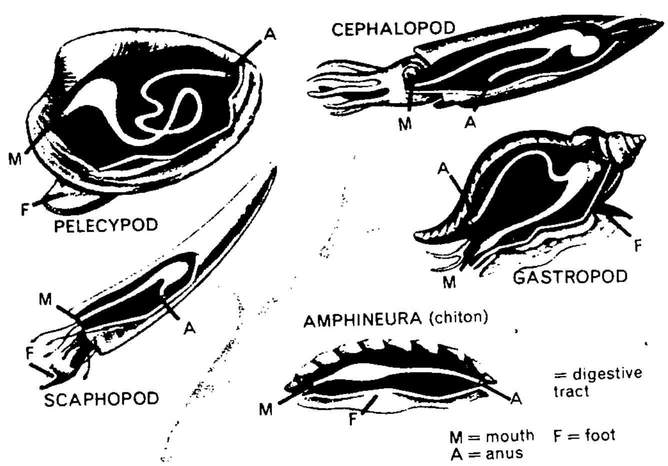
CRUSTACEONS

Prior to the Tertiary, crutaceans are quite rare. Fragmentary crab material is known from the Cretaceous deposits of southern Oklahoma. Cretaceous marine crustaceans are more common to the south in Texas.

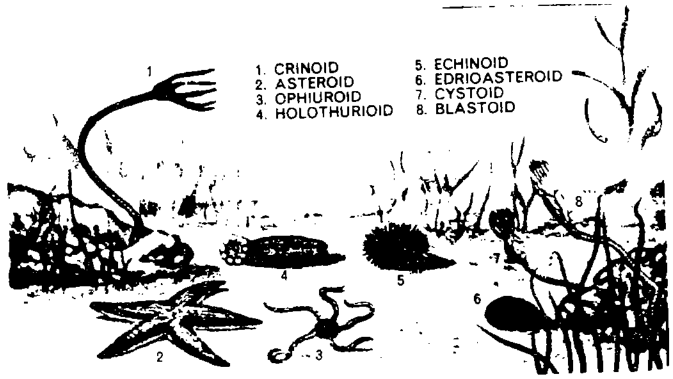
A late Cretaceous sea floor showing a rich variety of mollusks. Ammonites 1. *Helioceras*, 2. *Baculites*, 3. *Placenticeras;* gastropods 4. *Turritella*, 5. other; pelecypods 6. oysters, 7. *Pecten*.



Geology map showing Kc (Caddo Fm.).

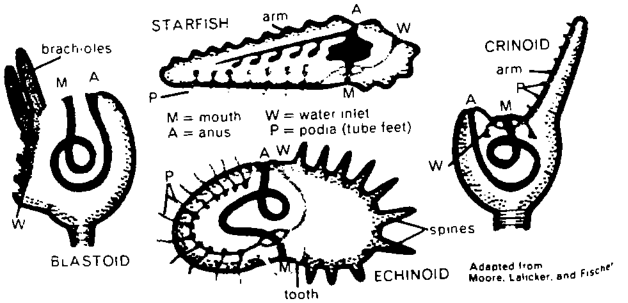


MOLLUSKS include five classes of similar structure but different external appearance, as shown above. Mollusks are an old and successful group; most are marine, many fresh-water, and some live on land. A few aquatic forms are free floating or free swimming but the majority are bottom dwellers in sand or mud. Some burrow into rocks or timbers. About 150,000 living species and thousands of fossil forms have been described. Mollusks range in size from 60-ft. Giant Squids and *Tridacna* clams weighing over 500 pounds down to almost microscopic species. Shell structure varies from the coiled form of snails to the symmetrical bivalves of clams and the eight plates of chitons. Two living classes, the pelecypods (clams, oysters, mussels) and gastropods (whelks, snails, limpets), are abundant. Fossils of these groups and cephalopods are common but chitons and tusk shells are rare, though both occur in the early Paleozoic. Many mollusks are excellent index fossils.



Living echinoderms (1-5). Fossil forms (6-8).

ECHINODERMS are a phylum of marine animals covered with limy plates or spines. Plates are fixed in sea urchins (echinoids), flexible in some starfish (asteroids), and isolated in sea cucumbers (holothurioids). Edrioasteroids, cystoids, blastoids and crinoids lived attached; the rest are free moving. This phylum consists of eight common classes illustrated above. Below are typical internal structures. Digestive system is green; water-vascular system orange. Exoskeleton is purple. These animals also have a well-developed nervous system.



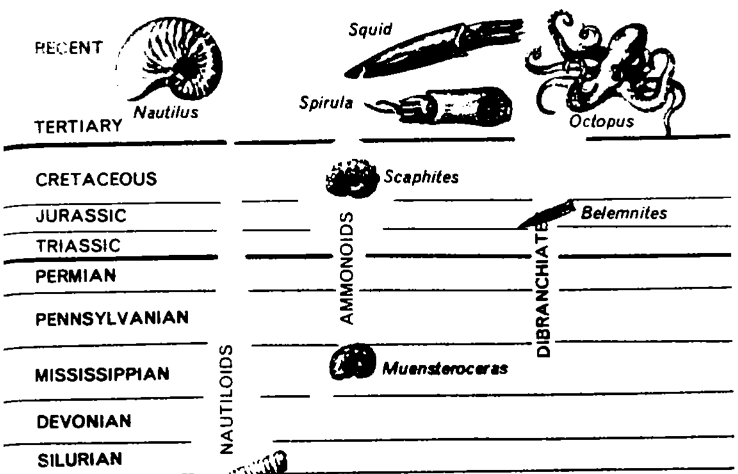
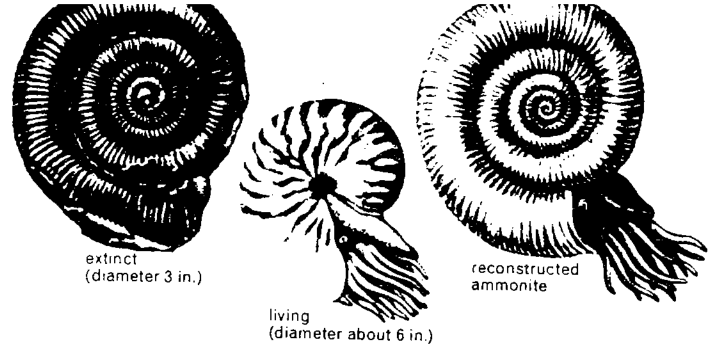


Diagram shows the development of cephalopods and the diversity of each group in geologic time. Living forms are at the top.

CEPHALOPODS are highly developed marine mollusks, represented by the living nautilus, octopus and squid. The shell may be external, internal or absent, and it may be variously coiled. Living forms have a well-developed head, eyes, and tentacles. Most fossil forms had well-developed shells. Three main groups exist. Ammonoids and nautiloids are four-gilled cephalopods with an external shell divided into chambers by transverse plates or septa. The animal lives in the outermost chamber. A fleshy stalk perforates the septa. The junction of the septa with the shell wall forms the suture line.

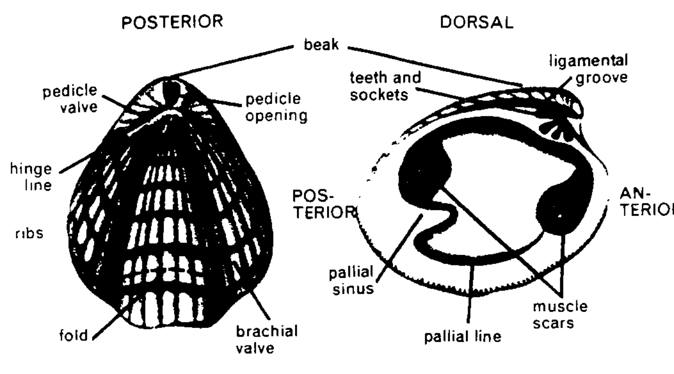
Coleoid cephalopods (octopus and squid) have two gills and have either an internal shell or none at all. The most common fossil forms, Mesozoic cigar-like belemnites, are the internal skeletons of squid-like species.



LIFE OF THE PAST

Fossils are almost always incomplete. A fossil horse is known by a skull and a few bones. Only the shell of a fossil shellfish is found, and an ancient tree is represented only by leaf fragments. Yet entire plants and animals are reconstructed on a scientific basis that uses *present* living forms as a key to interpret the life of the past.

A study of living plants and animals is essential to understand fossils. Fossil ammonites have been extinct for 70 million years, but their shells are very similar to the living Pearly Nautilus. Geologists assume that their soft parts were also similar and make reconstructions accordingly. A comparison of large vertebrate fossils with living species shows how muscles fit to bones. This indicates body structure. Living plants help us understand those known only by fossil fragments. These reconstructions, with other geologic information, make it possible to form an accurate picture of the animal and its environment. This interplay of past and present illustrates how man uses science to develop new frontiers—an increased understanding of both past and present at the same time.



BRACHIOPOD

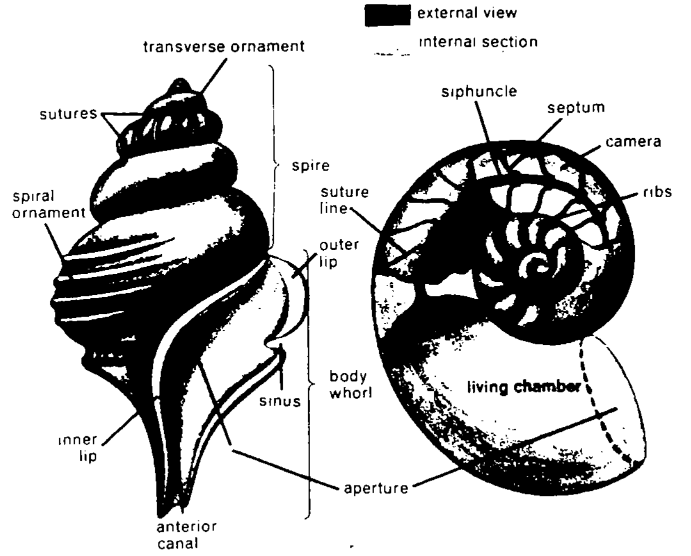
PELECYPOD

GASTROPOD

CEPHALOPOD

external view

internal section



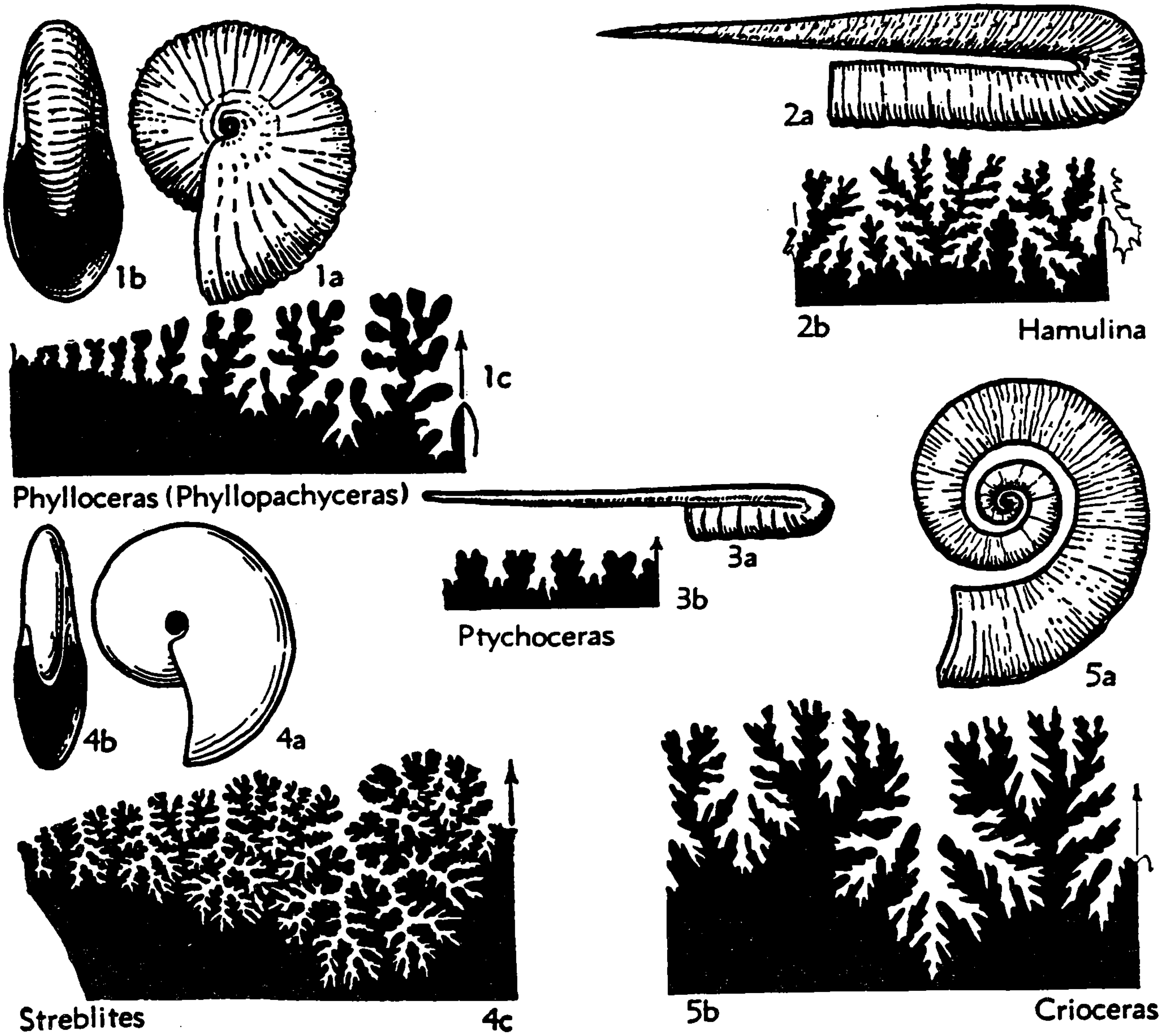


FIG. 9-39. **Representative Lower Cretaceous (Neocomian) ammonoids.** In Early Cretaceous time the diversity of ammonoids reached a new high—all gradations from highly involute forms to loose spirals and U-shaped shells are present; sutures, all ammonitic, vary from exceedingly dissected to some which are simplified.

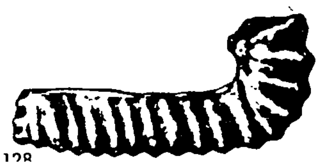
Crioceras d'Orbigny, Lower Cretaceous. Shell coiled in a loose spiral. *C. duvali* Léveillé (5*a*, *b*, ×0.2), Hauterivian and Barremian, French Alps.

Hamulina d'Orbigny, Lower Cretaceous. A straight-chambered shell which, at maturity turns abruptly 180 deg. to form a straight mature living chamber. *H. astieri* d'Orbigny (2*a*, *b*, ×0.2), Barremian, Europe.

Phylloceras Suess, Triassic–Cretaceous. A Liassic species is shown in Fig. 9-36 *P.* (*Phyllopachyceras*) *infundibulum* d'Orbigny (1*a*–*c*, ×0.5), Hauterivian and Barremian, Europe.

Ptychoceras d'Orbigny, Lower and Middle Cretaceous (Albian). Resembles *Hamulina* in form of growth, but differs in having a simplified ammonitic suture. *P. emerici* d'Orbigny (3*a*, *b*, ×0.3), Barremian, Europe.

Streblites Hyatt, Upper Jurassic–Lower Cretaceous. Smooth, discoidal shell having extraordinarily dissected sutures. *S.* (*Uhligerites*) *kraffti* Uhlig (4*a*–*c*, ×0.5), Tithonian and Berriasian, Himalayas.



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HAMITES, Lower Cretaceous, is loosely coiled in one plane, with one short and two long shafts which are circular in cross section. The prominent ribs extend across the outer edge of the whorls. Complex suture lines. Length 2 to 3 in.

TURRILITES, Cretaceous, has a high-spired shell with whorls barely in contact. It looks like a gastropod, but is distinguished by presence of septa and a complex pattern of sutures. Conspicuous transverse ribs or tubercules. Length about 5 in.

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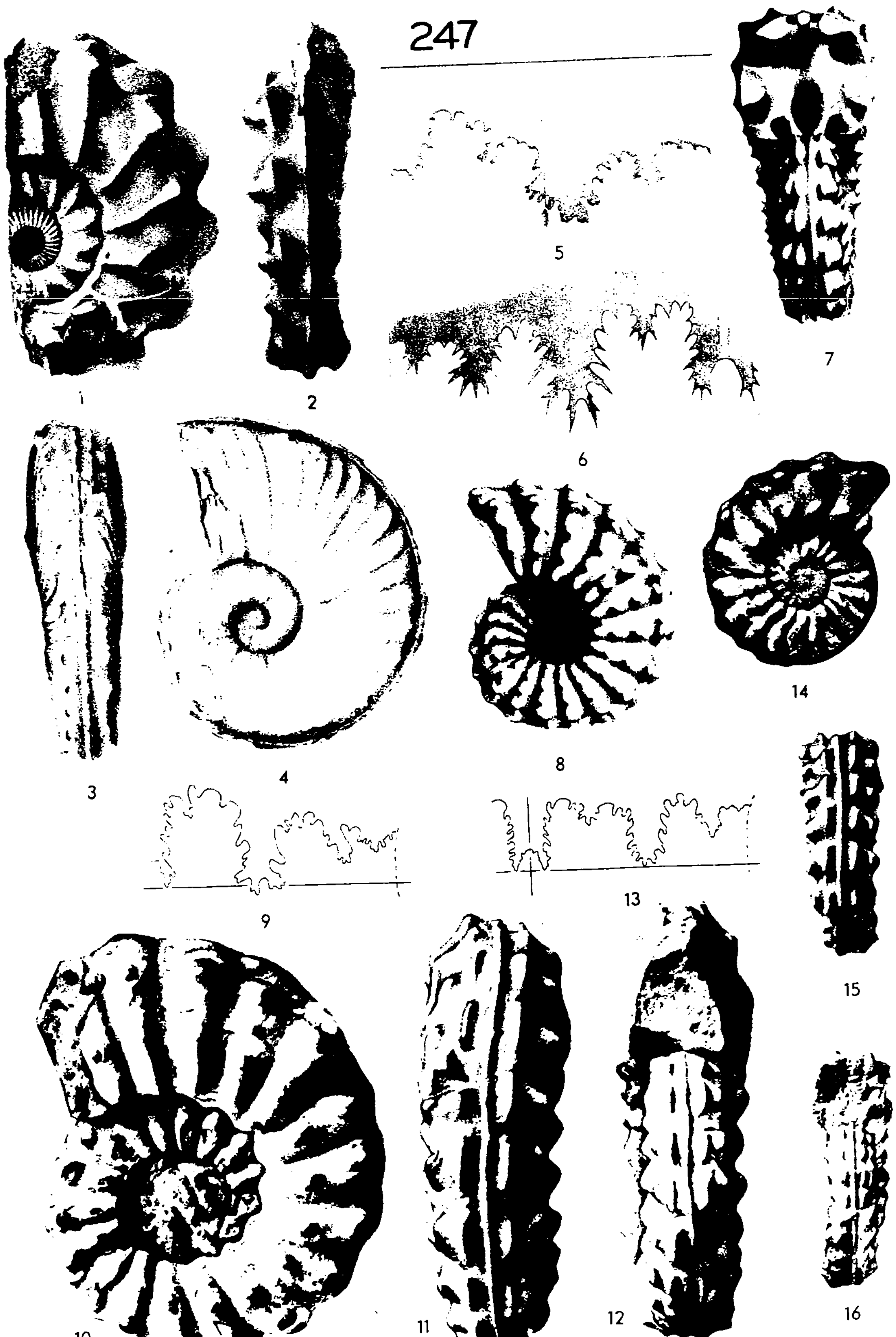


CEPHALOPODS

1, 2. **Prionotropis woolgari** [USGS Ter 9]. Two views of a fragmental specimen. **3–5. Prionocyclus wyomingensis** [USGS Ter Wyo and Idaho] Two views of a half grown specimen, and suture. **6–16. Mortoniceras spp. 6–8. M. texanum** [Roemer: Kreidebild Tex]. Suture enlarged, and two views of a partly grown specimen. **9–12. M. shoshonense.** Suture (x2) at 50 mm, and side, rear, and front views of a slightly squeezed specimen. **13–16. M. shoshonense.** Suture (x2) at 38 mm, and side, rear, and front views of a smaller specimen [9–16: USGS, PP 150].

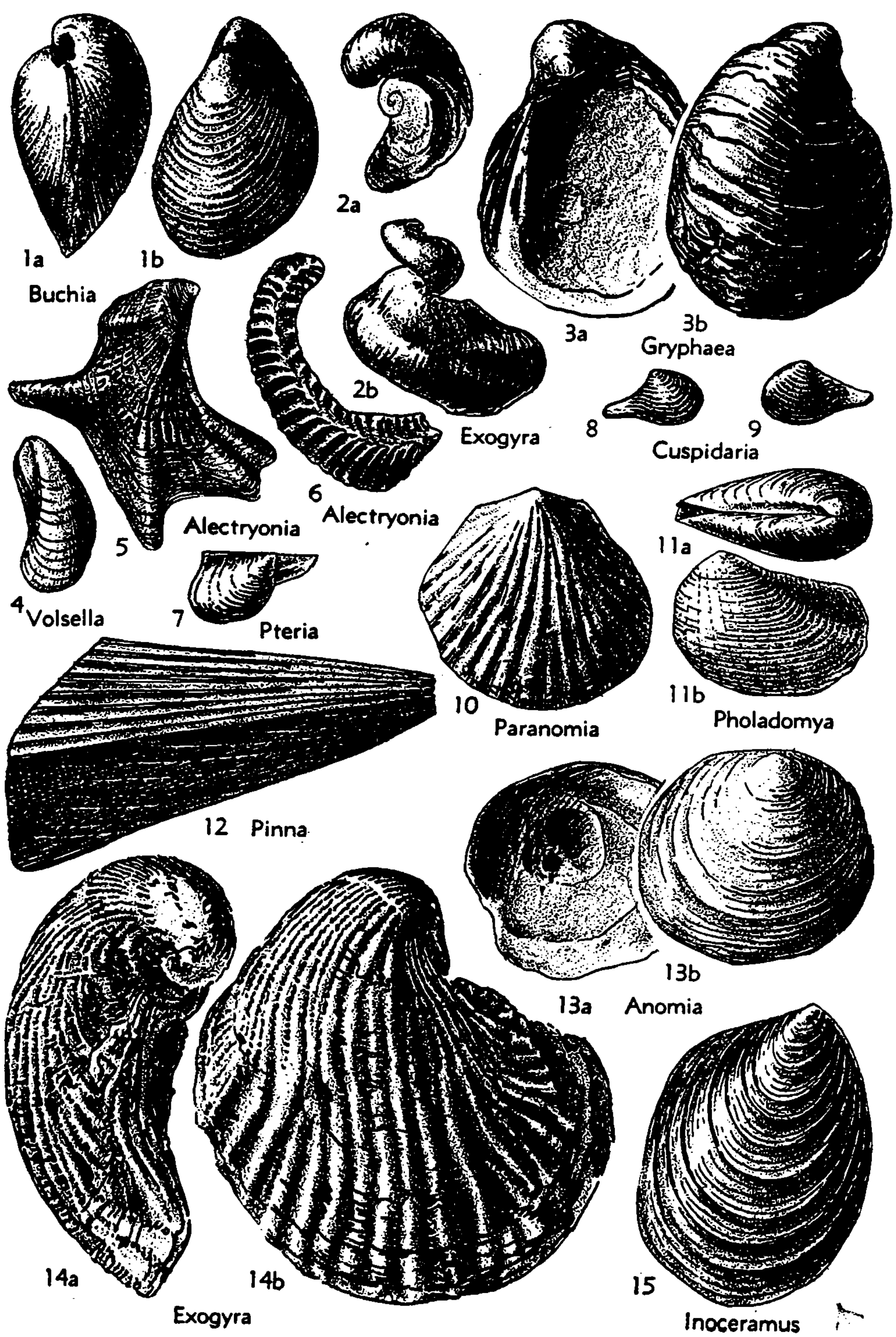


FIG. 10-19.

Alectryonia Fischer, Cretaceous (subgenus of *Ostrea*). A plicate oyster. *A. quadriplicata* Shumard (5, R); *A. carinata* Lamarck (6, L, ×0.5); both Lower Cretaceous (Washitan), Texas.

Anomia Linné, Jurassic–Recent. Thin-shelled isodont. *A. argenteria* Morton (13*a*, *b*, R), Upper Cretaceous, Tennessee.

Buchia Rouillier, Jurassic–Cretaceous. Mytilid dysodont. *B. terebratuloides* (Lahusen) (1*a*, anterior; 1*b*, R), Lower Cretaceous, California.

Cuspidaria Nardo, Jurassic–Recent. A small desmodont having the highly specialized septibranch type of gill structure. *C. moreauensis* Meek & Hayden (8, R, ×2), Upper Cretaceous, South Dakota. *C. ventricosa* Meek & Hayden (9, L, ×2), Upper Cretaceous, Montana.

Exogyra Say, Jurassic–Cretaceous. An ostreacean dysodont characterized by large spirally twisted left valve and small flat right valve. *E. arietina* Roemer (2*a*, R; 2*b*, L), Lower Cretaceous (Washitan), Texas. *E. costata* Say (14*a*, posterior; 14*b*, L; ×0.5), Upper Cretaceous, Mississippi.

Gryphaea Lamarck, Jurassic–Eocene. Ostreacean dysodont. *G. corrugata* Say (3*a*, *b*, L, ×0.5), Lower Cretaceous (Washitan), Texas.

Inoceramus Sowerby, Jurassic–Cretaceous. Concentrically wrinkled dysodont. *I. labiatus* Schlotheim (15, R, ×0.5), Upper Cretaceous, Kansas.

Paranomia Conrad, Cretaceous. Isodont. *P. scabra* (Morton) (10, L), Upper Cretaceous, New Jersey.

Pholadomya Sowerby, Jurassic–Recent. Desmodont. *P. papyracea* Meek & Hayden (11*a*, dorsal; 11*b*, L), Upper Cretaceous, Kansas.

Pinna Linné, Jurassic–Recent. An elongate dysodont with terminal beaks. *P. laqueata* Conrad (12, R, ×0.5), Upper Cretaceous, New Jersey.

Pteria Scopoli, Devonian–Recent. Pectinoid dysodont. *P. petrosa* (Conrad) (7, R), Upper Cretaceous, Tennessee.

Volsella Scopoli, Devonian–Recent. Mytilid dysodont. *V. multilinigera* (Meek) (4, L), Upper Cretaceous, Colorado.

FIG. 10-19. **Representative Cretaceous pelecypods.** Prominence of ostreacean dysodonts characterizes late Mesozoic clam assemblages. Forms illustrated here include isodonts (10, 13), dysodonts (1–7, 12, 14, 15), and desmodonts (8, 9, 11). Natural size except as indicated otherwise. L, left valve; R, right valve.

Family TROCHIDAE Rafinesque, 1815

[*nom. correct.* GRAY, 1834 (*pro* Trochinia RAFINESQUE, 1815)]

Peristome discontinuous in most genera, with columellar and outer lips not in same plane. Operculum circular, multispiral, thin, corneous, with central nucleus. *Trias.-Rec.*

Subfamily PROCONULINAE Cox, n. subfam.

Conical, mostly elevated shells with acute apex; nearly all of small or small-medium size; anomphalous or phaneromphalous; base more or less flattened; aperture quadrangular; columellar lip simple or with single plication. *Trias.-U.Cret.*

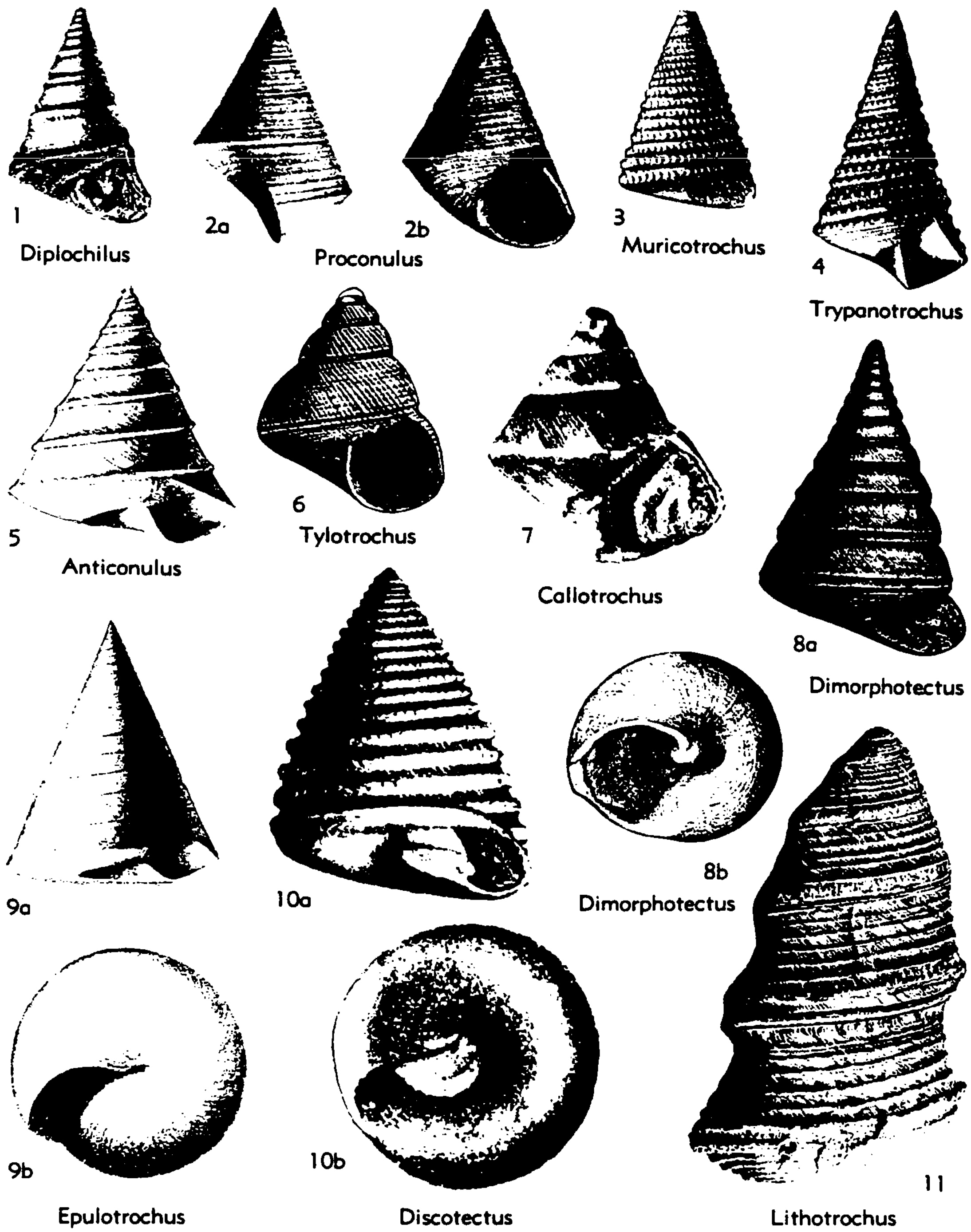


FIG. 159. Trochacea (Trochidae——Proconulinae (p. I248-I249).

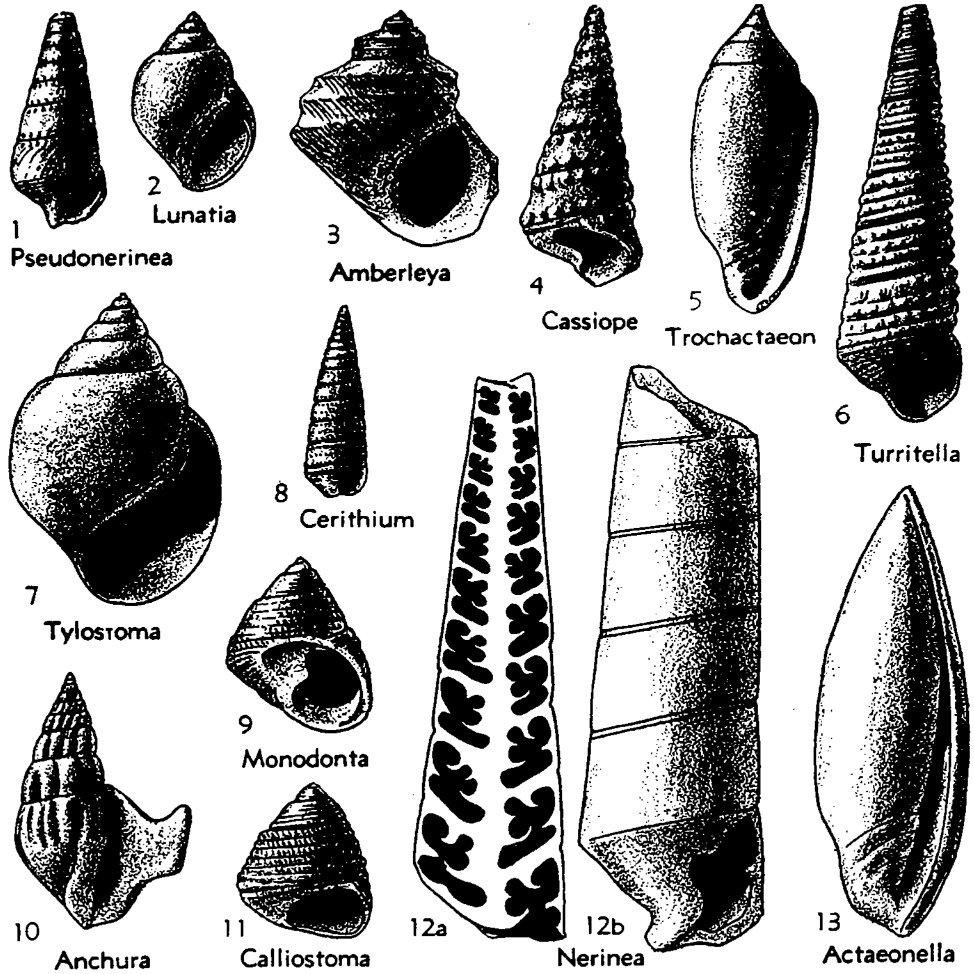
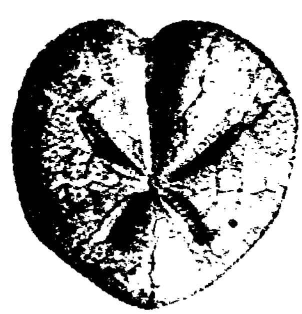


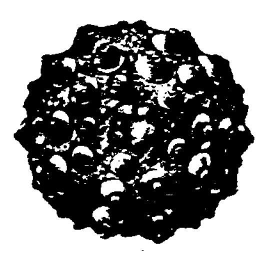
FIG. 8-28. **Representative Lower Cretaceous gastropods.** Archaeogastropods include species of Trochonematacea (3) and Trochacea (9, 11). Excepting two opisthobranchs (5, 13), the others are mesogastropods belonging to the superfamilies Cerithiacea (4, 6, 8), Nerineacea (1, 12), Strombacea (10), and Naticacea (2, 7). Natural size except as indicated otherwise.

ECHINOIDS (sea urchins, sand dollars and their kin) have spiny, globular, flattened or heart-shaped shells or tests made of small, limy plates. The test often has five-fold radial symmetry. All Paleozoic echinoids (as Lovenechinus) were regular; later forms (as Micraster) are irregular. Found from the Ordovician to Recent.

MICRASTER, Cretaceous to Miocene, has a thick, heart-shaped test. The ambulacral areas are sunken and the spaces between are filled with large plates. The mouth is near the anterior border. Surface oranular. Length about 2 in.



CIDARIS, Upper Triassic to Recent, is a group name for echinoids with a round test and mouth and anus at opposite poles. Ambulacra long and narrow; the spaces between are broad, with large tubercles and spines. Maximum diameter about 3 in.



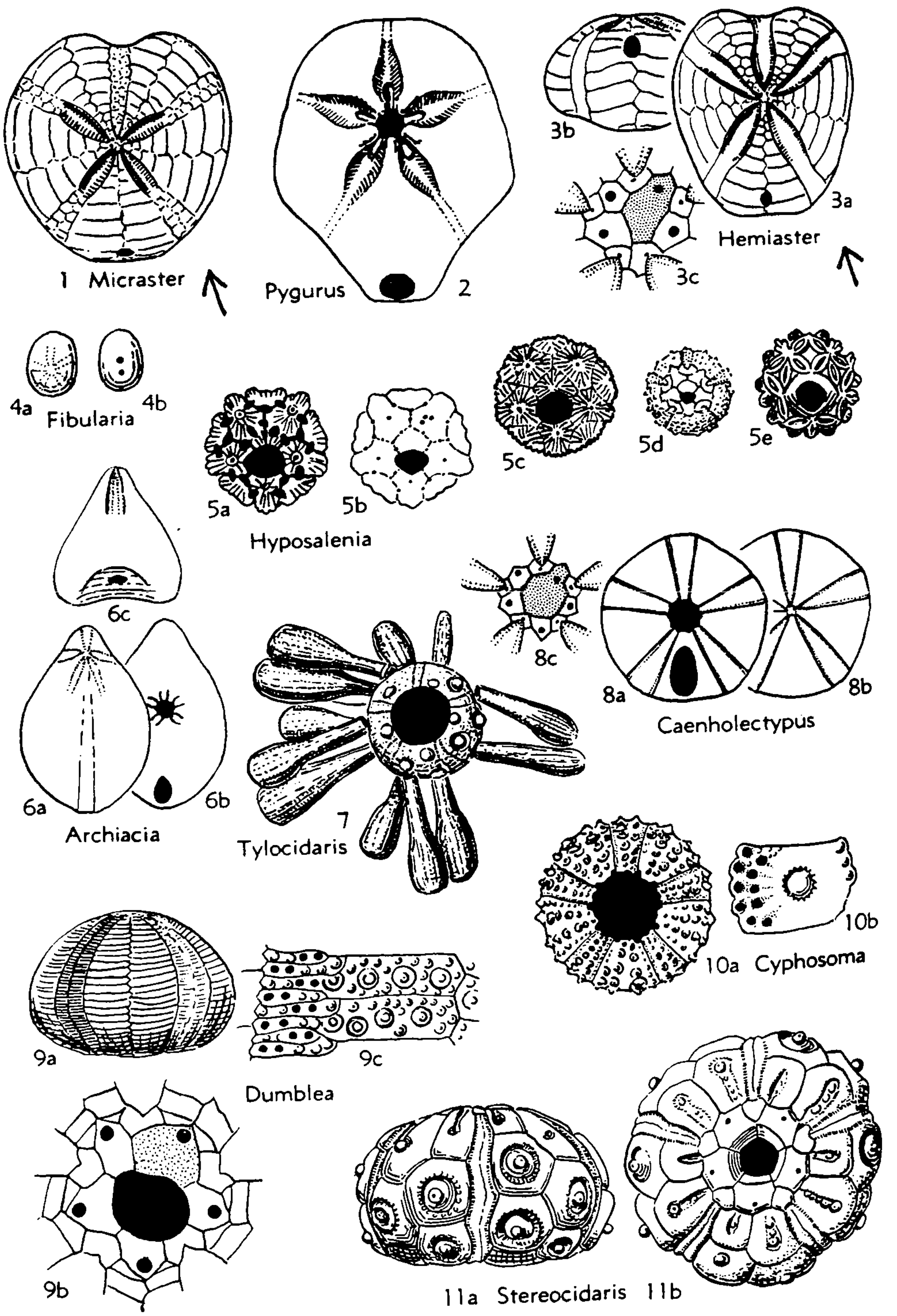


FIG. 21-24.

FIG. 21-24. **Representative Cretaceous echinoids.** Cretaceous echinoid faunas are rather modern in aspect but differ in general aspect from Recent ones in lacking sand dollars and in the small importance of the order Camarodonta.

Archiacia Agassiz, Cretaceous. Cassiduloid. This peculiarly pear-shaped echinoid has the attenuated apex located far toward the front, and was almost certainly a burrowing form. *A. sandalina* (d'Archiac) (6*a–c*, aboral, oral, and frontal views, ×0.7), Cenomanian, Mediterranean region.

Caenholectypus Pomel, Cretaceous. Holectypoid. Differs from the Jurassic *Holectypus* in having regained the fifth, posterior genital pore. *C. planatus* (Roemer) (8*a*, *b*, oral and aboral views, ×0.7; 8*c*, apical system, ×4), Middle Cretaceous (Comanchean), Texas.

Cyphosoma Agassiz, Jurassic–Eocene. Stirodont. The ambulacral pore pairs of this genus are arranged in a single row on the oral side, in a double row on the aboral surface. *C. texanum* Roemer (10*a*, oral aspect, ×0.7; 10*b*, an enlarged oral ambulacral plate, ×4), Middle Cretaceous (Fredericksburg), Texas.

Dumblea Cragin, Cretaceous. Stirodont. This genus differs from the contemporaneous *Pedinopsis* in having smooth rather than crenulate tubercles. *D. symmetrica* Cragin (9*a*, side view, ×0.7; 9*b*, apical system, ×3; 9*c*, ambulacral plates, ×5), Middle Cretaceous (Washita), Texas.

Fibularia Lamarck, Upper Cretaceous–Recent. Clypeastroid. *Fibularia* is one of the smallest and simplest of clypeastroids, devoid of internal partitions and of ambulacral furrows. The petals are only weakly developed. *F. subglobosa* Goldfuss (4*a*, *b*, aboral and oral sides, ×1), Senonian, Europe.

Hemiaster Desor, Cretaceous. Spatangoid. This common spatangoid has depressed petals and a weakly developed peripetalous fasciole. *H. whitei* Clark (3*a*, *b*, aboral and rear views, ×1; 3*c*, apical system, ×5), Middle Cretaceous (Fredericksburg, Washita), Texas.

Hyposalenia Desor, Cretaceous. Stirodont. A saleniid having a large apical system in which the anus is displaced toward the rear or toward the right posterior ambulacral area. Species of *Hyposalenia* are differentiated in part on the ornamentation of the ocular, genital, and suranal plates which form the apical system; several representative apical systems are those of *H. wrighti* (Cotteau) (5*a*), *H. clathrata* (Cotteau) (5*b*), *H. heliophora* (Cotteau) (5*c*), *H. bunburyi* (Forbes) (5*e*). The entire test of *H. acanthoides* (Desmoulins) is illustrated in 5*d*, ×1. Cretaceous, Europe.

Micraster Agassiz, Cretaceous–Miocene. Spatangoid. One of the most advanced of Cretaceous spatangoids, *Micraster*, possesses a nonpetaloid anterior ambulacrum and a subanal fasciole. The genus evolved rapidly in the chalk of England, particularly in shape and in the structure of the ambulacral plates, and has therefore served for subdivision of the chalk into a series of *Micraster* zones. *M. cor-testudinarius* Goldfuss (1, aboral side, ×0.7), Upper Cretaceous chalk, Europe.

Pygurus Agassiz, Jurassic–Cretaceous. Cassiduloid. The periproct of this highly advanced cassiduloid is located at the tip of a posterior extension, and the floscelle is exceptionally developed. *P. oviformis* d'Orbigny (2, oral side, ×0.7), from the Cretaceous of France.

Stereocidaris Pomel, Lower Cretaceous–Recent. Cidaroid. The genus *Stereocidaris* has been discussed in the text as model for regular echinoids. *S. sceptrifera* (Mantell) is a fossil representative (11*a*, *b*, side and aboral views, ×0.7), Cretaceous, France.

Tylocidaris Pomel, Cretaceous. Cidaroid. The primary spines of this striking echinoid are club shaped. *T. clavigera* König (7, ×0.7), Cretaceous, Europe.

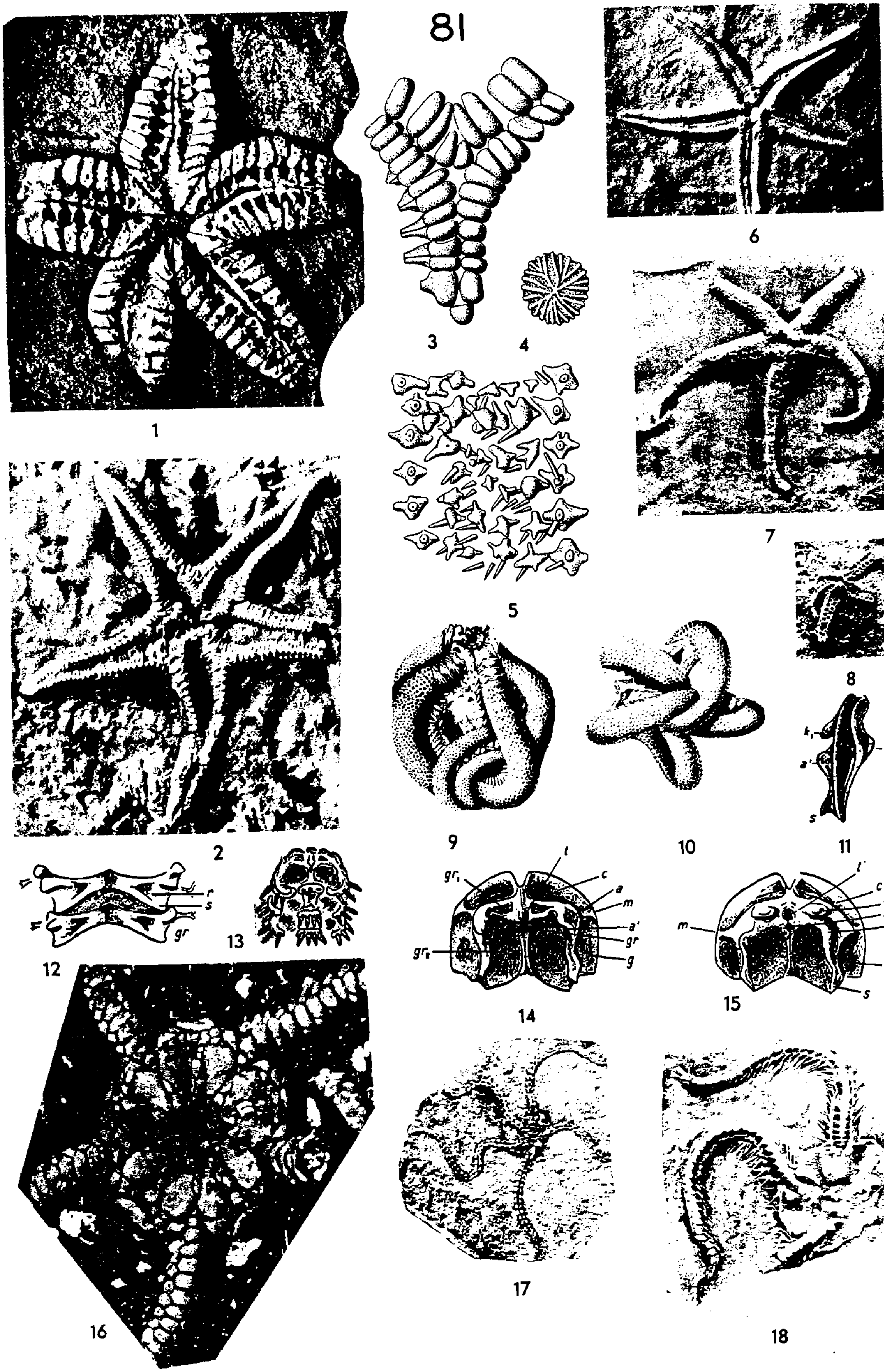


PLATE 81

[Figures are x1 and after Schuchert [USNM, B 88] unless otherwise indicated.]

1. Stenaster salteri (x3). Retouched photograph showing actinal surface. **2–5. Promopalaeaster bellulus.** 2: Retouched photograph of actinal side. 3: An interbrachial area of 2 (x4). 4: Madreporite (x7). 5: Abactinal area of a ray (x7), with ossicles displaced. **6, 7. Urasterella pulchella.** Actinal and abactinal views of different specimens. **8. Taeniaster spinosus.** Actinal view (x2). **9–15. Onychaster flexilis.** 9, 10: Two views of a specimen with arms intertwined [Ill G S 1]. 11, 12: Side and ventral views of two proximal vertebrae. 13: Ventral view of several successive vertebrae. 14, 15: Proximal vertebrae seen from aboral and adoral surfaces. **16. Ophiura marylandica** (x3.7) [Am Phil Soc, Pr 80]. Dorsal view. **17, 18. Amphiura sanctaecrucis** [USGS, M 54]. Ventral surface (x0.5) and dorsal surface (x1.5).

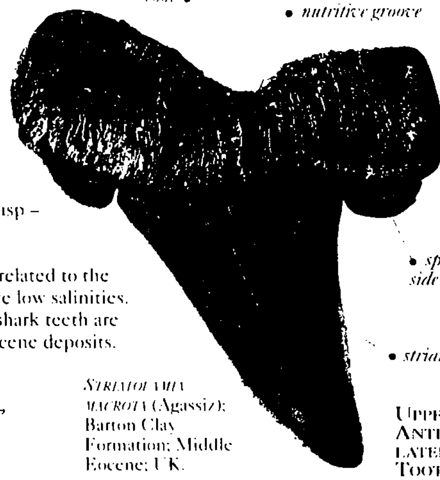
Order LAMNIFORMES	Family ODONTASPIDAE	Informal name Sand shark

STRIATOLAMIA

This extinct shark is known from fossils of its teeth and calcified vertebrae. In the front teeth, the crown is narrow and tapering, becoming triangular in side and back teeth. The labial surface (facing the lips) is ornamented with fine raised grooves (striae), and on either side of the crown is a single cusp – conical or broad and flat. A distinct nutritive groove divides the root.

• **HABITAT** *Striatolamia* is closely related to the modern sand shark and could tolerate low salinities.

• **REMARK** This and similar sand shark teeth are common in many Paleocene and Eocene deposits.



UPPER ANTERO-LATERAL TOOTH

STRIATOLAMIA MACROTA (Agassiz); Barton Clay Formation; Middle Eocene; UK.

Typical length 11½ ft (3.5 m)

Range Paleocene–Oligocene	Distribution Worldwide	Occurrence

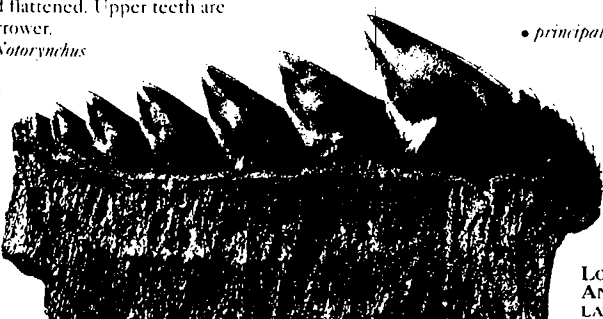
Order HEXANCHIFORMES	Family HEXANCHIDAE	Informal name Cow shark

NOTORYNCHUS

This is a seven-gilled shark with multi-cusped teeth, of which the lower teeth have crowns, comprising a principal cusp, and three to eight cusplets spreading out from the center. To the front of the principal cusp is a further series of small cusplets. The root is rectangular and flattened. Upper teeth are smaller and narrower.

• **HABITAT** *Notorynchus* lives in cool, shallow marine waters.

NOTORYNCHUS KEMPI Ward; Barton Clay Formation; Middle Eocene; UK.



LOWER ANTERO-LATERAL TOOTH

Typical length 10 ft (3 m)

Range Eocene–Recent	Distribution Worldwide	Occurrence

Order LAMNIFORMES	Family OTODONTIDAE	Informal name Mackerel shark

CARCHAROCLES

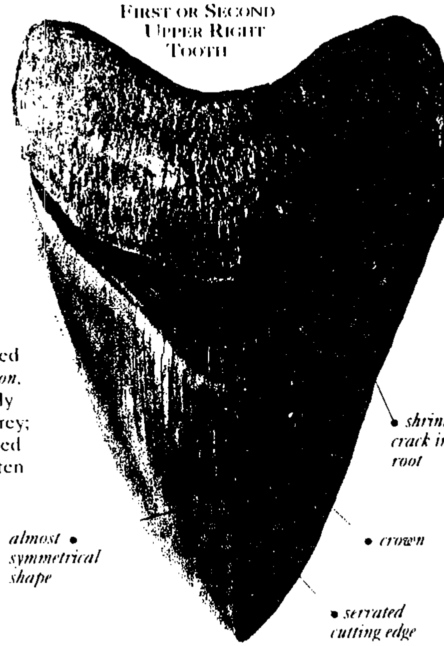
The genus *Carcharocles* is an extinct lineage of sharks characterized by massively constructed teeth with serrated cutting edges. An estimated 42½ ft (13 m) long, it was one of the planet's largest predators. The crowns of its razor-sharp teeth are triangular, with or without cusplets at the side, and the roots massive, without a nutritive groove. There were approximately 24 teeth in the upper jaw and 20 in the lower. The species *Carcharocles megalodon* was the youngest and largest of the lineage, and had no side cusplets.

• **HABITAT** *Carcharocles* lived in warm seas, and its teeth are most abundant in deposits rich in marine mammals, its probable prey.

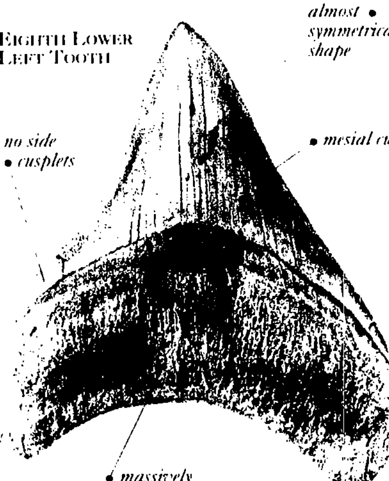
• **REMARK** This genus is often confused with the modern white shark, *Carcharodon*, because of their apparent, but in fact only superficial, similarities in lifestyle and prey; the two are only distantly related. Serrated teeth, similar to those of *Carcharocles*, often appear in large carnivores.

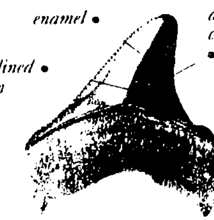
CARCHAROCLES MEGALODON (Agassiz); Yorktown Formation; Early Pliocene; USA.

FIRST OR SECOND UPPER RIGHT TOOTH



EIGHTH LOWER LEFT TOOTH





TENTH LOWER RIGHT TOOTH

Typical length 42½ ft (13 m)

Range E. Eocene–Pliocene	Distribution Worldwide	Occurrence

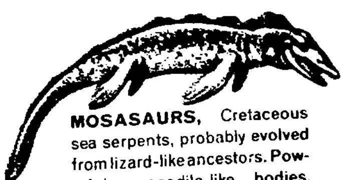
DINOSAURS FOUND IN SOUTHERN OKLAHOMA AND NORTH TEXAS

In the last five years, twelve dinosaurs have been found in southern Oklahoma and thirteen in north Texas. This represents 90% of the dinosaurs that have been found in this area!!!!!!!! Why we are finding so many dinosaurs so quickly is a mystery to me. However, this adds a new exciting twist to any visit to the Cretaceous sediments along the Red River.

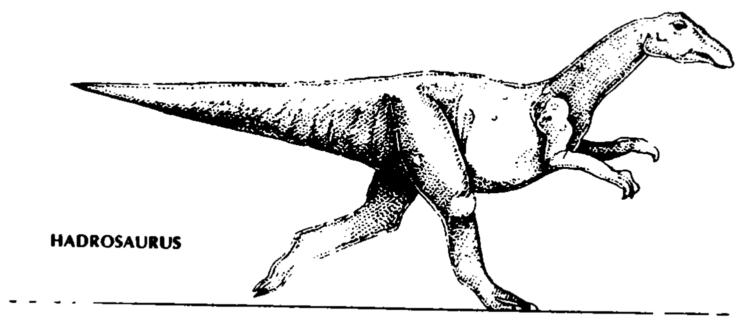
ORNITHOPODS
Duck-billed dinosaurs

The L. Cretaceous sea shore extended as far north as 40 miles into Oklahoma and as far south as 30 miles into Texas. Therefore, the Cretaceous units represents layered marine and non-marine sediments. This allows us to find marine and terrestrial dinosaurs in the same general area. Also, land dinosaurs were washed out to sea during hurricanes. Their skeletons have been found in marine units in north Texas.

The dinosaurs found recently in Oklahoma are <u>marine and terrestrial</u>. A stream deposit near Atoka produced five duck-billed and a carnivorous dinosaur. Either one or two huge <u>Tyrannosaurus</u> like and a two legged turkey size dinosaurs have been found in far southeast Oklahoma. Near Durant two <u>Plesiosaurs</u> and a 45 foot long <u>Mosasaur</u> were discovered in 1991!

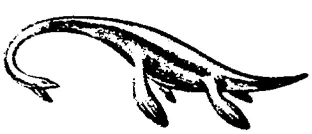


MOSASAURS, Cretaceous sea serpents, probably evolved from lizard-like ancestors. Powerful, crocodile-like bodies, strong jaws and teeth, and well-developed paddles. Length 30 ft.



HADROSAURUS

THEROPODS
Carnivorous dinosaurs



PLESIOSAURS, Jurassic to Cretaceous, were marine carnivores. They were active swimmers propelled by powerful paddles. Some were long-necked, with small heads and long tails; others were short-necked and long-headed. Length 15 to 40 ft.

The Atoka site may represent one of the major dinsaur sites in North America. They have found adult and <u>baby</u> Hadrosaurs. This is one of only a few lower Cretaceous dinosaur sites. It is unlikely that we will find a dinosaur on this trip. However, a tooth or portion of a flipper might be uncovered by some lucky person. The marine dinosaurs often fed on ammonites. You will occasionally find an ammonite that was bitten but escaped. The tooth marks will be obvious in its shell.

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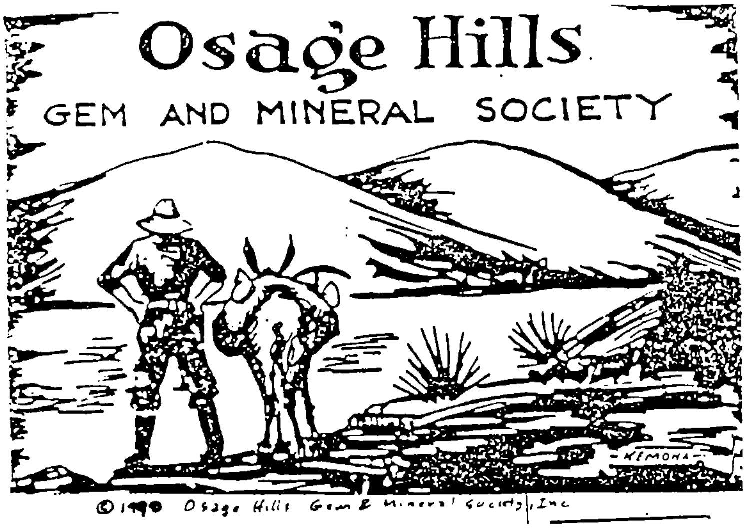


OFFICIAL BULLETIN OF THE OSAGE HILLS GEM AND MINERAL SOCIETY
P. O. BOX 561, BARTLESVILLE, OK 74005
VOLUME 31, NO. 5, May, 1990

WHO CAN COLLECT?

by L. C. Simpson

I've heard views that only professionals should collect fossils. After all, only the professionals have the care and knowledge to properly collect and preserve these rare remains.

In fact, vast numbers of fossils are beautifully collected and preserved by the so called amateurs. Some buy $1000's of dollars of equipment to clean and preserve this material.

There is very little money supporting very few professionals in collecting and preserving fossils. Many of the museum collections have never been seen or preserved. If only professionals collected fossils, most areas would be uncollected! Fossils on the surface last less than a year, usually! Thus such a policy would lead to the distruction of most fossils weathered to their surface - not their preservation!

If only professionals collect fossils, who will collect fossils and spend years working on them in the next century? People get interested in fossils by collecting them in the field when they are young amateurs. If only professionals collect, they will become extinct like the fossils they are collecting because no young paleontologists will want to or be able to follow in their footsteps. This will lead to an end of evolutionary research as has been promoted by professional paleontologists for centuries. With the demise of this work, civilization will take a slow step backwards into darkness!

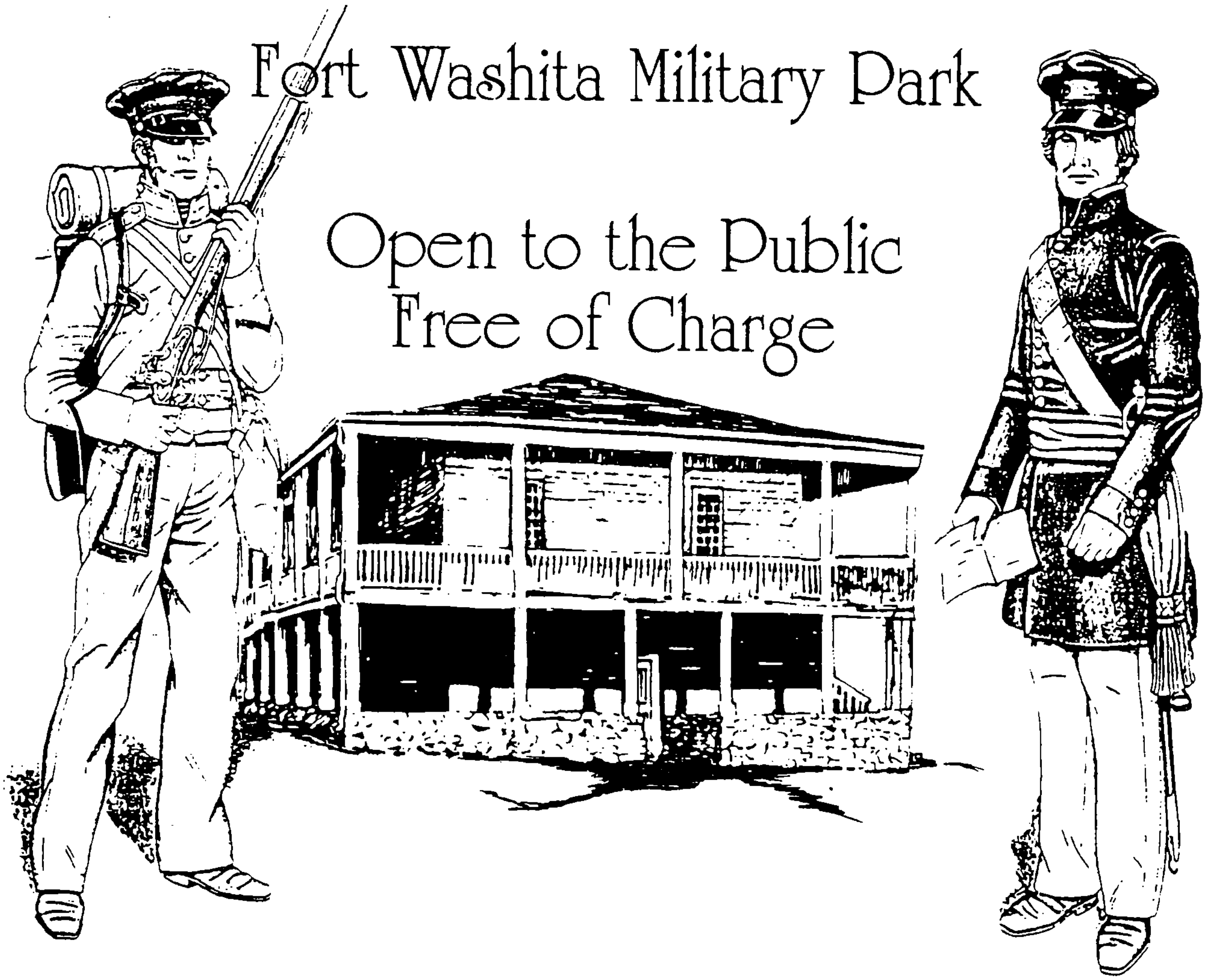
The amateur rockhound in this way holds the tiny flame of knowledge in his hand. Restrictive legislation will extinguish this light and diminish the light of knowledge and truth for future generations. We have a grave responsibility to uphold the rights of the amateur paleontologist for the rest of humanity.

I am no longer a member of the Society of Vertebrate Paleontologists.

(Mr. Simpson is a professional Paleontologist who is now with the Association of Central Oklahoma Governments. He wrote this in response to a request from member Dan Pearson asking his views of the stand taken by the Society of Vertebrate Paleontologists that permits must be required for vertebrate fossil collecting. The SVP did this in opposition to their memberships vote and was the only paleontological society of over 20 to hold such a view.)

Fort Washita Military Park

Open to the Public Free of Charge



This ancient stone fort is an fun place to visit on trips to the Lake Texoma area. Many of the original building are still preserved at this very peaceful site. The fort is open from 2 - 5 pm on Saturday and Sunday. If your car becomes bottomed out from the weight of too many fossils, you might want to quit collecting and visit the fort on your way home.

To reach the fort:

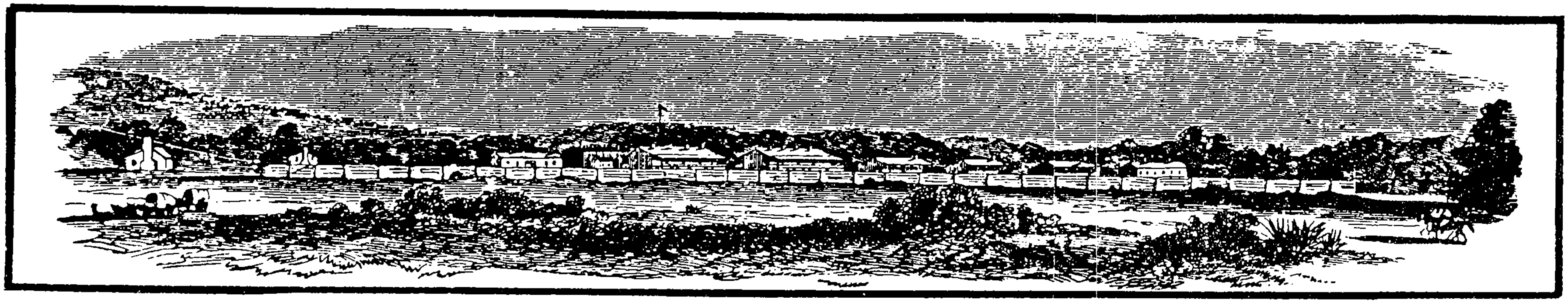
a. Go north on HW 70 (used to go from Madill to the fossil site) into downtown Madill where a number of highways meet at a stop light.

b. Turn right or east on Hw 99, 199. Proceed around the old town square and continue east over the railroad tracks.

c. The road will "Y" and you take the straight or right fork (HW 199).

d. This road passes 14 - 15 miles of prairie and timber country and after crossing two bridges over the Washita River, you will find the fort on the hill to the north or left.

Many feel that this site is worth a return visit. I hope you brought your camera.



The Oklahoma Historical Society's

Fort Washita

In 1841 Choctaw and Chickasaw Indians were busy building schools and establishing law and order in southeastern Indian Territory. Their prosperity, however, was threatened by raiding plains Indians and instability on the frontier. To intercept such raiding parties and to maintain peace, the U.S. Army established Fort Washita.

The dramatic story of Indian fights and endless patrols, as well as fort construction and camp life, is preserved at the Oklahoma Historical Society's Fort Washita, located near Madill and Durant.

The Site

In the late summer of 1841, General Zachary Taylor, with a small detachment of mounted troopers, rode far into the frontier of Indian Territory, eighty miles west of the nearest fort. His mission was to find the best site for a new military outpost, from which soldiers could protect the Choctaws and Chickasaws.

After thoroughly exploring the wooded region, "Old Rough and Ready" Taylor selected a site eighteen miles north of the Red River on the Washita River, a mile and a half east of the stream. The new fort, occupied in April of 1842, was named Fort Washita.

Construction

Isolated even by frontier standards, soldiers moving onto the site for construction experienced supply difficulties. Unlike most military installations, local materials had to be used for construction and food had to be obtained in the area. Manufactured goods from St. Louis and New Orleans were shipped to Doaksville, located near Fort Towson eighty miles to the east, and then moved west on the Red River to the Washita.

Construction was started by Captain George Blake using Companies A and F of the 2nd Dragoons. Because of worn equipment and supply problems, construction was slow. Temporary log barracks were built in 1842 and served until the large south barracks were built in 1850. The supply problem slowed permanent construction and forced the troops to use temporary log structures years beyond the normal period.

The Fort

The fort served as a staging area for forays west against raiding plains tribes. The Comanches, styled "Lords of the Southern Plains," proved the most consistent foes of the Washita garrison. Because the columns operating west out of the fort were of necessity made up of cavalry and dragoons, the fort had an extensive corral and stable area, as well as shops for blacksmiths and farriers.

The fort ultimately covered an extensive area. The parade ground was enclosed on the south by the South Barracks, enlisted men's quarters now restored. On the west were the West Barracks (now in ruins), used for enlisted men. To the north was the Commanding Officer's Quarters, and to the east were the Bachelor's Officers' Quarters. Behind and north of the Commanding Officer's Quarters were the Married Officers' Quarters and the new Hospital. South of the South Barracks was the Commissary, the old Hospital, and the Guard House.

Many prominent men served at Fort Washita during its heyday. Among them were General Zachary Taylor, Captains Randolph B. Marcy and George B. Mc Clellan, and General William G. Belknap. Colonel Braxton Bragg, later a Confederate general, commanded the 2nd Artillery Regiment stationed at the fort.

Fort Washita was abandoned by federal forces in 1861, soon after the capture of Fort Sumter in Charleston, South Carolina. Confederate forces from Texas occupied the fort, and it became a major supply depot for Confederate troops in Indian Territory. General Douglas Cooper commanded the fort briefly after the Battle of Honey Springs, the largest battle fought in Indian Territory. He is buried at the fort. Stand Watie, a Cherokee who was a Confederate brigadier general, was one of the officers commanding the southern occupation forces. The fort was also a regional headquarters and hospital facility for southern troops operating in the area.

Later History

In 1870 the War Department transferred the fort to the Department of the Interior, and it was never reactivated. Frontier expansion had overtaken the fort and at the time of its abandonment it was militarily obsolete.

From the Department of the Interior the land was turned over to the Chickasaw family of Abbie Davis Colbert and her son. The remaining structures of the fort served as farm buildings well into the 20th century. The Colbert family also utilized the cemetery as a family burial ground.

For ninety years the buildings and grounds of Fort Washita collapsed in disrepair. Then, in 1962, Ward S. Merrick, Sr., of Ardmore, contributed money to the Oklahoma Historical Society for the fort's purchase. Five years later the state legislature appropriated money for restoration which continues to this day under the guidance of the Oklahoma Historical Society.

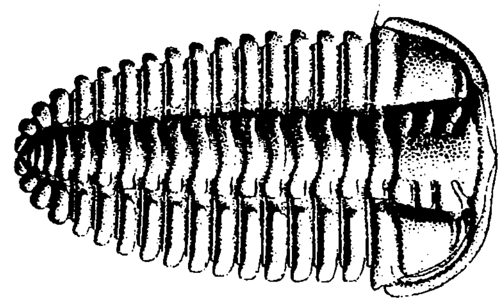
FOSSIL PREPARATION

The preparation of some fossils can be difficult. Fortunately, these Cretaceous fossils are in soft rock and can be cleaned with dental tools, fine files, an occasional quick attach by vinegar on a tooth brush followed by flushing with fresh water. Most of the ammonites are mud casts and should not be cleaned extensively.

However, these are not the only fossils in the world. Some are very delicate and\or in harder rock. These specimens can be cleaned to museum quality by <u>you</u>. All you need to get is a micro-air abrader. This micro sandblaster (actually uses limestone power as fine as face powder) can clean the rock matrix off almost any fossil. Museums and professional collectors use these devises to prepare their specimens. There are many units on the market. By far the finest and the best is made by S.S. White. Their new Series II "K" model is designed for cleaning fossils. S.S. White invented the micro-abrader and still leads the world in design and performance. I have used my S.S. White for years and it can do almost anything.

Trilobites are sometimes very difficult to clean.

You shouldn't try to clean this trilobite without an S. S. White.



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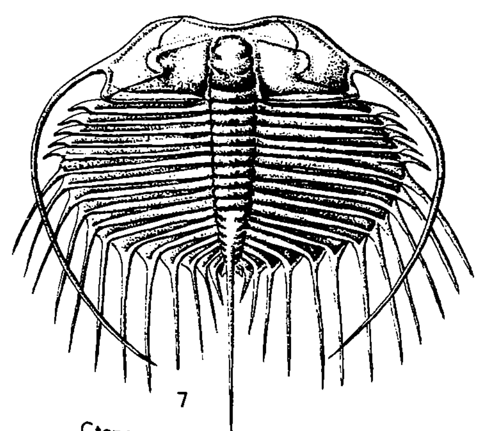

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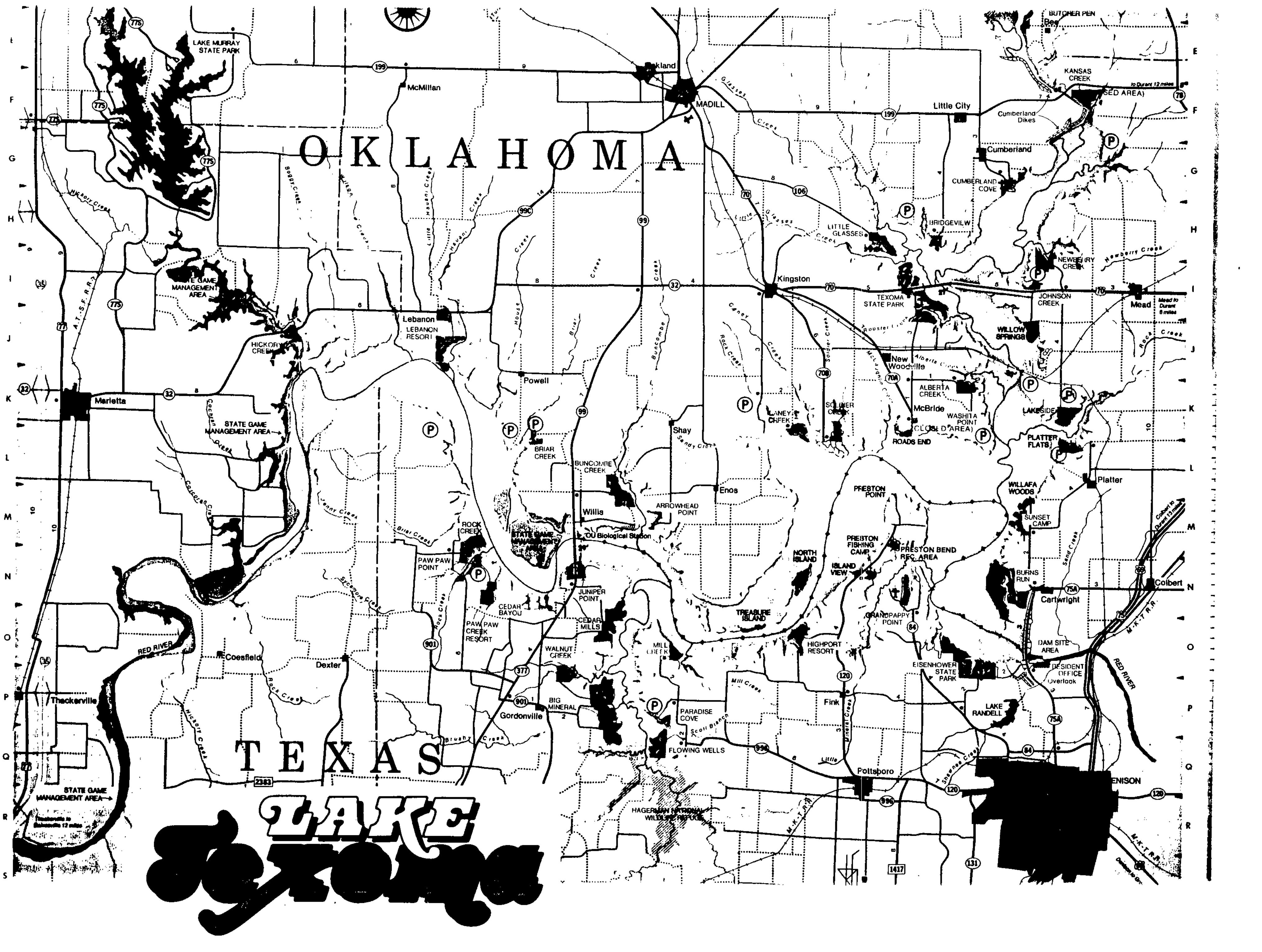
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Mead
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Platter
WILLAFA WOODS
SUNSET CAMP
BURNS RUN
Cartwright
Colbert
DAM SITE AREA
RESIDENT OFFICE
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WALNUT CREEK
BIG MINERAL
Gordonville
Dexter
Coesfield
Thackerville
RED RIVER
SOLDIER CREEK
LANEY'S CREEK

OKLAHOMA GEOLOGICAL SURVEY
Charles J. Mankin, *Director*

The Oklahoma Geological Survey does much of the geologic research in the State of Oklahoma. Their large, well experienced staff has published vast amounts of data on all aspects of geology in Oklahoma for 88 years.

The OGS has published 146 bulletins, 98 circulars, 35 mineral reports, 29 guidebooks, 4 educational publications, 53 geologic maps, 9 hydrologic atlases, 4 hydrologic investigation atlases and 55 special publications. Oklahoma Geology Notes has been published by the Survey since 1940 and volumes 16-54 are still available. They also carry USGS topographic maps for all of Oklahoma. Publications on and adjacent to Oklahoma from the Tulsa Geologic Soc., Univ. Texas at Austin, and the AAPG Geologic Highway Maps for the United States are also for sale. This vast storehouse of data can be accessed at the OGS offices in the basement of the Sarkeys Energy Center on the OU campus at Norman (100 E. Boyd, room N-131). On the floor above the OGS, is the beautiful University of Oklahoma Youngblood Energy Library. This is the largest Geology Library in the world, with 88, 726 books and 136,280 maps! ALL geologic data on Oklahoma is stored in the Energy Center Library and Survey offices.

An even more convenient way to acquire material from the OGS is to order by phone (325-3031; 1-800-330-3996; FAX 1-405-325-7069). A list of available publications can be mailed to you free of charge. Then you can order any of this material by phone ad receive it in only a few days. A vast amount of the books and maps from the OGS are less than $6.00 each in price!

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