MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph. D.
Director

BULLETIN 35

THE
GEOLOGIC HISTORY OF LEGION STATE PARK

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MISSISSIPPI GEOLOGICAL SURVEY

COMMISSION

STAFF

LETTER OF TRANSMITTAL

Office of the State Geological Survey
University, Mississippi
June 29, 1937

To His Excellency,
Governor Hugh White, Chairman, and
Members of the Geological Commission

Gentlemen:

I have the pleasure of transmitting the manuscript of Bulletin 35, entitled The Geologic History of Legion State Park. It is the fourth report in the educational series of the survey and was prepared at the request of the State Forester, Mr. Fred B. Merrill, who has charge of the state parks.

Very sincerely yours,

WILLIAM CLIFFORD MORSE, Director

ACKNOWLEDGMENTS

After the early efforts of Mrs. D. L. Fair to have some Indian mounds, more than twenty miles southeast of Louisville, set aside as a state park had almost failed because of poor roads, Allen Post No. 62 of the American Legion came forward with an initial offer of 72 acres, lying one mile northeast of Louisville, for a state park. This tract and an additional area became Legion State Park through the assistance of the officials of Winston County. Its development came about largely through the aid of Congressman Jeff Busby in securing a C. C. C. Company that worked under the direction of the National Park Service—all according to information from the State Forester.

Mr. E. H. Rainwater, at his own expense, made two special trips to the Park to determine certain geologic features; Mr. A. E. Miller, Superintendent of the Park, and Mr. Allen, Engineer in charge, both aided to the fullest extent; and finally Dr. Louis C. Conant, Associate Professor of Geology, and Mr. Frederic F. Mellen have read the manuscript critically.

In order that the report may be somewhat complete even though brief, some repetition of material in other educational bulletins has been necessary.

NOTE

Legion State Park, like the other state parks, is under the management of the Mississippi Board of Park Supervisors, from whose executive officer, the State Forester, Jackson, information concerning the use and facilities of the Park may be obtained.

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THE GEOLOGIC HISTORY OF LEGION STATE PARK

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INTRODUCTION

Legion State Park is a surprise, a topographic surprise to the trained geologist as well as to the educated layman but a pleasant surprise none the less. It is not exactly twin topography, for most twins are equal. Neither is it precisely an Adam (Figure 2) and Eve topography, for the rib never grew to full stature, and then there are more than one Adam and one Eve. Legion State Park will never cease to be a very pleasant and enticing surprise.

Figure 2.—Adam, shoulder first.

ANCIENT GEOLOGIC HISTORY

Geologic eons had come and gone before Legion State Park surface environs came into existence. The Archeozoic era had come and gone; the Proterozoic era had come and gone; the Paleozoic era had come and gone; the Mesozoic era had come and gone. Four of the five geologic eras had come and gone and the Cenozoic was well under way.

The Paleozoic era had slowly passed into eternity—an era during which sediments from the Archeozoic and Proterozoic land masses in the great Canadian Shield about Hudson Bay, in old Appalachia Land of the present Appalachian Piedmont and Atlantic Coastal Plain, and in Old Cascadia Land of the present Great Salt Lake Basin area had been swept down into the great Appalachian trough of the present mountain area, into the great Cordilleran trough of the present Rockies, and into the intermediate area.

Figure 3.—North wing of Lodge, showing detail of native ferruginous sandstone construction.

The huge Orthoceras, close relative of the Pearly Nautilus, had developed early in the Paleozoic until it supported in the sea waters an almost cylindrical shell one foot in diameter and twelve to fifteen feet in length, and then disappeared. The Trilobites, crayfish-like animals, had appeared early in the Paleozoic, had reached their climax in the second period of that era, and had then declined to extinction at the close of the era, but they did leave some of their remains, during the fourth period, in the Devonian sediments, which now form the oldest rocks of northeastern Mississippi. But other life, shell fish life, had contributed its part to these limestones, soon unfortunately to be submerged by back waters from Pickwick Dam.

The huge shark-like fishes that swam the Devonian seas farther to the north, and here as well, had left only their larger bones to be worn into the form of flat pebbles to be accumulated in the basal part of some of these sandstone layers in Tishomingo County. The plants that filled the swamps and grew about their borders had left only their finely ground fragments to form the carbon of the black clay shales of this county.

Countless billions of shell fish had lived, had died, and had contributed their limy shells, along with the limy tests of other organisms, to a relatively small quantity of clay mud in the early Mississippian sea to form the limestones of this age in Tishomingo County. Similarly

Figure 4.—Over-night cabin, built of native logs, shingles, and ferruginous sandstone.

still other forms had lived, had died, and had contributed their limy remains to a comparatively larger quantity of mud and sand in the late Mississippian sea to form mostly fossiliferous shales and sandstones of that age, rather than purer limestone, in this county.

Though these organisms had furnished their calcareous tests to form limestones or had added them to greater quantities of mud and sand to form shales and sandstones that now crop out only in Tishomingo County, nevertheless, these same rocks or other similar rocks form the solid foundation of Legion State Park—the solid foundation on which later Coastal Plain beds of unconsolidated rocks of the park environs were to rest. Were a deep well to be drilled for oil and gas in this region, the only possible forecast would have to be based on a study of these hard beds where they lie at the surface in the northeastern part of the state.

Fern-like trees and other types had appeared and had developed until in Pennsylvanian times towering Lepidodendrons and Sigillarians, several feet in diameter and more than one hundred feet in height, grew in and about the swamps that extended all the way from the present site of Pennsylvania to the present Alabama-Mississippi line and contributed their remains to form the great coal beds of this period. And old Appalachia Land had contributed mud and sand sediments not only to form shales and sandstones but to form a covering for the successive beds of plant material, whereby the beds were converted into high grade bituminous coals—coals that will have to be more nearly exhausted before the lignitic coals of Legion State Park environs come to be of economic importance, unless Survey research at an earlier date discovers valuable lignitic by-products.

Similar forms had appeared, had developed, and had contributed their remains to form lesser beds of coal in Permian times. Old Appalachia Land had continued to furnish mud and sand for the sediments of this age. And finally sedimentation processes had given way to deformative stresses which forced the newly formed series of limestones, shales, sandstones, and coals into the series of parallel folds that constituted the original Appalachian Mountains—folds that on the present surface extend to northeastern Mississippi and beneath the surface perhaps farther toward Legion State Park, or even to it or beyond.

Throughout the first three periods of the Mesozoic era destructive forces had been at work until they had slowly worn down to a plain the lofty Appalachian Mountain system. Then the plain had been gently arched up at the north as the Cretaceous sea of the Mississippi (Valley) Embayment slowly transgressed Legion State Park environs and pressed on toward the northeast corner of the state.

The bordering shores and the Cretaceous sea had received gravel, sand, and mud, and the sea had received additional limy tests from the organisms of that period—and time had converted these sediments into the Tuscaloosa gravels and sands, the Eutaw clays and sands, the Selma chalk, and the Ripley sands of the northeast-central belt of Mississippi.

Huge Clams, Inoceramus, had appeared, had developed, and had attained a length of ten to twelve inches in the Eutaw sea of Cretaceous times. Enormous Ammonites, Nautilus-like forms, had appeared, had developed, had sported wonderful partition frills, and had begun their decline toward extinction at the close of Cretaceous times, but they did leave behind their large shells in the Eutaw sediments as at

Plymouth Bluff above Columbus. Giant sea lizards, Mosasaurs, had come, had advanced, had plied the Selma sea, and finally added their skeletal remains to other organic remains of Cretaceous times.

The plants of the Great Plains had contributed their remains to form the vast coal beds of that area. The sediments of the Cordilleran region had been folded and faulted into the lofty Rocky Mountains. All these features and many others had appeared, had existed, and had disappeared when the Cenozoic sea, which was to receive the present surface sediments of Legion State Park environs, came into its own. To be sure the successive Tuscaloosa, Eutaw, Selma, and Ripley seas of the Mississippi Embayment of the Gulf Coastal Plain of Cretaceous times had occupied the present Legion State Park environs, but the sediments of these seas are so deeply covered here by the later Cenozoic sediments that the Cretaceous formations crop out only near their shoreward edge in northeastern Mississippi.

GEOLOGIC HISTORY OF LEGION STATE PARK AND RELATED AREAS

The early Cenozoic seas of the Mississippi Embayment extended at least as far landward as Tippah, Union, Pontotoc, Chickasaw, Clay, Oktibbeha, Noxubee, and Kemper counties. The earliest of these seas, the Clayton sea, abounded in shell fish life. Chief among these forms was *Turritella mortoni*, a Gastropod second cousin of the Snail, but an animal bearing a beautifully ornamented shell having a spire four or eight inches in height. So abundant were these Turritella shells that on consolidation of the fragmental shell material to form limestone their beautiful shells made up such a large part of the Clayton limestone in Tippah County that it is scarcely possible today to break one shell from the rock without destroying two or three others at the same time.

Farther to the south, especially in Clay and Oktibbeha counties, the shell fish were different; they did not contribute shell fragments that, on consolidation, formed massive crystalline yellow limestone like that of Tippah County. Rather each was a small clam-like or oyster-like form, *Ostrea pulaskensis*—"an oyster so small that it would take a thousand to make a meal," Watson Monroe—whose test fragments when mixed with the reworked Selma chalk so resemble that material as to be readily mistaken for it. Obviously then the Clayton sea shore environs differed from place to place at the same time as did Clayton life.

The Porters Creek sea of early Cenozoic time so quietly succeeded the earlier Clayton sea, that the sediments which accumulated seem to form a perfect transition from the one to the other. The shell fish perished or at least moved on, for, whereas shell marl was accumulating before, fine clay now filled the sea or the borders of the sea. The waters were exceedingly quiet, for no current was strong enough to bring in any material coarser than clay. Furthermore, they were so remarkably quiet that most currents were too weak to develop bedding planes, in consequence of which the clays are still massive, though they do break into spherical masses by means of conchoidal fracture. Furthermore the waters must have remained so over a long period of time, for during this time hundreds of feet of these, the finest of sediments, accumulated.

Figure 5.—Lakelet Palila in winter dress.

Farther to the north in Tippah County swifter currents disturbed the borders of the Porters Creek sea and brought to them sandy sediments as well as the finer clays. On consolidation, these formed the sandstones and interstratified shales, the Tippah sandstone member, so beautifully exposed in the street which extends up the steep hill on the west side of Blue Mountain College.

Most everywhere, though, the Ackerman border sea, by gradual transgressional stages, succeeded the quiet Porters Creek sea. While the Ackerman sea, too, was so still at times that it received, for the most part, only fine clayey material, it did possess sufficient currents to develop bedding planes even in the finest of its sediments, forming shales rather than clays of them. But these times of feeble currents alternated with times of somewhat swifter currents which brought in coarser sand material, especially early in its history.

Despite the stillness of its waters, the Ackerman sea was a shallow sea, a sea so shallow in fact that at successive stages it was converted into broad open swamps. In and about these swamps luxuriant forest trees and other plants grew. When their leaves, twigs, limbs, and even trunks fell, it was not upon a forest floor but rather into the swampy waters. In these waters, this vegetable material was largely protected from the oxygen of the air, so that oxidation or decay could take place only to a slight degree. Accordingly, through long intervals of time,

Figure 6.—Main lake the shore line of which shows the outline of the natural valley above the artificial dam.

the vegetable material slowly accumulated to great thicknesses, when currents, through submergence and other changed conditions, brought in mud and buried it. So buried, it has been converted into lignite; and thus protected, it has been preserved unto this day—the lignite beds of undetermined potential value.

Thus through the ages swamp succeeded sea and sea succeeded swamp in the Legion State Park environs. In these, the clays, the shales, the lignitic shales, and the beds of lignite, now exposed in the Park, accumulated. Therefore, while Legion State Park cannot boast of an ancestry extending back into the remotest geologic time, it can boast of one reaching back millions of years.

The border Ackerman sea of alternate quiet and swift currents gave way to the Holly Springs border sea into which great quantities of sand were dumped, largely as deltaic material. So swift were the stream currents that much of this sandy material was deposited in cross beds visible in Blantons Gap at Ackerman, in Legion State Park environs, as well as in nearly every other exposure of Holly Springs sand. At times, especially in mid-Holly Springs age, the currents were so weak that only the finest clay, the famous Holly Springs pottery clay, was deposited.

Successive later Eocene and Oligocene seas covered the southern and central parts of the state, but each succeeding sea, seemingly, failed to reach as far northward up the Mississippi Embayment as had its predecessor. In other words, each succeeding sea filled the embayment farther and farther southward, in which direction the beds were originally inclined and now dip. The beveled edges of these dipping beds constitute their belts of outcrop, as do those of earlier Gulf Coastal Plain deposits.

Miocene, Pliocene, and Pleistocene sea, stream, and coastal currents in each successive age contributed their part to the filling of the Mississippi Embayment until the Gulf shore came to be where it now is. Pleistocene winds deposited Loess along the Mississippi River Bluffs; and recent streams deposited alluvium on the Mississippi-Yazoo flood plain, thus completing the task of deposition.

MORE DETAILED GEOLOGIC HISTORY OF LEGION STATE PARK

But so far as Legion State Park's more detailed geologic history is concerned another process had already begun, as always begins, when an area is silted up to sea level or is raised above sea level. The rains and the streams had already begun to carry particle by particle the newly formed lands seaward. Into them they carved the surface features of Legion State Park, another one of God's beauty spots.

No sooner had these seas withdrawn from the coastal plain of newly formed beds than the rain that fell upon this gently gulfward-sloping surface, collected into tiny streams. These grew headward, and laterally by developing tributaries. And as the main stream and the tributaries grew, the tributaries in turn developed other tributaries, and these in turn still others, and so ad infinitum. Thus, as the main stream and tributary streams grew larger, a river system developed that has a dendritic or tree-like pattern.

As the stream grew, it cut first a gulley; then, by continuing the process, it formed a ravine of it; and, finally, a valley. It thus cut first a youthful V-shaped valley, then a wider valley, and finally a wide valley having a broad flood plain.

At first these streams carved only narrow grooves into this gently gulfward-sloping plain. These grooves, they cut deeper, wider, and extended farther headward. Eventually they transformed the plain into a region of slopes, into one of mature topography, whose ridges are the opposite counterparts of the valley system—an opposite dendritic pattern.

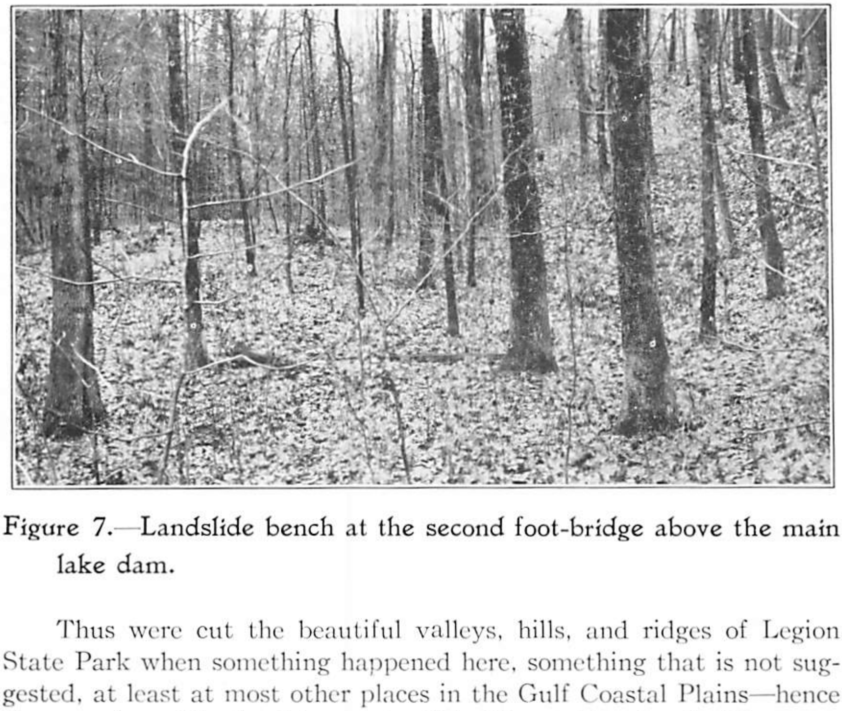

Figure 7.—Landslide bench at the second foot-bridge above the main lake dam.

Thus were cut the beautiful valleys, hills, and ridges of Legion State Park when something happened here, something that is not suggested, at least at most other places in the Gulf Coastal Plains—hence the surprise. The land began to slide (Figure 7). Land slides were initiated on the slippery clay and clay shales of the Ackerman formation.

When the streams had cut down into this clayey material, the state of equilibrium was disturbed, and the clays could not sustain the additional stresses thus developed. Consequently parts of these ridges cleaved and moved down slope. Where there had been one ridge, there were now two—not twins, for one was derived from the other and was smaller.

One of the largest of these cleaved ridges lies directly west of the main ridge (Figure 2) extending toward the Lodge. The mass moved westward but a few feet, leaving between a linear depression resembling an old road cut. Farther to the west, near the parking space, but separated from the same main ridge at earlier dates, are two or more ridges or waves of slipped material. Toward the east is a cleaved mass that has slipped farther downward. Rather than one, Old Man Topographic Adam thus suffered the loss of at least four ribs or slices from his sides: three on one side, and one on the other.

Figure 8.—Landslide knoll that slipped away from Lodge hill.

Another beautiful rounded mass (Figure 8) slipped northward off the knoll on which the Lodge is now located (Figure 9). Another and yet other ridges without an erosional valley between them and the main ridge reveal how numerous have been these slips; how many the polygamous Adams.

But these land slide ridges and hills are not the ugly scarred masses of most land slide regions. Rather they are beautifully rounded ridges and hills (Figure 8), which, according to the evidence of the tree growth which they now support, came into existance 25, 50, and 75 years ago. They add immensely to the charm of the other work of that great natural sculptor, running water. They are so beautifully unusual that they constitute the Park's surprise.

Figure 9.—Lodge located on Adam's head.

Figure 10.—Main lake in spring attire.