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A NOTE ON THE DISCOVERY OF SAND FULGURITES IN MISSISSIPPI

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INTRODUCTION

Natural glass formed by lightning striking the surface of the earth is known as fulgurite. The name derives from the Latin word *fulgur*, and translates into English as "lightning." Fulgurites form when heat generated from the electrical discharge we call lightning passes through quartz-rich sediments or rock, causing localized melting and the formation of an unstable natural silica glass (lechatelierite). The heat of lightning has been estimated to be as much as 30,000° K (Orville, 1968), far in excess of the melting point of quartz. A temperature of approximately 1,800° C is required for the rapid melting of quartz, such as results from a lightning discharge (Rodgers, 1946). The extreme conditions created by the electrical discharge of lightning have also been suggested by Daly and others (1993) as a natural source of fullerenes—isotopes of carbon (C_{60} and C_{70}) first identified as a product of laser ablation.

Fulgurites are classed as sand fulgurites or as rock fulgurites, according to the type material through which the electrical discharge passed. Rock fulgurites typically consist of a glass crust formed when lightning strikes bare rock surfaces (Frondel, 1962). Sand fulgurites take the form of hollow glass tubes of various shapes and are found in silica-rich sediments, typically outcrops of quartz sands or quartz sand beaches.

Sand fulgurites have been documented from several states along the Atlantic Coastal Plain, and from the western and the midwestern states, but few have been reported from the Gulf Coastal Plain or the Mississippi Embayment. Fulgurites from the Mississippi Embayment are rare, and few geologists have ever had the opportunity to examine one.

Two fulgurites from Mississippi (Figures 1 and 2) were recovered from the Tertiary Tuscahoma Formation and Meridian Sand. Both were recovered from sand pits, and the lithologies hosting the fulgurites were, in both cases, predominantly quartz sand. Both were recovered by the authors while conducting field work associated with surface geological mapping. Both are assumed to be of modern origin, although fossil fulgurites are known to exist. These specimens are the first to be reported from Mississippi.

A SAND FULGURITE FROM LAUDERDALE COUNTY, MISSISSIPPI

The first fulgurite was found in a small sand/clay pit in the basal sand of the Tuscahoma Formation during field mapping activities in 1992. The pit is located along a secondary road in the SE/4, SE/4, Section 27, T.17N., R.18E., Lauderdale County (Figure 3). Mining at the pit appears to be restricted to local users. This specimen was recovered from a sediment fan that formed on the pit floor through sloughing of the pit highwall. Several small, broken fragments were found with the specimen but were not collected. A search was conducted to find additional pieces of the fulgurite but was unsuccessful. The sand in the pit is white (N9) to pale yellowish-orange (10 TR 8/6) to grayish-orange (10 YR 7/4) (Geological Society of America, 1984), unconsolidated, cross-bedded, fine- to medium-grained quartz. The sand is micaceous and iron cementation occurs along bedding planes. Minor amounts of clay are present in the sand but are dispersed due to deep weathering of the outcrop.

The fulgurite is a medium dark gray (N4) hollow tube 3.5 inches (8.9 cm) long and 0.75 inch (1.90 cm) wide (Figure 1). It has a counterclockwise spiral (left rotation) with a wavelength approximately coincident with its length. The central tube is ellipsoid and irregular in shape. Diameters measured at the broken surface ends vary. The short axis measures 0.3 inch (0.8 cm); the long axis measures 0.5 inch (1.3 cm). The tube wall varies in thickness from 0.075 inch (0.190 cm) to 0.125 inch (0.318 cm) and is comprised of a fused glass matrix with inclusions of numerous gas vesicles and a few partially melted sand grains. Gas vesicles appear globular and vary in size up to approximately 0.05 inch (0.12 cm). No evidence of vesicular alignment perpendicular to the tube wall was observed. The inner tube wall is mostly smooth but pitted by vesicle openings. The outer wall has an appearance similar to volcanic pumice, due, in part, to the acicular or bladed glass projecting from the outer surface. The pumice-like appearance derives from a granular texture, likely a feature resulting from partially melted sand grains of the surrounding sand matrix. The outer surface has numerous small nodes, 0.075 inch (0.190 cm) to 0.3 inch (0.8 cm) in size, extending out from the tube wall. In general, the nodes appear randomly spaced over the surface. In places, however, they appear to exhibit a rough alignment over the length of the tube, suggesting poorly formed wings, but this relationship is not clear. Partially fused sand grains are incorporated into the outer tube surface as well. White and orange coloration is evident on both the inner and outer tube surfaces. The orange coloration is associated with iron staining related to weathering of the sand body which encased the specimen. The white coloration is related to inclusion of partially fused milky quartz sand grains and/or a white clay. The white clay inclusions are most likely derived from the clays dispersed within the outcrop.

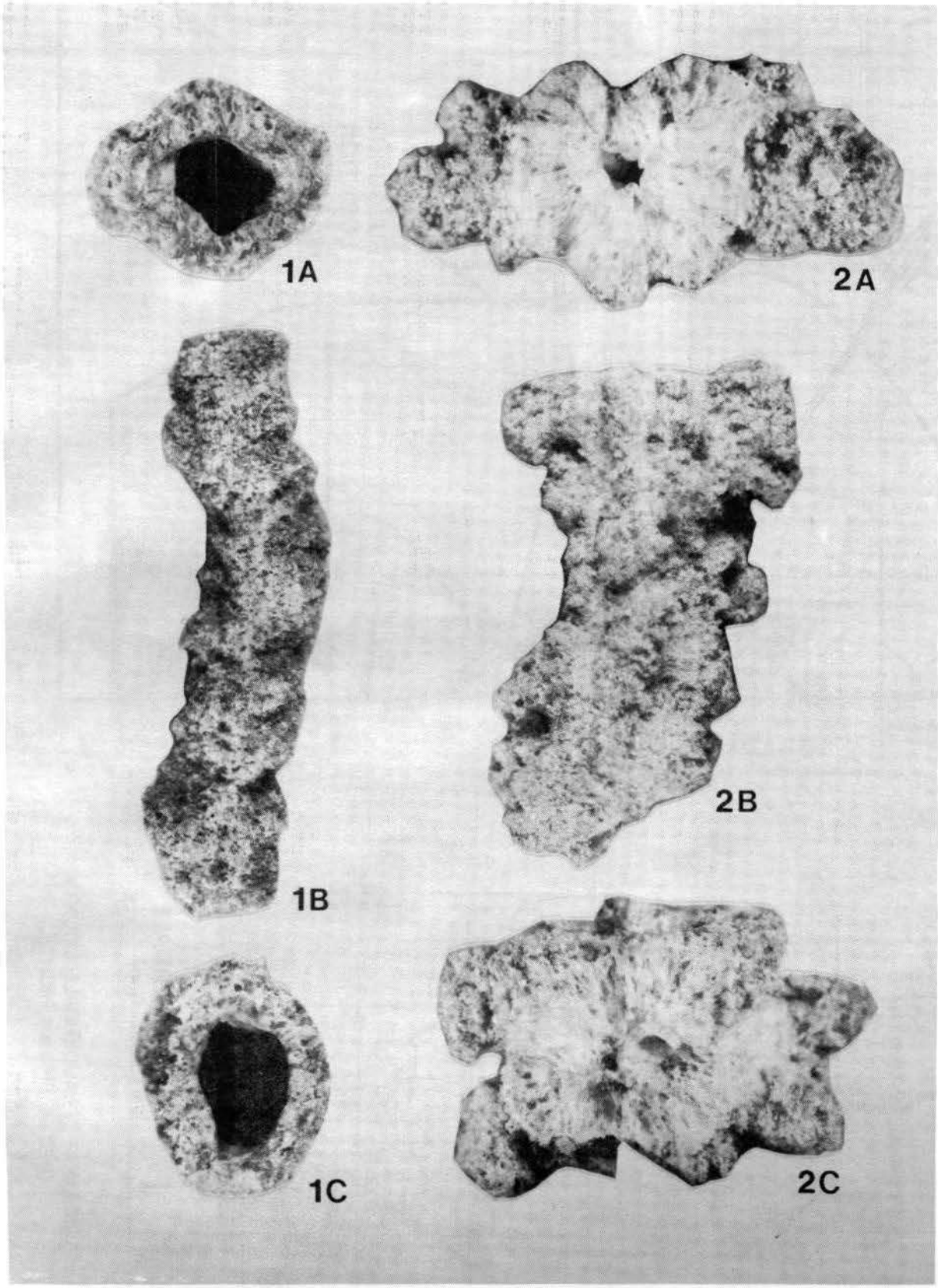
A SAND FULGURITE FROM TIPPAH COUNTY, MISSISSIPPI

The fulgurite recovered from Tippah County, Mississippi, was found in a commercial sand pit operated by Benefield Sand Co. and located a few miles west of Ripley (Figure 4). The specimen was recovered by the mine operators during the process of sand beneficiation. It consists of a fragment broken from what was undoubtedly a larger specimen. Benefield Sand Co. is mining the Meridian Sand, the basal unit of the Claiborne Group. The grain size ranges from fine to coarse, but medium-grained sand is the most abundant component. The sand may also contain minor amounts of dispersed clays (typically less than five percent) and small amounts of iron oxides derived from present day weathering.

The fulgurite is 2.8 inches (7.1 cm) in its longest dimension (measured parallel to the hollow central tube) and, when viewed in cross section, is strongly "winged" (Figure 2) at one end of the fragment. The "winged" aspect becomes less marked toward the opposing end of the fulgurite fragment where the wings are diminished in size and additional ridges are present. Where best developed, the wings are as much as 0.5 inch (1.2 cm) wide, resulting in a total width of 1.75 inches (4.44 cm) at the widest point, and approximately 1 inch (2.54 cm) at the opposite end. The diameter measured between the wings, *i.e.*, the diameter of the body of the fulgurite, is 0.8 inch (2.0 cm) at one end and 0.9 inch (2.2 cm) at the other. A central, hollow tube is characteristic of fulgurites, and, in this specimen, the central tube has a maximum diameter of approximately 0.1 inch (0.2 cm). The central tube is irregular in shape with the walls consisting of smooth, globular glass.

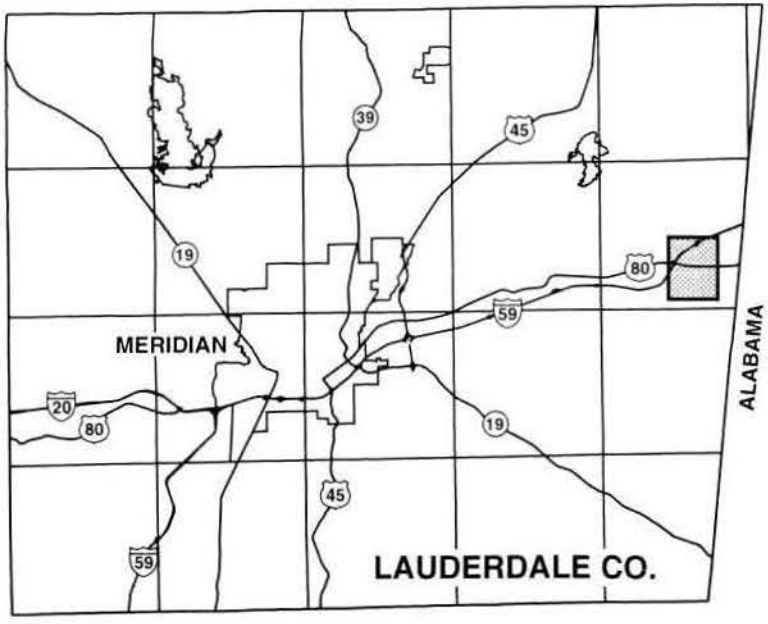
The body of the fulgurite consists of a vesicular glass, with elongate vesicles oriented with their longest axes normal to the central tube near the center of the body of the fulgurite. The glassy walls contain what appears to be incompletely melted quartz encased in the vesicular glass. Near the perimeter of the body is a thin, discontinuous zone of moderate reddish-orange color (10 R 4/6, Geological Society of America, 1984). This coloration is probably derived from iron oxides that were present in the parent sediment.

Major external features include the wings described earlier, as well as poorly defined, knobby, spiral ridges located along the length of the fulgurite body. The wings and spiral ridges appear to be separate features which commingle in some areas of the fulgurite. The intricate external surface consists of an overall acicular texture resulting from partially melted quartz grains and fine needles of glass. There are also fine white grains attached to the exterior of the fulgurite which appear, under magnification, to be clay minerals.



Figures 1-2. Side views x1.2, end views x2. Figure 1, fulgurite from Tuscahoma Formation in Lauderdale County, Mississippi. Figure 2, fulgurite from Meridian Sand in Tippah County, Mississippi.

LOCATION OF LAUDERDALE CO.
IN MISSISSIPPI



LOCATION IN LAUDERDALE COUNTY
(DETAIL SHOWN RIGHT)

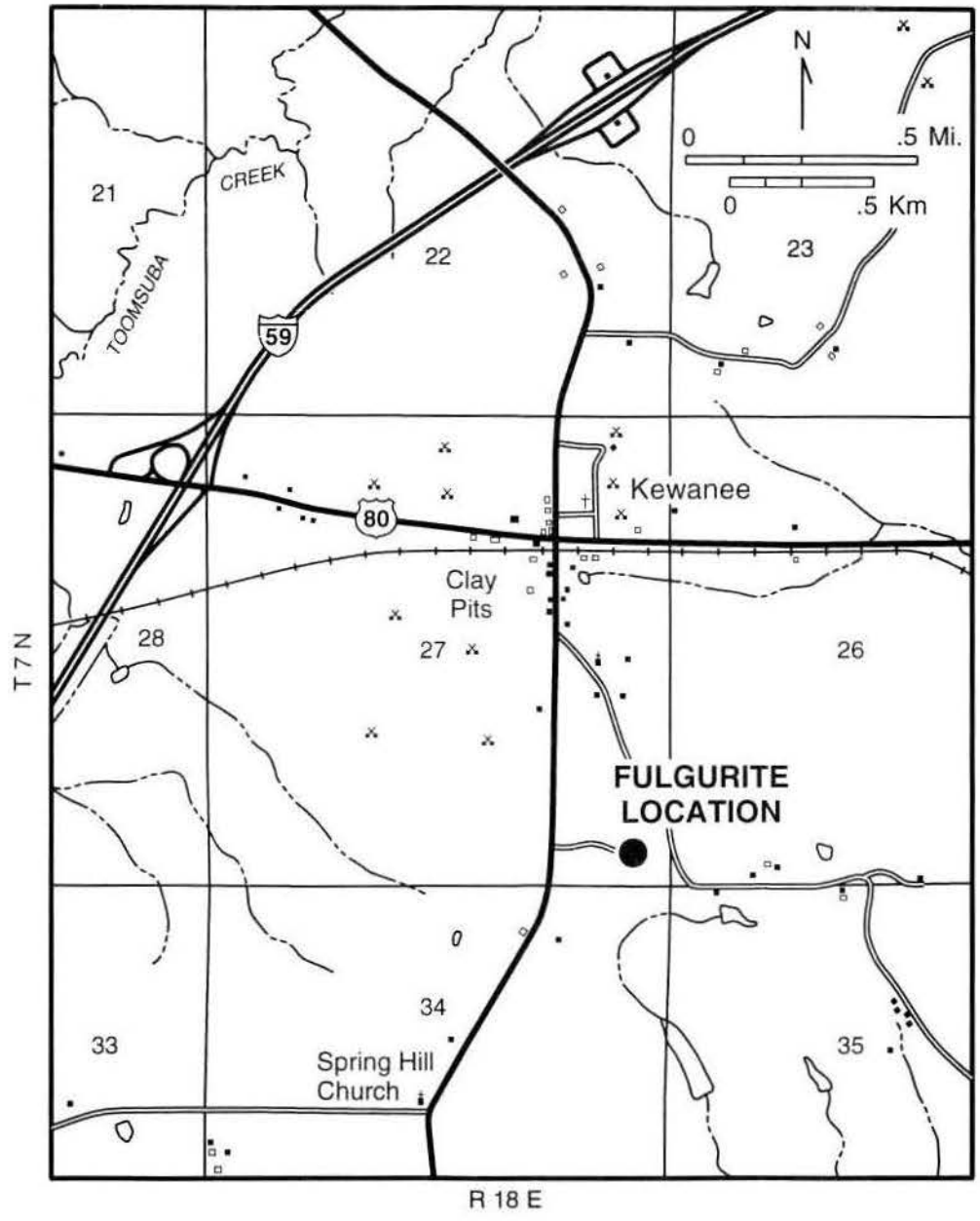


Figure 3: Location of the sand pits in which the Lauderdale County fulgurite was found.

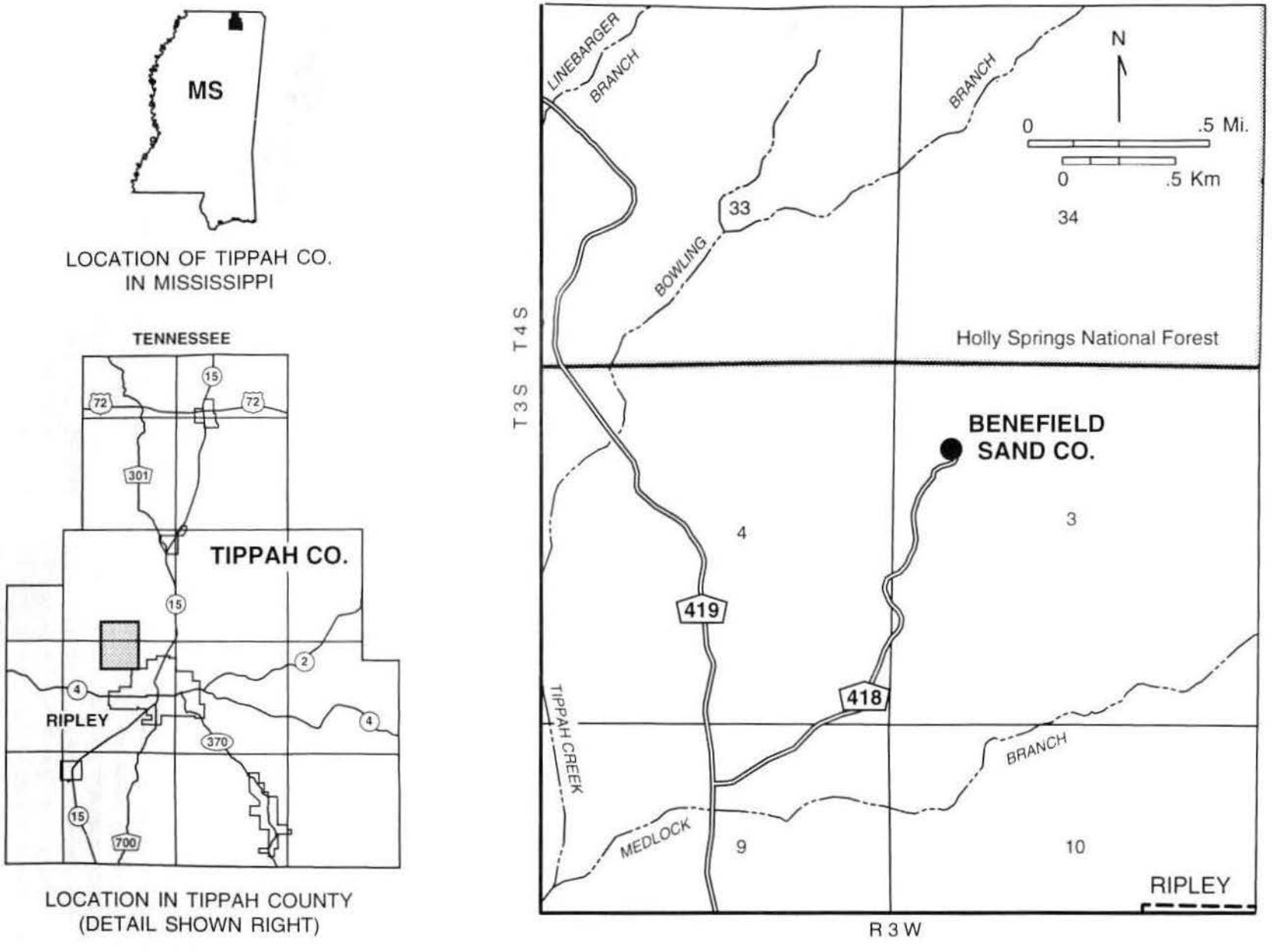


Figure 4: Location of the Benefield Sand Co. These sand pits are where the Tippah County fulgurite was found.

CONCLUSIONS

Sand fulgurites are known from throughout the United States, but are not commonly found in the Mississippi Embayment. The fulgurites described herein were collected from Tertiary units consisting predominantly of quartz sand, and represent the first fulgurites to be described from Mississippi. Although similar in overall features, they are strikingly different in color and details of exterior morphology. This physical variability probably represents variability present in the lightning itself and in the sediment through which the electrical current passed.

ACKNOWLEDGMENTS

The authors wish to express their appreciation to Mr. Rusty Benefield and Mr. Bobby Benefield, who brought the Tippah County fulgurite to our attention. We acknowledge the assistance of Mr. Paul Mitchell, Technical Design Specialist at the Mississippi Mineral Resources Institute, who constructed the line illustrations, and Dr. David Dockery, Mississippi Office of Geology, who provided the photographs of the fulgurites. Ms. Carol Lutken, Research Associate at the Mississippi Mineral Resources Institute, provided critical review of the manuscript.

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FIRST EDMAP GRANT IN MISSISSIPPI

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University of Mississippi graduate student McCullough Moyse is receiving funding from the U.S. Geological Survey Educational Geologic Mapping Program in support of her geologic mapping project of the Myrtle, Mississippi, quadrangle. Ms. Moyse is the first graduate student in Mississippi to receive funding from this program. Objectives of the Educational Geologic Mapping Program include providing funds for graduate students where geologic mapping is a major component. Ms. Moyse, a native of Greenville, Mississippi, received her Bachelor of Science degree in Geology from Millsaps College in Jackson.

The Myrtle quadrangle is in northern Mississippi, just northwest of New Albany. Rocks from both the Midway and Wilcox groups are present in this general area. The Porters Creek Formation, a Paleocene-age clay, crops out throughout the Myrtle quadrangle. This clay has well-established abilities to swell upon hydration, and locally is mined and sold for industrial purposes because of its swelling capacities. Rocks of the Porters Creek form an expansive soil upon weathering, leading to foundation and road maintenance problems. The continued growth of New Albany into this area has resulted in housing developments being built on the Porters Creek Formation. Accurate location of this formation at a 1:24,000 scale will be useful to the municipality of New Albany in its efforts for planning in an area undergoing rapid urbanization.

The Mississippi Office of Geology is providing a stratigraphic drill hole for this project, in order to completely sample the Tertiary formations at depth. Such information is critical for an understanding of the geology in three dimensions. The core hole will be drilled near the western edge of the map area, immediately north of the town of Myrtle.

Ms. Moyse's activities are coordinated with Charles Swann of the Mississippi Mineral Resources Institute. Mr. Swann has extensive mapping experience in northern Mississippi. Former State Geologist Tracy Lusk, who has authored regional maps in this area, is also a consultant on this project.

INSIDE *MISSISSIPPI GEOLOGY*: THE JOYS AND PAINS OF PUBLISHING A SMALL GEOLOGICAL JOURNAL

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Mississippi Office of Geology

To look inside *Mississippi Geology*, one does not have to look far. The editing and publication of this journal are the responsibility of just two of the Mississippi Office of Geology's 36 staff members; the Assistant State Geologist Michael Bograd serves as senior editor and Director of the Surface Geology Division David Dockery serves as assistant editor. Together, and on top of other duties, the editors see the publication through from the acquisition and editing of articles to collating and saddle-stitching the issues by hand, either with or without additional help. For many years, these responsibilities included sorting addresses and bulk mailing, a process now done by a commercial vendor.

Looking a little deeper, one finds a layout artist or "graphic designer" and a printer behind each issue. From the first issue to the present, the printer has been the same, Bill Howard of the Department of Environmental Quality's print shop. The typesetting for the first volumes of the journal was done by a commercial typesetter. The typesetters were always great people to work with—pleasant, helpful, competent—but repeated trips downtown to their office for corrections were a nuisance. The galleys then had to be cut and pasted, and shifted around, to do the layout.

The advent of word processing programs on the personal computer has made a world of difference. No more galley proofs. At present, we edit the text using our familiar software and take it on a diskette to the graphic artist. For many years the layout was done by graphic artist Marilyn Ellis, who left the department after getting the desktop publishing system running smoothly. A recent note from Marilyn included an invitation to her graduation from the University of Houston with a Master of Science in Occupational Technology. The *Mississippi Geology* layout is now performed by graphic artist Joe Wilson, who has climbed the learning curve on PageMaker software to become proficient.

Maintaining the mailing list for *Mississippi Geology* requires constant attention as professional geologists and other subscribers have been very mobile since the 1980s. Many times we are not informed when a subscriber leaves an oil company, as his subscription is read by his replacement or others. The mailing list is organized by zip code and has been maintained in recent years by Angie Herrington. Jean Inman, Margaret Allen, and Erni Rutledge have helped with the mailing labels and zip code sorting through the years. Labels and mailing services are now performed by a commercial vendor.

Many hurdles stand in the way of each *Mississippi Geology* issue. These include the timeliness of submitted articles and the workload of the editors. The most serious problem we have in publishing this journal is when we do not have any articles in hand and it is time to put an issue together. Sometimes we get out of this fix by receipt of an unexpected manuscript. The editors sometimes resolve the problem with an impromptu article of their own. Once an issue is ready for press, the editors then cross their fingers as they take the issue to the graphic artist, hoping that he's not in the middle of some major project. At this stage, the layout may go through several edits before it's ready for the press. One problem is that the page-layout must be in signatures of four pages each (i.e., a 12, 16, 20, or 24-page issue). The probabilities are not good that the layout will fall out this way by chance, even though it seems to do so against the odds much of the time. The bottom line is, once the issue is paged up, we may find ourselves looking for a filler item.

Many filler items come from spur of the moment ideas, and, surprisingly, they often receive more reader attention than do the main articles. A short note and photograph concerning the find of an exceptionally large "*Carcharodon*" shark tooth collected near Yazoo City (June 1981 issue) prompted a flurry of reports of other such findings and led to an article on giant shark teeth from across the state (September 1986 issue). An announcement of a publication in progress accompanied by illustrations of three, randomly-selected, fossil shells (December 1988 issue) was noticed by Lindsey Grove of the Natural History Museum of Los Angeles County, who later named one of the shells as a new species in the molluscan journal *Veliger* (1990, v. 33). One fun filler item reviewing two science-fiction novels (September 1997 issue) received animated comments from California.

Another hurdle the editors face is catching the printer at the right time with the ready-for-press layout. Often, we get a smile and hear, "Man, I've got to finish running 40,000 letterheads (or envelopes, or thousands of copies of pollution regulations). When the printer's work begins, he must shoot the negatives, splice in the halftones, burn the plates, print the pages, and then fold the pages in the shop's temperamental folder. Next the editors come in to collate and saddle-stitch the issue by hand. Often helping with this is a long-time staff member, Robert Ervin, and whoever else we can find.

For much of our publication history, the last obstacle in our way was the U.S. Postal Service's Bulk Mailing Office. Each time we brought in a stamped, sorted, bundled, and bagged shipment, with our hands full of paper cuts and rubbed raw from the thick, Post Office-issued, rubber bands that were required for the bundles, we faced the possibility it would be rejected.

Perhaps the sorting was not perfect or a bag was incorrectly labeled or someone forgot to pay our bulk mail fee or we were unaware of some new regulation/requirement. These requirements seemed as fluid as water; perhaps those who mailed on a monthly basis could keep up with them, but our mailing was quarterly. Sometimes the shipment would be accepted and we would be charged for mistakes. It all seemed to depend on the changing policies and changing faces we encountered across the bulk mail counter. Finally the rules became indecipherable. That was when we turned our bulk mail problems over to a commercial mailer, after going through the state government contracting process.

So, why would sane people add such a burden to their professional responsibilities? Because the job of publishing new work in geology is exciting and comes with a feeling of accomplishment. There are many rabbit trails we would like to follow as we conduct and manage research into the state's geology. *Mississippi Geology* gives us a publication avenue to bring relatively short papers to press in a timely manner and to distribute them to 1,000 readers here and overseas, a readership that extends beyond the geological profession. Also the journal allows us to encourage others outside our staff to publish on their research within our state and sometimes to begin new research in Mississippi, thus extending the work of our staff without an increase in the payroll. Many times the editors solicit articles from those they know to be conducting important research, information which might otherwise end up in the black hole of some company file.

It has been a pleasure working with all of the authors who have contributed work to the journal. It is a compliment to us for an author to think enough of our journal to submit an article on which he has devoted long hours of work. The only problem we have ever had with authors is when they do not send in a promised article. We learned early on not to "make up" an issue with articles not yet received. Even the most believable promise and imminent submittal cannot be taken for granted. Sometimes long-promised manuscripts do come in. We seem to suffer from feast or famine. Sometimes we have many articles in hand and have to explain to authors why their article is not in the new issue of *Mississippi Geology*; sometimes we have no articles in hand.

In some ways *Mississippi Geology* has been a timesaving publication for the editors. Many articles are tailored to address those questions most frequently asked by the public and by professionals. At one time, responding to such inquiries meant time-consuming research and lengthy letters. Now, many of our responses require only a short note and the appropriate issue of *Mississippi Geology*. Two issues tailored to the public (June 1995 and December 1996) illustrate and identify rocks and fossils that children (and adults) so often find in creek and driveway gravel. When someone asks about the volcano under the state's capital city, we can send him the article about the Jackson Volcano in the September 1997 issue. If the question is about earthquakes, we can send a copy of the December 1992 issue with an article about earthquake occurrences in Mississippi. For many other *Mississippi Geology* subjects, the agency's Open-File Report 15 carries a current index to the journal that is updated with each new issue. This report is available from our Publication Sales department for $2.00 (plus $2.00 for postage and handling if ordered by mail). The latest version (revised after December 1997) covers 70 issues, showing those still available, and lists 127 authors and 190 titles. This report is close at hand on the editors' desks and dog-eared from use.

Mississippi Geology was created at a special time within the Office of Geology. It was a time of youthful energy, an active oil exploration industry, and a large and influential Mississippi Geological Society. When it was suggested that we publish a regularly scheduled journal, the idea was immediately approved by State Geologist Bill Moore. Models for the new publication included *California Geology*, *Pennsylvania Geology*, and other journals published by state geological surveys. Production of this journal began in 1980 when Dora Devery, an energetic Rutgers graduate married to Justin Devery, a geologist working for an oil company, saw potential in the senior editor's long-time wish for a journal and responded with "Let's do it!" She became the journal's first assistant editor.

Finding articles for the new journal seemed to be no problem. With staff members like Danny Harrelson, who studied Mississippi's subsurface igneous rocks for fun while running the office's water-well logging program (a program featured in *Mississippi Geology*'s first issue, September 1980), and librarian Anne Bellomy, who spun off four *Mississippi Geology* articles while researching for a compendium bulletin on the "Bibliography of Mississippi Geology," material seemed assured.

Also at this time, the Mississippi Museum of Natural Science (once a wildlife museum) was discovering paleontology with the help of their new geologist hire Michael Frazier. Funds were raised to pay Ken Carpenter, author of four *Mississippi Geology* articles and now a famous dinosaur expert, to mount the museum's fossil whale. Afterwards, a resolution in the state legislature declared the fossil whale as the state fossil.

Some of the journal's paleontology articles were written by specialists overseas. Four such articles were written by Luc Dolin of France, some of which were coauthored by his brother Cyrille and by Pierre Lozouet, now with the French National Museum of Natural History in Paris. Dirk Nolf of the Royal Belgian Institute of Natural Sciences wrote two articles on the fossil ear bones (otoliths) of Cretaceous and Tertiary fish. Ernest E. Russell, professor emeritus of Mississippi State University, once told of his first meeting with an executive and well-known German geologist at a geological institute in Krefeld, Germany. The executive greeted him by waving the latest issue of *Mississippi Geology* and acknowledging, "I know where you're from."

With such diverse and interesting contributions to geol-

ogy, we know that *Mississippi Geology* must have some fans among its readership, even if we seldom hear from them. The publisher of a small scientific journal, such as *Mississippi Geology*, receives very little feedback from his readers. The bits we get are treasured. What are we doing right? What are we doing wrong? The editors generally have to figure this out for themselves. What kinds of articles do our readers want to see? We have to make assumptions based on our familiarity with the kinds of people on the mailing list. The mailing list includes geologists and paleontologists in industry, government, and academia, as well as the interested lay public—people who are interested in collecting rocks, minerals, and fossils or who are interested in the history of science and information about "how the world is made." This is a diverse group. We try to please our readers by publishing a range of articles from scientifically academic or technical to popular items on interesting rocks or fossils.

Through the years we have received some very nice and encouraging compliments. These are always a joy to receive. Some examples follow:

"I would like to be placed on the list of subscribers to *Mississippi Geology*, beginning with v. 1, no. 1. It appears to be a very useful publication for those of us working in this state."—from Hattiesburg

"I wish to compliment you and your organization on the new publication *Mississippi Geology*, which promises to be a valuable addition to the literature."—from Bloomington, Indiana

"The publication represents good work. I appreciate the subscription."—from Jackson

"Let me congratulate you on a very nice-looking issue. I think that *Mississippi Geology* serves a real need in the Southeastern area. I hope that it will continue to be published for a great many years to come."—from Oxford, Ohio

"I recently read a copy of your quarterly journal *Mississippi Geology* and found it extremely interesting. Would you please enter a subscription for the journal in my name?"—from Marathon Oil Company, Houston, Texas

"This is to let you know how much I enjoy receiving your publication *Mississippi Geology*. It's interesting, informative, and well done. I hope to see it continue for many years to come."—from Tennessee Valley Authority, Knoxville, Tennessee

"I have recently begun to work in the Mississippi Salt Basin and have found your journal to be a valuable source of information. The addition of my name to your mailing list would be greatly appreciated."—from Richardson, Texas

"I read with a great deal of interest your recent article appearing in the *Mississippi Geology* magazine on the excavation of a mastodon at Vicksburg, Mississippi. In fact, thus far I have read it twice. It is absolutely fascinating. I want to congratulate you on a fine job."—from Mississippi Museum of Natural Science Foundation member, Jackson

"I will use the publication in my earth sci. classes, my physical sci. classes and my biology classes."—from Ruleville

"I want to thank you very much for sending the back issues of *Mississippi Geology* and adding my name to the mailing list....I never dreamed such a good publication existed."—from Ruleville

"I have been meaning to write and tell you what a fine job is being done with *Mississippi Geology*. The articles are well written and illustrated, readable, interesting and timely, yet of permanent value. Keep up the good work!"—from Bellaire, Texas

"Thank you very much for copies of the September '85 and September '86 issues of *Mississippi Geology*; I am impressed with your publication and would like to have back issues....Your photo-essay on "The Making of a State Fossil" was a mind-boggler! We hope to get over to Jackson to see the real thing."—from Ocala, Florida

"Thank you for the back issues of *Mississippi Geology*. I just spent the last two hours cataloging all the articles that pertain to Paleogene faunas and environments. This journal is a real gem!"—from California State University, Northridge

"Your *Mississippi Geology* publication is a very high quality quarterly, and I would very much like to continue receiving it."—from Garyville, Louisiana

"Thank you for your assistance, and congratulations to all concerned on a very professional publication."—from Norristown, Pennsylvania

"I also want to take this time to thank you for such a well planned and information packed publication as *Mississippi Geology*....I look forward to my four annual issues."—from Camden, South Carolina

"Congratulations on your *Mississippi Geology* publications. You are doing fore-front work."—from Ithaca, New York

"This type of geologic publication is an excellent vehicle to promote geologic interest and to keep the public informed of your projects." –from Hot Springs, Arkansas

"Thanks very much for continuing to send me *Mississippi Geology* -much appreciated. Your latest very informative

paper on French Tertiary localities and calcareous nannoplankton correlations with USA is particularly valuable, thanks very much."—from New Zealand Geological Survey

"Your periodical makes interesting reading for me & my students. Keep up the good work."—from Department of Geology and Geophysics, University of New Orleans, Louisiana

"The only purpose of this note is to tell you how much I appreciate receiving these issues, ... You and your fellow editor are really doing a very fine job of enlightening us about the geology and paleontology of Mississippi and surrounding areas."—from Department of Paleobiology, U.S. National Museum, Washington, D.C.

We apologize to those who wrote complimentary letters not included and to the many authors not mentioned. We appreciate you all. In explanation to those wondering about our bout with nostalgia and stroll down memory lane, we had a few pages to fill.

NEW PUBLICATION AVAILABLE FROM THE MISSISSIPPI OFFICE OF GEOLOGY

GEOLOGIC MAP OF THE REFORM QUADRANGLE, CHOCTAW COUNTY, MISSISSIPPI

The Mississippi Office of Geology announces the availability of Open-File Report 55, "Geologic Map of the Reform Quadrangle, Choctaw County, Mississippi," by David E. Thompson.

Open-File Report 55 is a geologic map of the Reform 7.5-minute quadrangle, printed in color at the scale 1:24,000. It is one of our series of geologic quadrangles, created in a geographic information system using ARC/INFO software and printed on an inkjet plotter. The geologic map differentiates five geologic units in the Midway and Wilcox groups of the Paleocene Series. From oldest to youngest, the units are the Oak Hill Member and the Coal Bluff Member of the Naheola Formation, the Gravel Creek Sand Member and the Grampian Hills Member of the Nanafalia Formation, and the Tuscahoma Formation. Holocene alluvium is mapped also. This geologic map provides vital information about the area's water-bearing sands and economically important lignite resources.

Open-File Report 55 may be purchased from the Office of Geology at Southport Center, 2380 Highway 80 West, for $5.00 per copy. Mail orders will be accepted when accompanied by payment ($5.00 per copy, plus a postage and handling charge of $5.00 for rolled maps (1-3 maps) or $2.00 for folded maps (1-3 maps)). Send mail orders (with check or money order) to:

Mississippi Office of Geology
P. O. Box 20307
Jackson, MS 39289-1307

telephone (601) 961-5500; publication sales (601) 961-5523

WINNERS OF THE 1998 EGG-CARTON ROCK AND FOSSIL COLLECTION CONTEST

The third annual egg-carton rock and fossil collection contest was held at the Mississippi Office of Geology booth at the Mississippi Gem and Mineral Society's annual rock show on February 28, 1998. These collections contained twelve rocks and fossils collected from chert gravels native to Mississippi and which were correctly labeled as to rock or fossil type. Guidebook resources used by the contestants included the June 1995 and December 1996 issues of *Mississippi Geology*, containing illustrated articles on rocks and fossils from Mississippi gravel. Winners were: First Place - Aaron Graham of Brandon, Second Place - Scott Graham of Brandon, and Third Place - Brandi Williams of Clinton.

An up-to-date index of *Mississippi Geology* is available from the Office of Geology. Open-File Report 15, "Current Index to *Mississippi Geology*," compiled by Michael B. E. Bograd, is available for $2.00 (plus $2.00 postage by mail) from the Office of Geology, P.O. Box 20307, Jackson, MS 39289.

WHEN NATURE DRAWS THE MAP

Donald M. Hoskins
Pennsylvania State Geologist

The title above is taken from page 16 of the January/February 1998 issue of *Nature Conservancy*, the magazine of The Nature Conservancy, a national organization that protects land and waters to preserve natural living communities. The author of the article states that the maps now used by the Conservancy are "delineated not by political lines or national borders, but by the realms of climate and **geology**" (highlight added). Whereas biological-diversity protection formerly was directed at individual species and small habitat patches, biologists now recognize that larger systems—ecosystems—must be the focus of their efforts. They now use geology as one criterion to define these larger systems.

Geologic maps of bedrock and surficial materials provide basic information for many human endeavors. They long have been used to locate economic minerals and rocks that support our economies and our societal and personal living standards. But, increasingly, geologic maps are being used for many other purposes. For example, they can help define ecological regions, the large natural land areas that support economically valuable or endangered ecosystems for which management and protection are required. It is in these regions, defined by geology and climate, that conservation of biological diversity is now being targeted.

The geology of every land region of our planet determines what we observe as we look out upon our landscapes. Hills and dales, and mountains and lowlands result from differences in resistance to weathering and erosion of the underlying bedrock. The soils on which plant life survives are determined by the constituent minerals of the same bedrock. The quality and quantity of groundwater in a region depend on the rock-defined aquifers. The mineral and water content of the rocks and soils and differing elevations of the landscapes combine to produce a variety of ecological environments, each having a diversity of biological entities.

Geologic maps, combined with their topographic counterparts, are a necessary and powerful tool now being used in defining the key tracts of biological diversity that deserve protection.

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NEW PUBLICATION AVAILABLE FROM THE MISSISSIPPI OFFICE OF GEOLOGY

GEOLOGIC MAP OF THE TOMNOLEN QUADRANGLE, CHOCTAW AND WEBSTER COUNTIES, MISSISSIPPI

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