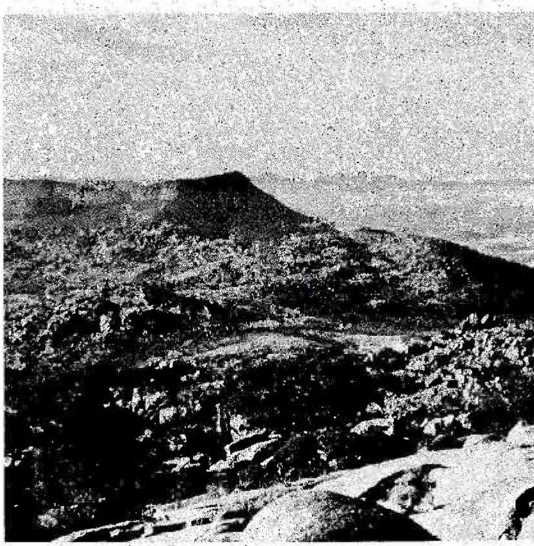
OKLAHOMA GEOLOGICAL SURVEY
THE UNIVERSITY OF OKLAHOMA
NORMAN, OKLAHOMA

$2.00 PER YEAR $0.25 PER COPY

OKLAHOMA GEOLOGY NOTES



VOLUME 27, NUMBER 5 MAY 1967

Cover Picture

WICHITA MOUNTAINS FIELD TRIP

This month's cover picture is a view toward the west from the top of Mount Scott in the Wichita Mountains of southwestern Oklahoma. The prominent peak near the center of the photograph is Mount Sheridan, which is capped by a granite sill overlying gabbro and diorite. Most of the hills seen from this point are composed of granites dated at 525 million years.

The geology of this area was the subject of the one-day field trip that terminated the first annual meeting of the South-Central Section of the Geological Society of America, Inc., March 30-April 1, 1967. Stops were made at significant outcrops of the Wichita Mountains-Southern Oklahoma geosyncline complex in Comanche and Kiowa Counties. The trip was under the direction of George T. Stone, School of Geology and Geophysics, The University of Oklahoma. Clifford A. Merritt, of the School of Geology and Geophysics, and William E. Ham, of the Oklahoma Geological Survey, participated as leaders and as lecturers at the various stops.

The 46-page guidebook, *The Structure and Igneous Rocks of the Wichita Mountains, Oklahoma,* from which the cover picture is taken, contains articles by Drs. Ham and Merritt and by Hugh E. Hunter, State University of New York at Binghamton, and a detailed road log and route map. A limited number of the books is available, and may be purchased at $2.00 per copy from the Oklahoma Geological Survey, Norman, Oklahoma 73069.

Oklahoma Abstracts of Papers Given at GSA Regional Meeting

March 30-31, 1967

The first annual meeting of the South-Central Section of the Geological Society of America, Inc., was held at Norman, Oklahoma, on March 30-April 1, 1967. Papers were presented on March 30-31 at the Oklahoma Center for Continuing Education, at The University of Oklahoma. The meeting was jointly sponsored by the School of Geology and Geophysics and the Oil Information Center of The University of Oklahoma and by the Oklahoma Geological Survey.

Of the forty-five papers presented at the meeting, fourteen were related directly to Oklahoma geology. The abstracts of the Oklahoma papers are here reproduced photographically from the program of the meeting. The permission of the authors and of R. C. Becker, Executive Secretary of the Geological Society of America, to reproduce these abstracts is gratefully acknowledged.

Oklahoma Geology Notes should not be given as the primary source in citations of or quotes from the abstracts. The correct citation is: Geol. Soc. America, South-Central Sec., 1st Ann. Mtg., Program, p. ... Page numbers are given in brackets at the lower right of each abstract.

General Session
March 30, 1967

Basal Surfaces of the Trinity and Woodbine near the Oklahoma Mountains of Southwestern Arkansas and Southern Oklahoma

SPEER, JOHN H., *Dept. Earth Sciences, East Texas State University, Commerce, Tex. 75428,* and FRANK A. MELTON, *School of Geology and Geophysics, University of Oklahoma, Norman, Okla. 73069*

Projected profiles drawn from published topographic maps across the outcrop of the Trinity show the basal erosional surface to be preserved only a few miles updip from the outcrop. The surface, projected upward toward the Oklahoma mountains, southwestern Arkansas and southern Oklahoma, passes well above the present tops of the mountains. Changes in the rate of slope along the strike indicate it has been affected by post-Comanchean, pre-Woodbine movements. Later movements have brought it to its present attitude. The present rate of slope ranges from about 30 feet per mile to 130 feet or more per mile, the maximum rate being reached in the vicinity of the core area of the Ouachita Mountains.

Projected profiles drawn across the outcrop of the Woodbine show the basal Woodbine surface to be preserved an even shorter distance updip from the outcrop. This is most likely the result of the less resistant nature of the pre-Woodbine beds as compared with the pre-Trinity beds. The present rate of slope of the pre-Woodbine surface ranges from as little as 20 feet per mile to as much as 80 feet or more per mile. Again the maximum rate is reached in the vicinity of the core area of the Ouachita Mountains.

A comparison of the rates of slope of the two surfaces shows the pre-Woodbine surface to be in general a subdued replica of the pre-Trinity surface. The difference in the slope rates of the two surfaces indicates that vertical uplift of the order of magnitude of at least 1500 feet occurred in the Arkansas portion of the core area of the Ouachita Mountains during this time. Subsurface data in south-central Arkansas indicate that an even greater amount of uplift may have occurred there during the same time. [26]

Early Paleozoic Overlap, Northeastern Oklahoma

CHENOWETH, PHILIP A., *Sinclair Oil & Gas Co., Tulsa Research Center, P. O. Box 7190, Tulsa, Okla.*

Late Cambrian seas invaded Oklahoma from the east, depositing the Lamotte Sandstone upon a very irregular surface of gently folded and deeply eroded Precambrian granitic and volcanic rocks. During the earliest phases of marine transgression, the seas advanced most rapidly up deep and wide valleys in Wagoner, Rogers, Mayes, Craig, and Delaware Counties. The shoreline extended roughly north-south from north of Tulsa to McAlester. Large islands in extreme northeast Oklahoma became separated from the mainland to the west by a 10–20 mile-wide strait. During the succeeding Bonneterre Dolomite deposition, the hilly coastal area of the mainland remained as another, larger, island extending southward from the Kansas border at least to Okfuskee County. These islands stayed above sea level until late Canadian time, gradually becoming submerged until only a few of the highest peaks remained to form a widely spaced archipelago. Except for two brief episodes of sea withdrawal, the progressive overlap of the islands is recorded in the sediments of the lower "Arbuckle Group." The basal sandstone, Lamotte Formation, is restricted to the channel of eastern Oklahoma. Only small amounts of clastic rocks are found in younger deposits, and there is essentially no basal conglomerate on the islands. **[15]**

Computer-Plotted Base Map for Oklahoma

BOYD, HAROLD A., JR., *Gulf Research & Development Co., Pittsburgh, Pa.*

A general approach to conversion of conventional General Land Office point descriptions (meridian, township, range, section, etc.) to machine-processable point coordinates is described. The system requires use of an electronic coordinatograph, digital computer, and a data plotter. The technique is illustrated by machine-plotted examples from Oklahoma. A table of *xy* values in the appropriate map projection is prepared for the corners of each township. Coordinates for points internal to the township are obtained from the corner data and the established rules for subdivision of a township. Methods for dealing with irregular sections and townships are described. In addition to the reduction of General Land Office location descriptions to digital form, the system also provides points for automatic plotting of the state land grid. [12-13]

Paleontology, Stratigraphy, Sedimentation Session
March 30, 1967

Widespread Zone of Pentamerid Brachiopods in Subsurface Silurian Strata of North-Central Oklahoma*

AMSDEN, THOMAS W., *Oklahoma Geological Survey, University of Oklahoma, Norman, Okla. 73069*

Shells of a large, coarse-ribbed *Rhipidium* (Pentameracea) are present in the highest Silurian beds over a large area in north-central and northwestern Oklahoma. They have been found in eight cores from Cleveland, Oklahoma, Kingfisher, Blaine, and Custer Counties. The Silurian rock with the brachiopods is a gray to brownish-gray, fine to medium-crystalline dolomite with scattered quartz grains. These strata are immediately overlain either by the

Frisco Formation (Early Devonian, Siegenian), or by the Woodford Shale (Late Devonian-Mississippian). The brachiopods make shell-rich beds distributed through the upper 60 feet of the Silurian, with their greatest concentration in the upper 15 feet. No large pentamerid brachiopods of this type have ever been reported from Silurian strata exposed at the surface in Oklahoma and their presence in such abundance in subsurface strata is therefore of considerable interest. This zone occupies the stratigraphic position of the Henryhouse Formation (Late Silurian), which crops out in the Arbuckle Mountains region of south-central Oklahoma, and the few fossils associated with the pentamerids suggest that it is a lateral, dolomitic facies of the Henryhouse Marlstone. These brachiopods, which are large and easily recognizable in cross section, make a distinctive and useful Silurian zone. [11]

Geochemistry and Petrology Session
March 31, 1967

Paleomagnetism of older igneous rocks from Texas and Oklahoma

SPALL, HENRY R., *Dept. Geological Sciences, Southern Methodist University, Dallas, Tex. 75222*

Collections have been made in Texas and Oklahoma as part of a regional paleomagnetic survey of older igneous rocks in the southwestern United States. The directions of natural remanent magnetization (N.R.M.) from the 1.0-billion-year granite from the Franklin Mountains, El Paso, Texas, suggest high magnetic stability, and show little change after A.C. demagnetization to 2800 oersteds. Rhyolite intruded by the granite shows similar high stability, further indicated by the presence of normal and reversed directions nearly 180° apart. Paleomagnetic poles for the two rock types, after structural correction, are close to those for Duluth and Sierra Ancha diabases of the same general age. This suggests that: (1) the geomagnetic field was dipolar at that time, (2) the rhyolite is coeval with the granite, and (3) there have been no large tectonic displacements between those regions rince 1.0 billion years B.P.

The grouping of N.R.M. directions from the 0.5-billion-year granites from the Wichita Mountains, Oklahoma, showed a mean pole 40° away from the present field. After A.C. demagnetization (700 oersteds), the mean pole ($dp = 4°$, $dm = 7°$) lies close to the mean Permian pole for North America and is of reversed polarity. Thermal demagnetization suggests a pole nearer the North American Cambrian pole. This is interpreted as indicating a thermoremanent component of low coercivity reflecting a Cambrian pole. Overprinted on this, possibly as a result of weathering prior to or during the deposition of the overlying Permian sediments, is a high coercivity component which is resistant to progressive A.C. demagnetization.

Initial N.R.M. directions from the 1.35-billion-year Arbuckle Mountains granites (Troy and Tishomingo) from Oklahoma showed fairly high dispersion. This is significantly reduced by A.C. demagnetization to 700 oersteds and a paleomagnetic pole is obtained at 142° W., 26° N., ($dp = 8°$, $dm = 13°$). [25-26]

Structural Geology Session
March 31, 1967

Basement Rocks in Northeast Oklahoma

DENISON, RODGER E., *Mobil Oil Corp., FRL, P. O. Box 900, Dallas, Tex. 75221*

Petrographic examination of samples from more than 130 wells penetrating basement rocks in northeast Oklahoma shows that the rock distribution and petrographic groups are simple.

Four rock units can be defined: (1) Rhyolites, mostly extruded as ignimbrites, and lesser amounts of andesite comprise an extensive rock unit. The rhyolite is converted to metarhyolite around the margin of the unit. (2) Microgranite porphyry is present in a roughly circular area of 320 square miles in southern Osage County. The rock unit is uniform and petrographically distinctive. (3) Micrographic granite porphyry, similar to that occurring near Spavinaw in Mayes County, is present along a broad pre-sediment arch extending from central Oklahoma to southwest Missouri. (4) Coarse-grained, two-feldspar granites underlie the Nemaha uplift, but also occur in east-central Oklahoma.

Fifteen isotopic ages available from these rocks fall into the range of about 1130 to 1280 m.y. with an isochron age of 1200 $\pm$ 30 m.y. The rock units show no consistent difference in age and all are identical within analytical error. The volcanic rocks, microgranite, and micrographic granite are interpreted as a volcanic epizone-type petrographic province. It is similar in many respects to the silicic part of the Cambrian Wichita Province in southern Oklahoma. The two-feldspar granites are more typical of mesozone intrusions and probably represent the deeper seated expression of the same magma that gave rise to the epizonal plutonic rocks and rhyolites. The occurrence of more deeply emplaced rocks at the basement surface indicates that the Paleozoic Nemaha uplift had a precursor in Precambrian time.

[16]

Deformational Patterns in the Springer Group of Southern Oklahoma

SHELTON, JOHN W., *Oklahoma State University, Stillwater, Okla. 74074*

The Springer Group, which is composed of the Upper Mississippian Goddard Formation and Lower Pennsylvanian Springer Series, has experienced deformation by uniform flow and shear folding and by overthrusting. Illustrating, in southern Oklahoma, the former types of deformation are the disharmonic folds at the Caddo and Fox-Graham structures and the shale diapir at Carter-Knox field. Thrust faulting developed in the Springer Group at the southern edge of the Ardmore basin to form the Overbrook overthrust.

The Springer Group is 3000 to 4500 feet thick and composed of a shallow-marine sequence of dark-gray to black, fissile shale with sandstone units in the upper part. The shale is characterized by montmorillonite or mixed-layer illite-chlorite-montmorillonite. Shale beds are also characterized by abnormally slow velocities and low resistivities, both of which strongly suggest that abnormal fluid pressure existed in the Springer during its deformation in the Pennsylvanian. The high fluid pressure probably resulted from the high montmorillonite or mixed-layer content in the thick shale section.

Disharmonic and diapiric folds formed in the overpressured and undercompacted shale as a secondary feature of differential vertical uplift by faulting. Fault movement resulted in unequal loading, which in turn triggered the shale flowage. Lateral stresses which caused movement of the Overbrook thrust developed from a space problem in the narrow, subsiding basin, and the thick section of sedimentary rocks parted from its foundation in the zone of abnormally pressured shale. [25]

Structure of the Nemaha Ridge, Central United States

GAMMILL, E. R., and R. R. WHEELER, *Dept. Earth Sciences, East Texas State University, Commerce, Tex. 75428*

Detailed mapping of the Nemaha ridge, based upon information from the many wells drilled in north-central Oklahoma, reveals the structure is not a ridge or anticlinal axis but is composed of a large number of differentially warped fault blocks. In several places these appear to be displaced by high-angle reverse faults which pivot locally (scissor-faulting). The Nemaha trend extends 900 miles northward from the Oklahoma City uplift across eastern Kansas, southeastern Nebraska, into Iowa, Wisconsin, and Minnesota, where it enters the Canadian Shield in the Lake Superior region along a petrographic boundary in the basement rocks.

The amplitude of Nemaha folding is proportionate to the amount of fault displacement, and both are compressional adjustments to the Early Pennsylvanian orogeny in southern Oklahoma. The existence of Precambrian stable features controlled the position and direction of fault displacement so that: (1) fault blocks tend to be upthrown to the east toward the Ozark uplift in Oklahoma; (2) displacement dies out and reverses across the Chatauqua arch; and (3) fault blocks are upthrown to the west toward the Central Kansas uplift.

[17-18]

Growth Faulting in the McAlester Basin Of Oklahoma

KOINM, DAVID N., *Phillips Petroleum Company, Bartlesville, Okla. 74003*, and PARKE A. DICKEY, *University of Tulsa, Tulsa, Okla. 74104*

Lower Atoka deposition in the McAlester basin of Oklahoma is influenced by two normal down-to-the-basin growth faults. Across these faults, from the upthrown north to the downthrown south side, there are abrupt increases in the thickness of the Atoka Formation. The increase is about 2,000 feet across the Kinta fault and 3,000 to 3,500 feet across the Sans Bois fault. This disparity in thickness can be explained only by movement along the fault during sedimentation. They resemble the growth faults which have recently been shown to control the structure and stratigraphy of large areas of the Gulf Coast of Texas and Louisiana.

Structural and stratigraphic electric-log cross sections and surface geologic maps indicate that the faulting ceased to exhibit growth characteristics at about middle Atokan time. The Hartshorne near-surface folding is more intense than the folding of the deeper Wapanucka Limestone, suggesting that plastic flow of the Atoka has occurred. [20]

Palynology Symposium
March 31, 1967

Palynology of the Secor Coal (Pennsylvanian) of Oklahoma

CLARKE, ROBERT T., *Mobil Oil Corp. FRL, P. O. Box 900, Dallas, Tex. 75221*

The Secor coal in Oklahoma occurs approximately 400 to 500 feet above the base of the Desmoinesian Boggy Formation, and ranges from 15 to 45 inches in thickness. Samples collected from outcrops of the Secor in Pittsburg and McIntosh Counties are geographically separated by 46 miles. Fifty-eight species of trilete spores, seven species of monolete spores, and nine species of saccate pollen occur in the assemblage counts. Quantitatively, however, monolete spores account for 52 per cent, trilete spores for 32 per cent, and saccate pollen for 16 per cent of the assemblage.

Palynological assemblage analysis has been shown to be a useful technique for illustrating plant succession in coal beds and for the correlation of coals. The distribution of palynomorphs in the Secor coal exhibit a distinct succession from *Lycospora*, *Calamospora*, *Triquitrites*, and *Laevigatosporites ovalis* to *Punctatisporites* to *Laevigatosporites minutus*, *Florinites*, and *Wilsonites* in the lower, middle and upper thirds of the coal, respectively. Although the order of species succession is similar in both localities, statistical analysis of species variance indicates the coal in the McIntosh County section correlates with the lower 32–34 inches of the coal from the Pittsburg County section. Palynological assemblages from a number of other Oklahoma coals of Pennsylvanian age are qualitatively and quantitatively compared with the Secor coal. [15]

Miospores from Upper Part of Coffeyville Formation, Tulsa County, Oklahoma

UPSHAW, CHARLES F., and RICHARD W. HEDLUND, *Pan American Petroleum Corp., P. O. Box 1654, Oklahoma City, Okla.*

Assemblages which include a total of 68 species of miospores representing 37 genera are reported from a coal-bearing sequence in the upper part of the Pennsylvanian (Missourian) Coffeyville Formation at three localities in Tulsa County, Oklahoma. One species is new. Spore assemblages are compared by application of chi square, student's *t* tests, distance functions, and Simpson's faunal indices 2 and 11. Results indicate that roof shale, coal, and underclay assemblages are distinctive; that the coal bed in each of the three sections probably does not represent a single, laterally continuous unit; and that assemblages in the upper part of the Coffeyville Formation are most nearly correlative with the New Haven coal assemblages of Illinois. [28]

Palynological Composition and Succession in a Dawson Coal (Pennsylvanian) Section of Oklahoma

WILSON, L. R., and B. S. VENKATACHALA, *School of Geology and Geophysics, University of Oklahoma, Norman, Okla. 73069*

The Dawson coal is a seam in the Seminole Formation, Missourian Series, of the Pennsylvanian System, and its outcrops are restricted to northeastern Oklahoma. The section reported here was recovered from an excavation in the city of Tulsa where the Dawson is 30 inches thick. The palynological assemblage consists of 65 per cent Filicinae and/or Pteridospermae spores and pollen, 23 per cent Lycopsida spores, 8 per cent Gymnospermae (saccate) pollen, and 4 per cent Sphenopsida spores. These palynomorphs are classified into 14 genera and possibly 73 species. They constitute an assemblage that can be used as a characteristic Seminole Formation suite of coal-swamp palynomorphs. Four stages of palynological succession are recognized in the section. These, in order from bottom to top, are: (1) *Florinites-Laevigatosporites*, (2) *Thymospora*, (3) *Lycospora-Laevigatosporites*, and (4) *Endosporites-Wilsonites*. [29]

Permian Palynomorph Assemblages of Southwestern Oklahoma

MORGAN, BILL E., *Esso Production Research Company, P. O. Box 2189, Houston, Tex. 77001*

Several distinctive, diverse, and well-preserved palynomorph assemblages are recognizable in the Flowerpot, Blaine, and Dog Creek Formations of the El Reno Group from southwestern Oklahoma. The oldest of three assemblages from the Flowerpot Formation is dominated by bisaccate gymnosperm pollen, with rare acritarchs. These bisaccate pollen belong mostly to the *Striatiti* (i.e., *Strotersporites communis*, *Striatopodocarpites* sp., *Protohaploxypinus* sp., and

Lueckisporites virkkiae). The last species constitute about half the assemblage. Acritarchs are represented by *Acanthodiacrodium* and *Psophosphaera*. These are more abundant in the youngest assemblage from the Flowerpot Formation.

In the oldest assemblage from the overlying Blaine Formation, 70 per cent of the specimens are *Lueckisporites virkkiae*, with a corresponding decrease in acritarchs. In assemblages recovered from the middle of the Blaine, the ratio of *Lueckisporites virkkiae* to acritarchs is reversed. Younger Blaine assemblages are similar to those from older Blaine in that *Lueckisporites virkkiae* represents 70 per cent, but they differ in containing several undescribed species of *Vittatina*.

The Dog Creek assemblage resembles the Flowerpot assemblage in containing approximately 50 per cent *Lueckisporites virkkiae;* it differs, however, by having many undescribed species lacking in the older assemblages.

Qualitative and quantitative differences between these assemblages are interpreted as reflecting changes in: (1) depositional sites, (2) the local environment, and (3) modifications of the parent flora. [22]

Palynology of a Cretaceous Coal in the Omadi Formation, Dakota Group, Oklahoma

POTTER, DELBERT E., *5300 East Skelly Drive, Tulsa, Okla. 74105*

The numerous fossil spores and pollen in a Cretaceous coal in the Omadi Formation, Dakota Group, Cimarron County, Oklahoma, are assigned to the following natural groups: Bryophyta 1, Pteridophyta 20, Gymnospermae 6, and Angiospermae 5. Three forms were not assigned.

The Omadi coal is identified as Lower Cretaceous. The guide fossils used in this determination are the genera or species of *Arcellites, Balmeisporites, Spermatites, Cicatricosisporites,* and *Trilobosporites,* forms found only in the Lower Cretaceous.

A succession of three ecological habitats are suggested for the Omadi coal: (1) aquatic, (2) *Sphagnum* swamp or bog and, (3) swamp forest. The spore flora indicates a warm subtropical or tropical climate, based upon the abundance of spores which are comparable to modern schizeaean forms of the tropical regions. [23]

Method of Calculating Absolute Spore and Pollen Frequency

Douglas W. Kirkland*

A technique for determining absolute spore and pollen frequency—the number of spores and/or pollen grains per unit weight of sediment or rock—has been described by Benninghoff (1962). The technique consists of adding a known number of modern extoic pollen grains to a sample of sediment or sedimentary rock *prior* to processing, and utilizing the ratio of the number of fossil grains to that of the modern grains to determine the absolute frequency of the fossil grains. Fossil spores and pollen react differently from modern pollen grains in standard preparation techniques and care must be taken to prevent loss of the added pollen.

Benninghoff's method can be modified by adding a known number of distinctly stained modern pollen grains to the fossil spore and/or pollen residue *after* processing, and using the ratio of fossil to modern grains to determine fossil-grain frequency. This method is rapid, yields results which are generally of desired accuracy, and is a simple adjunct to routine processing schedules. Only one easily made volumetric measurement is required: the addition of a predetermined volume of a standardized suspension with a Mohr pipette. The differently stained modern pollen are added to the fossil residue, which is then thoroughly mixed immediately before mounting on slides. Fossil grains, stained red with safranin O, and modern grains, stained with methyl green (or another non-red stain), are counted separately under the microscope, at low magnification, during several traverses of the slide. From this count, the ratio of red-stained grains to green-stained grains is determined. The number of green pollen grains added to the residue is calculated from their concentration in a standard suspension and the volume of suspension added. The ratio of red-stained grains to green-stained grains multiplied by the number of green pollen grains added yields the number of fossil grains in the sample; division of this product by the sample weight yields the absolute spore and pollen frequency. Several examples are tabulated in table I.

The concentration of green-stained modern pollen grains in the standard is determined by the method refined by Davis (1965, 1966). A quantity of acetolyzed modern pollen is placed in a known volume of tertiary butyl alcohol. The suspension is stirred, an aliquot is withdrawn and placed on a microscope slide in the manner prescribed by Davis, and the grains are counted. The grains in at least ten aliquots should be counted in order to assure accurate calibration. From the average number of grains per aliquot, the number of grains in the alcohol suspension can be determined. The modern pollen is then washed, stained green, and transferred to a liter of water and glycerine in an Erlenmeyer flask. The suspension is stirred with a magnetic stir-

* Mobil Oil Corporation; Field Research Laboratory, Dallas, Texas.

TABLE I.—DETERMINATION OF ABSOLUTE SPORE AND POLLEN FREQUENCY IN SELECTED SAMPLES

SAMPLE	COUNT OF FOSSIL GRAINS	COUNT OF MODERN GRAINS	FOSSIL/MODERN RATIO	NUMBER OF MODERN GRAINS ADDED	NUMBER OF FOSSIL GRAINS IN SAMPLE	SAMPLE WEIGHT (GRAMS)	ABSOLUTE FOSSIL-GRAIN FREQUENCY (GRAINS PER GRAM)*
Cretaceous shale, Texas	455	404	1.13	26,000	29,380	23	1,000
Jurassic shale, Germany	580	114	5.09	26,000	132,340	23	6,000
Triassic shale, Australia	1,126	521	2.16	130,000	280,800	23	12,000
Pennsylvanian shale, Canada	1,100	148	7.43	520,000	3,863,600	23	168,000
Mississippian shale, Libya	1,023	552	1.85	26,000	48,100	23	2,000
Devonian shale, Canada	627	233	2.69	260,000	699,400	23	30,500

* Figures rounded to nearest 500.

rer in order to maintain uniform pollen distribution. A few crystals of copper sulfate are added to prevent growth of mold, and the standard is covered in order to prevent evaporation. Aliquots of the standardized suspension are withdrawn as needed and are added to fossil residues.

References Cited

Benninghoff, W. S., 1962, Calculation of pollen and spore density in sediments by addition of exotic pollen in known quantities [abs.]: Pollen et Spores, vol. 4, no. 2, p. 332-333.

Davis, M. B., 1965, A method of determination of absolute pollen frequency, **in** Handbook of paleontological techniques: San Francisco, W. H. Freeman and Co., p. 674-686.

________1966, Determination of absolute pollen frequency: Ecology, vol. 47, p. 310-311.

Frank A. Melton Honored

Dr. Frank A. Melton, professor of geology, School of Geology and Geophysics, The University of Oklahoma, will retire at the end of the current school term, after more than forty years of devoted service to teaching, counseling, and research. In recognition of his many contributions toward the pursuit of excellence at The University of Oklahoma, the faculty and alumni are joining in an appreciation dinner to be held Friday, May 19, at 7:30 P.M. in the Oklahoma Memorial Union. Friends and former studens of Dr. Melton are invited to attend. Reservations must be made with the School of Geology and Geophysics by Wednesday, May 17; the price per ticket is $4.00.

Dr. Melton, who came to The University of Oklahoma in 1926, is one of the leading experts in the field of aerial-photograph interpretation. During his career, he has made many significant contributions to geology, particularly in geomorphology, using aerial photographs as his principal tool. His exceptional skill with aerial photographs has received wide recognition and has brought much credit to the University.

Fresh-Water Sponges of Oklahoma

Carl C. Branson

The intent of this report is to give a preliminary summary of fresh-water sponges in Oklahoma and to record their occurrences as fossils. The common fresh-water sponge genus is *Spongilla*, a genus characterized by acerate spicules and with or without gemmule spicules. Gemmules in fresh-water sponges are bodies of cells surrounded by membranes. In most genera the gemmule has one or more types of birotulate spicules. This type of spicule consists of a shaft with terminal disks (rotules). Thirty-eight generic names are in present usage; most are probably synonymous.

Oklahoma fresh-water sponges were first noted by Wickham (1922) as *Spongilla fragilis* Leidy. The specimens were collected in Shuler's Lake in Durant, Bryan County. The sponges occurred on submerged timbers and piles near a small island. The original collection was lost and subsequent search of the lake yielded no further specimens.

Additional forms were observed by Rainbolt (1954) from localities in Payne, Pushmataha, and Pittsburg Counties. She identified and figured four genera and seven species: *Spongilla aspinosa* Potts, 1880, *S. lacustris* (Linné, 1759), *S. fragilis* Leidy, 1851, *Meyenia subdivisa* (Potts, 1887), *M. crateriformis* (Potts, 1882), *Trochospongilla leidyi* (Bowerbank, 1863), and *Asteromeyenia plumosa* (Carter, 1849); the *Meyenia* species were reported as *Ephydatia*.

Spongilla occurs in Lake Texoma at the boat dock of the University of Oklahoma Biological Station (Carl Riggs, 1966, oral communication).

Fossil fresh-water sponges are little known. A Miocene (Sarmatian) form was described by Traxler (1894) from Hungary as *Ephydatia* (= *Meyenia*) *fossilis*. The species was recorded by Firtion (1944) from another Hungarian locality, Kavna Bremia (p. 336, text-figs. 1e,f; pl. 7, figs. 16, 17). From the volcanic Puy-de-Dôme area of the Auvergne in a lignitic Pliocene deposit Firtion reported *Spongilla lacustris, S. fragilis* Potts, *Meyenia muelleri* Lieberkühn, *M. fluviatilis, M fossilis, Heteromeyenia argyrosperma* Potts, and *Carterius stepanowi* Dybowski.

Russian scientists have described fossil sponges from Paleocene to Miocene of the Lake Baikal region of Siberia assigned to ten species in five genera (according to Naletov, 1961).

Pleistocene fresh-water deposits at many places contain sponge remains, and many more such deposits are unrecorded. Diaz Lozano (1936) reported *Spongolides asicularis* (sic) in clay about 9 feet below the surface of lake deposits in the Distrito Federal de Mexico. Associated were six genera of diatoms and the ostracode "*Cypris mexicana* Ehrenberg." The sponge name would seem to be *Spongolithis acicularis* Ehrenberg, 1839, assigned by Traxler in 1895 (probably erroneously) to *Spongilla lacustris*. Ehrenberg obtained his material from his brother Carlos, who collected the samples from lake deposits near Real del

Monte, Toluca, Mexico (City) and other localities in central Mexico (Rioja, 1953). The species recorded by Ehrenberg are: *Spongolithis flexuosa, S. inflexa, S. mesogongyla, Amphidiscus anceps, A. rotula,* and *A. martii.*

Pleistocene fresh-water sponges have been noted from Mexico, Guatemala, Massachusetts, North Dakota, Russia, and here from Oklahoma. In Oklahoma they have been found in McCurtain, Harper, and Beaver Counties. The late Pleistocene forms of McCurtain County have not yet been studied. The occurrence in Harper County is in the volcanic ash which bears snails and bones, as well as armadillo scutes. An absolute age (C_{14}) date on this deposit is 21,360 years (Myers, 1965). Another Pleistocene sponge-bearing deposit is that reported by Buttram and described and sampled by Schemel (1967).

The Laverne facies of the Ogallala Formation has been investigated by Schemel (1967). He collected samples from the type section in Beaver County; and, in slides from this locality prepared by L. R. Wilson, Wilson and I have found numerous body spicules and five amphidisks of fresh-water sponges. The amphidisks are presently indistinguishable from those named *Meyenia fossilis* by Traxler, as identified by Firtion in the Pliocene of France. The associated extensive diatom flora in Beaver County is being studied by Wilson.

Siliceous fresh-water deposits of Oklahoma will be further investigated for economic and scientific reasons.

References

Diaz Lozano, Enrique, 1936, Estratigrafia de un yacimiento en la colonia de "Los Alamos," D. F.: Sociedad Geologica Mexicana, Boletin, vol. 9, p. 289-293.

Explanation of Plate I

Spicules of fresh-water sponges from the Laverne diatomaceous marl

Figures 1-3. Body spicules.

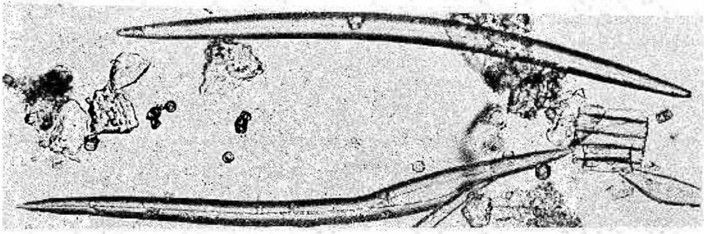
1. **Two spicules, the lower one with an abnormal expansion of the axial canal. Length 245 microns.**
2. **Acerate spicule with bifurcated tip; length 265 microns, thickness 12 microns; OPC 1120-3-7-1.**
3. **Spiny body spicule; length 260 microns, thickness 15 microns; OPC 1170-3-1.**

Figures 4-6. Amphidisks of "Meyenia fossilis."

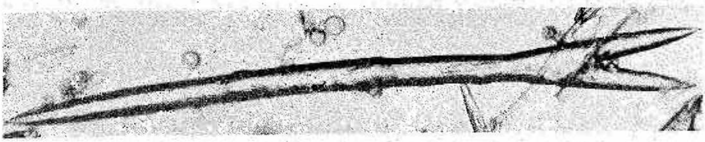
4. **Amphidisk; length 58 microns, diameter of rotule 30 microns, thickness of shaft 7 microns; OPC 1170-3-2-1.**
5. **Amphidisk, shorter than that of figure 4 but probably same species; length 55 microns, diameter of rotule 30 microns, thickness of shaft 7 microns; OPC 1170-3-1-1.**
6. **Stout amphidisk; length 50 microns, diameter of rotule 30 microns, thickness of shaft 9 microns; OPC 1170-3-1-2.**

(Photographs by L. R. Wilson, using Zeiss Photomicroscope)

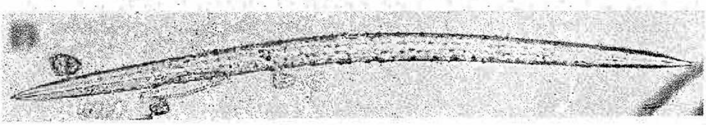
Plate I



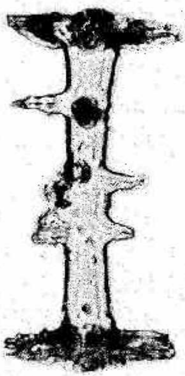
1



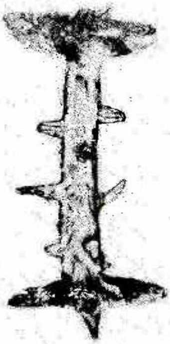
2



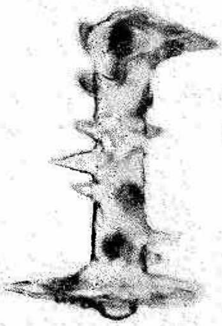
3



4



5



6

Firtion, L., 1944 [1945], Spongilles et Chrysostomatacées d'un lignite de la formation cinératique de Las Chambon (Puy-de-Dôme): Soc. Geol. France, ser. 5, vol. 14, p. 331-346, pls. 7, 8.
Myers, A. J., 1965, Late Wisconsinan date for the Bar M local fauna: Okla. Geol. Survey, Okla. Geology Notes, vol. 25, p. 168-170.
Naletov, P. I., 1961, Katalog mestonakhaschdenii iskopaemkh fauna, flory, pyltsy i spor tsentralnoi shasti buriatskoi ASSR: Buriatskoe Geologicheskoe Upravlenie, 64 p.
Rainbolt, M. L., 1954 [1955], Some fresh-water sponges in Oklahoma: Okla. Acad. Science, Proc. 1954, vol. 35, p. 84-87.
Rezvoi, P. D., 1936, Presnovodnye gubki, in Fauna SSSR, gubki, vol. 2, no. 2 (new ser. no. 3): Akad. Nauk SSSR, Zool. Inst., 124 p., 15 pls.
Rioja, Enrique, 1953, Datos historicos acerca de las esponjas de agua dulce de Mexico: Sociedad Mexicana Historia Natural, Revista, vol. 14, p. 51-57.
Schemel, M. P., 1967, Investigation of selected lower Pliocene and Pleistocene deposits in northwestern Oklahoma: Okla. Geol. Survey, Okla. Geology Notes, vol. 27, p. 24-33.
Thompson, G. G., 1962, Postglacial fresh-water limestone, marl, and peat from south-central North Dakota: N. Dak. Acad. Science, Proc., vol. 16, p. 16-22.
Traxler, Ladislaus, 1894, **Ephydatia fossilis**, eine neue Art der fossilen Spongilliden: Földtany Közlöny, vol. 24, p. 234-237, pl. 4.
Wickham, M. M., 1922, Identification on (sic) fresh water sponges in the Oklahoma fauna: Okla. Acad. Science, Proc., vol. 2, p. 23-24.
Wilson, L. R., 1949, A microfossil analysis of the lower peat and associated sediments at the John Hancock Fishweir site, in The Boylston Street Fishweir II: Phillips Acad., Robert S. Peabody Found. Archaeology, Papers, vol. 4, no. 1, p. 84-98.

OKLAHOMA GEOLOGY NOTES

Volume 27 May 1967 Number 5

In This Issue