OKLAHOMA GEOLOGY NOTES

VOLUME 34 NUMBER 5 OCTOBER 197

Cover Picture

Mysterious Grooved Granites of the Wichita Mountains, Oklahoma

The western part of the Wichita Mountains of southwest Oklahoma is characterized by scattered small knobs and short, low ranges of Cambrian granite and minor mafics that break sharply from the flat surface of the Permian red-bed plains. Several of the granite hills in a broad east-west belt between Mangum and Cooperton display what generally have been called "grooves." One groove locality is depicted in the cover photograph (SW¼NW¼NW¼ sec. 14, T. 4 N., R. 20 W., Greer County). The 2-foot machete indicates the scale.

The grooved granite surfaces are being exhumed from overlying Permian marine(?) sediments and are not geologically recent phenomena. It is widely believed that the grooves originated as a result of wave action in Permian seas, but I believe that such an origin is not supported by the facts. Resemblances between the grooves and wave-cut notches on present-day coasts are, at best, grossly superficial. The grooves come in various widths, ranging from several feet to less than an inch. Well-developed grooves are commonly found on the walls of deep, narrow joints.

Other hypotheses invoking an inorganic, physical-erosional origin for these grooves suffer similarly in their inability to reconcile the facts. The grooves have no modern or ancient counterparts and are apparently a unique geologic occurrence. Their origin remains very much a mystery.

–James A. Harrell

Editorial staff: William D. Rose, Rosemary Croy, Elizabeth A. Ham

Oklahoma Geology Notes is published bimonthly by the Oklahoma Geological Survey. It contains short technical articles, mineral-industry and petroleum news and statistics, an annual bibliography of Oklahoma geology, reviews, and announcements of general pertinence to Oklahoma geology. Single copies, seventy-five cents; yearly subscription, $3.00. All subscription orders should be sent to the address on the front cover.

Short articles on aspects of Oklahoma geology are welcome from contributors. A set of guidelines will be forwarded on request.

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OKLAHOMA GEOLOGICAL SURVEY

ANNUAL REPORT

July 1, 1973-June 30, 1974

INTRODUCTION

The fundamental role of the Oklahoma Geological Survey is to investigate the land, water, mineral, and energy supplies of our State and to collect and disseminate information derived from these investigations. This task received particular attention this past year with the public recognition of growing energy shortages. Current and past studies conducted by the Survey made important contributions to the State's efforts to resolve emerging problems associated with the decline of domestic energy reserves, reflecting the wisdom of our founding fathers in charging our agency with constitutional responsibility for the orderly development of Oklahoma's natural resources.

ENERGY PROGRAM AND RELATED ACTIVITIES

Survey staff members have participated in a number of activities this past fiscal year that were a direct consequence of the energy shortage. These activities were carried on in addition to other essential, continuing responsibilities. Two Survey projects that will have an impact on the declining reserves of fossil fuels in Oklahoma were completed during the past year. The investigation of coal deposits in eastern Oklahoma was concluded, disclosing that the State's coal resources are in excess of 7 billion tons, or about twice as large as had been previously indicated. The possibility of economic recovery of about one-half of this amount (approximately 3 billion tons) adds materially to the State's fossil-fuel reserves. The study was funded by a grant from the Ozarks Regional Commission and the Commission approved it for distribution in July 1974.

A companion study, an inventory of the location and status of surface-mined coal lands in eastern Oklahoma, was also completed this past year. Information from the study, released as GM 17, *Maps and Description of Disturbed and Reclaimed Surface-Mined Coal Lands in Eastern Oklahoma*, is expected to assist in monitoring and control of surface-mining activities. Publication of this study also provides useful data to assess the ultimate effectiveness of Oklahoma's Mining Lands Reclamation Acts of 1968 and 1971.

The Survey devoted a good deal of its attention during the past fiscal year to the pursuits of the Oklahoma Energy Advisory Council. This body was established by Senate Bill 386 and approved by the Governor on May 17, 1973. The council was charged by the Legislature to act as "coordinator

with the Oklahoma Geological Survey in the collection of data on Oklahoma's energy resources from state agencies." In addition to representation on the council, Survey staff members assisted in preparation of 4 of the 16 committee reports published in *Energy in Oklahoma, Final Report of Oklahoma Energy Advisory Council,* participating on the Supply of Coal, Supply of Crude Oil, Supply of Natural Gas, and Environmental Aspects committees. These working committees were created by the council to evaluate and project Oklahoma's energy supply and demand requirements through 1990, the first step in formulation of a State energy policy that will give equal priority to development and conservation of the State's energy and water resources and to maintenance and improvement of the State's natural environment. The Survey believes that the Oklahoma Energy Advisory Council has performed a valuable service to the State, and Survey personnel were happy to be able to assist in the council's endeavors.

In addition to its work with the Energy Advisory Council, the Oklahoma Geological Survey attempted to keep the general public informed on energy matters. The theme for the 1973 Oklahoma State Fair, held in Oklahoma City, was "Living Energy in Our Future." The theme was exemplified by a series of exhibits prepared by groups representing industry, academic institutions, and government and designed to depict our State's rich heritage in the development of fossil fuels. The Oklahoma Geological Survey presented three displays, the most elaborate of which was a large natural-resources map of the State, constructed for the Survey by Phillips Petroleum Company. Fair spectators could push buttons that would activate electric lights representing gas-processing plants, oil refineries, petrochemical plants, coal mines, and natural-rock-asphalt deposits. The location of the world's deepest well and the deepest producing well, both in Beckham County, were pinpointed by lights. The display map, about 12 feet long, was a larger version of a map prepared at a scale of 1:2,000,000 (by Phillips Petroleum Company, in cooperation with the Survey) and distributed at the fair. An oil and gas display, spotlighting cores from important producing formations in Oklahoma, and a display on coal mining and reclamation in Oklahoma were the Survey's other two displays. To complement the information available to the public in its display material, the Survey participated in the energy forum held at the fair, focusing its discussion on future energy sources. The one-day meeting featured a keynote address by the Honorable Carl Albert, Speaker of the U.S. House of Representatives.

The Survey also participated in an energy lecture series sponsored by The University of Oklahoma, presenting one of the seven lectures, entitled "Oklahoma's Energy Resources—Past, Present, and Future," and arranging speakers for several others. M. King Hubbert, U.S. Geological Survey geologist and American Association of Petroleum Geologists Distinguished Lecturer, and Dean A. McGee, chairman of Kerr-McGee Corporation, were invited—at the Survey's suggestion—to participate in the series.

In addition to the activities and projects outlined, staff members presented numerous lectures and contributed several articles to regional and

national journals concerned with energy matters. The lectures and articles reflect the Survey's concern for providing the scientific community and the public with accurate, definitive information on energy matters.

BASIC GEOLOGIC INVESTIGATIONS

Although the Survey focused attention on energy-related problems this past year and initiated several new projects in response to energy concerns, the other aspects of the Survey's permanent program were maintained. Basic to a continuing supply of geologic information are the programs of surface and subsurface mapping. The surface-mapping program is progressing well; seven counties have such mapping in various stages of completion. However, the completion of this facet of the Survey's activities will take at least another 10 years, because even with the publication of maps from these 7 counties, only slightly more than 50 percent of the State will be mapped on an adequate scale (a scale of at least 1 inch to the mile).

The study of factors controlling porosity and permeability of Silurian-Devonian (Hunton) strata in the Anadarko basin was completed at the end of the past fiscal year. Cartographic preparation of the maps associated with this project is currently underway. At the present rate of compilation, this project will be published either in late 1974 or early 1975.

WATER-RESOURCES INVESTIGATIONS

The Survey's hydrologic program is conducted as a cooperative activity with the Water Resources Division of the U.S. Geological Survey. The current program consists of preparation of a series of hydrologic atlases at a scale of 1:250,000 using a topographic map base. Each atlas contains a geologic map, a water-availability map, a water-quality map, and precipitation and surface-water maps for the area involved. The Fort Smith and Tulsa quadrangles have been published as HA-1 and HA-2; HA-3, the Ardmore-Sherman sheet, will be released in the fall of 1974. Field work for most of the remaining quadrangles has been completed. The essential task is cartographic preparation of the remaining sheets. Based upon the current rate of compilation, the last sheet in the 9-part series should be available for distribution by late 1978.

The second phase of the water program involves a detailed study of several important State aquifers. Investigation of the first of these, the Antlers Sandstone in southeastern Oklahoma, was initiated last year. The Survey hopes to obtain sufficient hydrologic information to permit the orderly development of the ground-water resources from this formation. Field and laboratory investigations of the Antlers should be completed in about 2 years.

MINERAL-RESOURCES INVESTIGATIONS

Mineral investigations this past year were limited to studies of the chemical properties of carbonates, copper mineralization in Permian red-bed deposits, and the mineralogy and chemistry of some underclays as-

sociated with coal beds in eastern Oklahoma. A report on the copper studies was presented at the symposium "Stratiform Copper Deposits of the Mid-Continent Region," held in conjunction with the South-Central Section Meeting of The Geological Society of America. This symposium, jointly sponsored by the Oklahoma State University Department of Geology and the Oklahoma Geological Survey, was held this past spring in Stillwater. (The Survey's plans for the coming fiscal year include publishing all of the papers presented at this symposium.) The results of the Survey's copper studies will also be presented at a symposium at Liege, Belgium, early this fall.

A mineral investigation initiated just this past year concerns the occurrence of copper, lead, and zinc in the Ouachita Mountains of southeastern Oklahoma. The first phase of this study includes locating deposits of these metals, describing each locality, and collecting samples for laboratory analysis. The program will continue with collection of additional data to provide a base for detailed geochemical research.

ENVIRONMENTAL-GEOLOGY STUDIES

The Survey participated in two major environmental-geology activities during the past fiscal year. Financial support was provided for several students who were doing research for graduate degrees at Oklahoma State University. The students were engaged in environmental mapping of several areas of north-central and northeastern Oklahoma. The students are mapping these impact areas at a scale of 1:24,000 (the same scale as 7½-minute topographic quadrangle maps). These studies should provide useful information in dealing with environmental problems pending in those areas of the State.

The other major environmental activity was the participation of the Survey in the development of a graduate course in environmental geology. A Survey staff member serves on the Oklahoma City Geological Society's Environmental Geology Committee, which conceived the idea for the course. Both The University of Oklahoma and Oklahoma State University agreed to assist the OCGS in presenting the class, and the Survey agreed to allow our environmental-geology specialist to conduct the course and make all arrangements for OU students desiring to participate. The large enrollment (approximately 50 persons) and the apparent enthusiasm of course participants indicates the interest in and the need for more Survey work in environmental geology.

PUBLIC SERVICE

The demand for technical assistance from the Survey staff continues to grow at a significant rate. This past year the Survey designated one person, half time, as our agency's public-information officer. Requests for information about the natural resources and the natural history of our State essentially consume all of that person's time, and further expansion will be

necessary soon to accommodate the increasing demand for these services.

In addition to written and personal requests for information, the Survey maintains a library of cores and samples from wells drilled throughout the State, and it is actively involved in the further development of the Oil Information Center at The University of Oklahoma. Use of the Core and Sample Library continued to grow—which is not surprising, because exploration activities have more than doubled during the past year. In a similar manner, the Survey believes that the need for the historical records maintained by the Oil Information Center will be of increasing value to explorationists in our State.

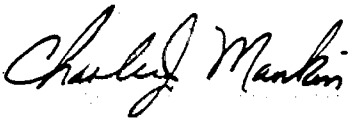
SUMMARY

This report presents only a few highlights from the broad spectrum of activities of the Oklahoma Geological Survey. Additional information about the many projects and activities of the Survey staff may be gleaned from an examination of the appendixes to this report.

The Survey recognizes its role as the State's research and development agency in the field of natural resources and understands the responsibility of responding to the needs of the public it serves. By continuing to strive for a better understanding of our State and its bountiful natural resources, the Survey believes that it will be in a good position to advise on the orderly and progressive development of its wealth in a manner consistent with the preservation of our environment. It was for this purpose that the Oklahoma Geological Survey was created and on this promise that it continues to exist.

ACKNOWLEDGMENT

The work of the Survey was greatly facilitated this past year by excellent cooperation from many state and federal agencies and from numerous professional organizations, civic groups, companies, and interested citizens. We wish to express our sincere appreciation for the invaluable assistance rendered, and we extend the pledge of reciprocal cooperation to these organizations and individuals.



Charles J. Mankin, *Director*
October 1, 1974

APPENDIX A

Survey Staff, 1973-74 Fiscal Year

Professional

Thomas W. Amsden

William H. Bellis[1]

Rosemary L. Croy

Robert O. Fay

David A. Foster

S. A. Friedman

Kenneth S. Johnson

Charles J. Mankin

John F. Roberts

William D. Rose

T. L. Rowland

Leonard R. Wilson

Part-Time Professional

George G. Huffman
(The University of Oklahoma)

A. J. Myers
(The University of Oklahoma)

John W. Shelton
(Oklahoma State University)

James H. Stitt
(University of Missouri, Columbia)

Patrick K. Sutherland
(The University of Oklahoma)

Technical

Cartographic

Marion E. Clark[2]

Roy D. Davis

David M. Deering

John O. Langford III[3]

Sondra L. Underwood

Core and Sample Library

Billy D. Brown

Eldon R. Cox

Editorial

Elizabeth A. Ham

Electron Microscope Technician

William F. Chissoe, III[4]

Geological Technician

Eugene R. Parris

Secretarial

Helen D. Brown

Margarett K. Civis

Lynda B. Smith[5]

Cynthia K. Trettevik[6]

Gwendolyn C. Williamson

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[1]Resigned October 1973
[2]Returned from leave March 1974
[3]Resigned May 1974
[4]Appointed September 1973; resigned April 1974
[5]Resigned August 1973
[6]Appointed August 1973

APPENDIX B

List of Survey Publications Issued, 1973-74 Fiscal Year

Bulletin 118.—*Models of Sand and Sandstone Deposits: A Methodology for Determining Sand Genesis and Trend,* by John W. Shelton. 122 pages, 141 figures, 3 tables. Issued October 1973.

Circular 75.—*Geology of the Eastern Part of the Lynn Mountain Syncline, Le Flore County, Oklahoma,* by Garrett Briggs. 34 pages, 13 figures, 1 color plate (geologic map by Garrett Briggs and Donald L. Smith, scale 1:42,240). Issued July 1973.

Final Report to the Ozarks Regional Commission.—*Investigation of the Coal Reserves in the Ozarks Section of Oklahoma and Their Potential Uses,* by S. A. Friedman. 117 pages, 24 figures, 77 tables. Issued July 1974.

Guidebooks for 1973 annual meeting of Geological Society of America.—*Regional Geology of the Arbuckle Mountains, Oklahoma,* by William E. Ham, compiled by T. L. Rowland. Guidebook for Field Trip No. 5. 56 pages, 50 figures. Issued November 1973.

Igneous Geology of the Wichita Mountains and Economic Geology of Permian Rocks in Southwest Oklahoma, by Kenneth S. Johnson and Rodger E. Denison, with contributions by Douglas C. Brockie, Hugh E. Hunter, and Nancy L. Scofield. Guidebook for Field Trip No. 6. 33 pages, 35 figures, 9 tables. Issued November 1973.

Guidebook for 1974 Geological Society of America South-Central Section Meeting.—*Guidebook to the Depositional Environments of Selected Pennsylvanian Sandstones and Carbonates of Oklahoma,* by John W. Shelton and T. L. Rowland. Published jointly with Oklahoma State University. 75 pages, 33 figures, 15 plates. Issued March 1974.

Oklahoma Geology Notes–Six bimonthly issues (August 1973-June 1974), containing 252 pages.

APPENDIX C

Publications by Survey Staff, 1972-73 Fiscal Year

THOMAS W. AMSDEN

Late Ordovician, Silurian, and Early Devonian strata, *in* Ham, W. E., Regional geology of the Arbuckle Mountains, Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 5 (1973 Annual Meeting), p. 39-43.

Porosity and permeability in Silurian carbonate rocks of Anadarko basin, Oklahoma [abstract]: Oklahoma Geology Notes, v. 33, p. 169-170 (reprinted from American Association of Petroleum Geologists Bulletin, v. 57, p. 766-767).

Porosity and permeability in Silurian carbonate rocks of Hunton Group, Anadarko basin, Oklahoma [abstract]: Oklahoma Geology Notes, v. 33, p. 231 (reprinted from American Association of Petroleum Geologists Bulletin, v. 57, p. 1821).

The pseudodeltidium in *Triplesia* and *Placotriplesia:* Lethaia, v. 6, p. 253-274.

ROSEMARY L. CROY

Bibliography and index of Oklahoma geology, 1973: Oklahoma Geology Notes, v. 34, p. 47-93 (ed., with Elizabeth A. Ham and William D. Rose).

M. King Hubbert launches energy series at OU: Oklahoma Geology Notes, v. 34, p. 11-12.

Oklahoma Energy Advisory Council issues final report: Oklahoma Geology Notes, v. 34, p. 106-107.

Oklahoma Geology Notes: Oklahoma Geological Survey, v. 33, nos. 4-6, v. 34, nos. 1-3, 252 p. (ed., with William D. Rose and Elizabeth A. Ham).

ROBERT O. FAY

Arbuckle anticline along Interstate Highway 35, *in* Ham, W. E., Regional geology of the Arbuckle Mountains, Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 5 (1973 Annual Meeting), p. 31-37.

Bromide Formation on Tulip Creek and in the Arbuckle Mountains region, *in* Ham, W. E., Regional geology of the Arbuckle Mountains, Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 5 (1973 Annual Meeting), p. 27-31 (with A. A. Graffham).

Economic geology, *in* Appraisal of the water and related land resources of Oklahoma—Region Eleven: Oklahoma Water Resources Board Publication 43, p. 90-91.

Economic geology, *in* Appraisal of the water and related land resources of Oklahoma—Region Twelve: Oklahoma Water Resources Board Publication 44, p. 80-81.

The Elk City blowout—a chronology and analysis: Oklahoma Geology Notes, v. 33, p. 135-151.

Geology, *in* Appraisal of the water and related land resources of Oklahoma—Region Eleven: Oklahoma Water Resources Board Publication 43, p. 18-25.

Geology, *in* Appraisal of the water and related land resources of Oklahoma—Region Twelve: Oklahoma Water Resources Board Publication 44, p. 19-27.

Tulsa's physical environment [review]: Geotimes, v. 19, no. 6, p. 35.

S. A. FRIEDMAN

Coal resources of eastern Oklahoma, January, 1974 [abstract]: Oklahoma Geology Notes, v. 34, p. 129.

Extrapolation and paleogeography of fossil river systems I: Late Ordovician through Early Pennsylvanian [abstract]: Geological Society of America Abstracts with Programs, v. 5, p. 103.

Investigation of the coal reserves in the Ozarks section of Oklahoma

and their potential uses: Oklahoma Geological Survey, 117 p. (final report to the Ozarks Regional Commission).

Mine inspectors meet at Fountainhead Lodge: Oklahoma Geology Notes, v. 33, p. 153-154.

Selection of a coal gasification plant site in Oklahoma [abstract]: Geological Society of America Abstracts with Programs, v. 5, p. 627 (reprinted in Oklahoma Geology Notes, v. 34, p. 34).

ELIZABETH A. HAM

Bibliography and index of Oklahoma geology, 1973: Oklahoma Geology Notes, v. 34, p. 47-93 (ed., with Rosemary L. Croy and William D. Rose).

Oklahoma Geology Notes: Oklahoma Geological Survey, v. 33, nos. 4-6, v. 34, nos. 1-3, 252 p. (ed., with William D. Rose and Rosemary L. Croy).

KENNETH S. JOHNSON

Eagle-Picher Industries, Inc.'s copper mine at Creta, *in* Johnson, K. S., and Denison, R. E., Igneous geology of the Wichita Mountains and economic geology of Permian rocks in southwest Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 6 (1973 Annual Meeting), p. 29-32 (with D. C. Brockie).

Gypsum and salt resources in the Oklahoma portion of the Permian basin [abstract]: Economic Geology, v. 68, p. 138.

Igneous geology of the Wichita Mountains and economic geology of Permian rocks in southwest Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 6 (1973 Annual Meeting), 33 p. (with R. E. Denison).

Inventory of strip-mined lands in Oklahoma coal field [abstract]: Geological Society of America Abstracts with Programs, v. 5, p. 683-684 (reprinted in Oklahoma Geology Notes, v. 34, p. 35-36).

The mineral industry of Oklahoma, *in* Area reports: domestic, *v. 2 of* Minerals yearbook 1971: U.S. Bureau of Mines, p. 567-581 (with L. G. Southard and John F. Roberts).

Permian copper shales of southwestern Oklahoma [abstract]: Geological Society of America Abstracts with Programs, v. 5, p. 108-109 (reprinted in Oklahoma Geology Notes, v. 34, p. 115).

CHARLES J. MANKIN

Oklahoma Geological Survey annual report, July 1, 1972-June 30, 1973: Oklahoma Geology Notes, v. 33, p. 179-189.

JOHN F. ROBERTS

The mineral industry of Oklahoma, *in* Area reports: domestic, *v. 2 of* Minerals yearbook 1971: U.S. Bureau of Mines, p. 567-581 (with L. G. Southard and Kenneth S. Johnson).

Oil and gas, *in* Appraisal of the water and related land resources of Oklahoma—Region Eleven: Oklahoma Water Resources Board Publication 43, p. 92-93.

Oil and gas, *in* Appraisal of the water and related land resources of Oklahoma—Region Twelve: Oklahoma Water Resources Board Publication 44, p. 83.

Statistics of Oklahoma's petroleum industry, 1972: Oklahoma Geology Notes, v. 33, p. 207-214.

WILLIAM D. ROSE

Bibliography and index of Oklahoma geology, 1973: Oklahoma Geology Notes, v. 34, p. 47-93 (ed., with Elizabeth A. Ham and Rosemary L. Croy).

Oklahoma Geology Notes: Oklahoma Geological Survey, v. 33, nos. 4-6, v. 34, nos. 1-3, 252 p. (ed., with Rosemary L. Croy and Elizabeth A. Ham).

T. L. ROWLAND

Deese (Desmoinesian) strata on Dry Branch of Buckhorn Creek, *in* Ham, W. E., Regional geology of the Arbuckle Mountains, Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 5 (1973 Annual Meeting), p. 51-54 (with W. E. Ham and R. L. Squires).

Guidebook to the depositional environments of selected Pennsylvanian sandstones and carbonates of Oklahoma: Oklahoma Geological Survey, Oklahoma State University, 75 p. (with John W. Shelton).

The Historic 1 Baden Unit and a brief look at exploration in the Anadarko basin: Oklahoma Geology Notes, v. 34, p. 3-9.

Regional geology of the Arbuckle Mountains, Oklahoma: Oklahoma Geological Survey, Guidebook for GSA Field Trip No. 5 (1973 Annual Meeting), 56 p. (compiler; William E. Ham, author).

World's largest land-based drilling rig used for record well: Oklahoma Geology Notes, v. 34, p. 2.

LEONARD R. WILSON

Memorial—Professor Gunnar Elias Erdtmann: Micropaleontology, v. 19, p. 370-371.

Observations on the morphology and stratigraphic distribution of *Hamiapollenites* [abstract]: Geological Society of America Abstracts with Programs, v. 5, p. 130 (reprinted in Oklahoma Geology Notes, v. 34, p. 121).

APPENDIX D

Papers Presented by Survey Staff at Professional Meetings, 1973-74 Fiscal Year

National Science Foundation Summer Institute—Environmental Perceptions in Planning

Southwestern State College, Weatherford, Oklahoma, July 2, 1973

KENNETH S. JOHNSON

Geology, mineral resources, and environmental geology of the southern Great Plains

Northern Oklahoma Gem and Mineral Society, Monthly Meeting

Ponca City, Oklahoma, July 13, 1973

KENNETH S. JOHNSON

Coal mining and land reclamation in Oklahoma

U.S. Bureau of Outdoor Recreation, Regional Conference
Albuquerque, New Mexico, July 31, 1973
KENNETH S. JOHNSON
Economics and surface-mined land reclamation

American Association of Petroleum Geologists, Mid-Continent Section Biannual Meeting
Tulsa, Oklahoma, October 3-5, 1973
THOMAS W. AMSDEN
Porosity and permeability in Silurian carbonate rocks of Hunton Group, Anadarko basin, Oklahoma

Sierra Club of Norman, Monthly Meeting
Norman, Oklahoma, October 18, 1973
KENNETH S. JOHNSON
Coal mining and land reclamation in Oklahoma

Osage Hills Gem and Mineral Society, Biannual Show
Bartlesville, Oklahoma, October 20-21, 1973
KENNETH S. JOHNSON
Adventures on the Colorado River
Coal mining and land reclamation in Oklahoma

Geological Society of America, Annual Meeting
Dallas, Texas, November 12-14, 1973
S. A. FRIEDMAN
Selection of a coal gasification plant site in Oklahoma
KENNETH S. JOHNSON
Inventory of strip-mined lands in Oklahoma coal field

Oklahoma Academy of Science, Annual Meeting
Oklahoma City, Oklahoma, November 16, 1973
KENNETH S. JOHNSON
Reclamation of strip-mined coal lands in eastern Oklahoma

Palynological Society of India, Sixth Professor Gunnar Erdtman Memorial Seminar
Bose Institute, Calcutta, India, November 26, 1973
LEONARD R. WILSON
Palynomorph floras and the drifting continents

Oklahoma City Geological Society, Monthly Meeting
Oklahoma City, Oklahoma, November 29, 1973
THOMAS W. AMSDEN
Porosity and permeability in Silurian carbonate rocks of Hunton Group, Anadarko basin, Oklahoma

Engineering Club of Oklahoma City, Weekly Meeting
Oklahoma City, Oklahoma, December 12, 1973

S. A. FRIEDMAN
The impact of the energy crisis on coal resources and development

Oklahoma Department of Pollution Control, Coordinating Board Meeting
Oklahoma City, Oklahoma, February 11, 1974
KENNETH S. JOHNSON
Strip mining and land reclamation in eastern Oklahoma coal field

Oklahoma State University Department of Geology, Colloquium Lecture Series
Stillwater, Oklahoma, February 13, 1974
KENNETH S. JOHNSON
Strip mining and land reclamation in eastern Oklahoma coal field

Ardmore Geological Society, Monthly Meeting
Ardmore, Oklahoma, February 21, 1974
THOMAS W. AMSDEN
Porosity and permeability in Silurian carbonate rocks of Hunton Group, Anadarko basin, Oklahoma

Society of the Sigma Xi, University of Texas Chapter Lecture Series
Austin, Texas, February 28, 1974
LEONARD R. WILSON
Palynological floras and the drifting continents

American Chemical Society, Oklahoma Section Annual Meeting
Stillwater, Oklahoma, March 2, 1974
S. A. FRIEDMAN
Coal resources of eastern Oklahoma, January, 1974

Geological Society of America, South-Central Section Annual Meeting
Stillwater, Oklahoma, March 7-8, 1974
S. A. FRIEDMAN
Extrapolation and paleogeography of fossil river systems I: Late Ordovician through Early Pennsylvanian
KENNETH S. JOHNSON
Permian copper shales of southwestern Oklahoma
LEONARD R. WILSON
Observations on the morphology and stratigraphic distribution of *Hamiapollenites*

Oklahoma Archaeological Society, Annual State Meeting
Norman, Oklahoma, March 16, 1974
LEONARD R. WILSON
Geomorphology and floral history of Tesesquite Creek valley, Cimarron County, Oklahoma

The University of Oklahoma, Energy Lecture Series
Norman, Oklahoma, March 22, 1974
CHARLES J. MANKIN
Energy in Oklahoma—past, present, and future

U.S. Geological Survey, Symposium on Base-Metal Resources in Stratibound Deposits
Denver, Colorado, May 2, 1974
KENNETH S. JOHNSON
Permian copper shales of southwestern Oklahoma

Departments of Geology at Selected European Universities, Invitational Lecture Tour
Universities of Mainz, Karlsruhe, and Bonn, West Germany, May 21-June 14, 1974
KENNETH S. JOHNSON
Geology of the Ouachita, Arbuckle, and Wichita mountain systems on the south margin of the United States craton
Permian paleogeography of western Oklahoma and adjacent areas

Arbuckle Mountains Covered in Survey's HA-3

Hydrologic Atlas 3, the third in the Oklahoma Geological Survey's cooperative series with the Water Resources Division of the U.S. Geological Survey, covers the Ardmore 1:250,000 quadrangle and the Oklahoma portion of the Sherman quadrangle to the south. Compiled and written by Donald L. Hart, Jr., USGS hydrologist, the atlas is entitled *Reconnaissance of the Water Resources of the Ardmore and Sherman Quadrangles, Southern Oklahoma.*

The atlas encompasses an area of about 9,000 square miles and consists of 4 large map sheets folded in an envelope. The four sheets include (1) a full-scale map of the bedrock geology and a smaller map of the alluvium and terrace deposits; (2) a full-scale map showing relative availability of ground water, a smaller map showing the approximate depth of the base of fresh water, and hydrographs of selected observation wells; (3) a full-scale map indicating the chemical quality of ground water; and (4) maps, graphs, and tables relating to the region's surface water.

The report concludes that potential for development of water supplies in the region is good. It is felt that several major aquifers in the area are capable of further development, as are springs. The characteristics of surface water indicate a greater potential for development in the eastern part of the region than in the central and western parts.

Aside from the obvious usefulness of the atlas for hydrologic information, many users will welcome the geologic map of the region, which covers the entire Arbuckle Mountains. Much of the region's geology has been re-

vised and reinterpreted specifically for this publication. The map explanation is relatively extensive, with as many as three parallel columns showing correlative units in the Arbuckle Mountains, Ouachita Mountains, and Ardmore basin.

Already published in the 9-part series are HA-1, covering the Oklahoma portion of the Fort Smith quadrangle, and HA-2, covering the Oklahoma portion of the Tulsa quadrangle.

HA-3 can be obtained from the Oklahoma Geological Survey for $5.00 a set.

USGS Issues Washington, D.C. Land-Use Maps

The first three experimental maps of a proposed *Folio of Land Use in the Washington, D.C. Area* have been published by the U.S. Geological Survey. Included are an 11-color map that shows various categories of land use, prepared with a photomosaic base derived from 1970 NASA high-altitude color infrared photography; an annotated orthophoto map showing political boundaries and cultural features; and a map of 1970 census tracts. The three maps are published at a scale of 1:100,000 (1 inch equals 1.6 miles), and the size is 30 by 29 inches. Future issues in the series will show changes in land use from 1970-1972, and a map showing 1973 land use prepared by direct computer classification of multi-spectral data acquired from NASA's ERTS-1, the Earth Resources Technology Satellite.

1970 land-use maps have already been released for the San Francisco Bay Region in California, and others are in preparation, as is a 1973 land-use map for Pittsburgh, Pennsylvania.

Copies of the maps, "Land Use Map, 1970, Washington Urban Area, D.C., Maryland, and Virginia"; "Annotated Orthophoto Map, 1970, Washington Urban Area, D.C., Maryland, and Virginia"; and "Census Tracts, 1970, Washington Urban Area, D.C., Maryland, and Virginia," can be ordered for 75 cents each, from USGS Distribution Section, 1200 South Eads Street, Arlington, Virginia 22202.

New Tectonics Publication Issued by SEPM

Special Publication 22, *Tectonics and Sedimentation,* has been released by the Society of Economic Paleontologists and Mineralogists. The volume contains 10 papers from an SEPM symposium that reviewed the evolution of plate-tectonics concepts based on regional examples of sedimentary successions in North America. Types of sequences treated include those of the craton, foreland basins adjacent to orogenic belts, marginal synclinal belts, and intra-montane and fault-bounded basins.

The publication is available from SEPM, Box 4756, Tulsa, Oklahoma 74104. Cost is $9.00 to SEPM and AAPG members, $11.00 to others (add 4 percent sales tax for books delivered in Tulsa, 2 percent for books delivered elsewhere in Oklahoma).

Lone Star 1 Rogers Unit Captures World Depth Record

T. L. Rowland[1]

INTRODUCTION

The Anadarko basin in western Oklahoma continues to hold the world depth record for hydrocarbon exploration. Lone Star Producing Company's 1 Bertha Rogers Unit, sec. 27, T. 10 N., R. 19 W., Washita County, recently preempted the 30,050-foot record set in February 1972 by their own 1 Baden Unit. The Rogers well, only 19 miles east of the Baden Unit (fig. 1), was spudded November 27, 1972, and it reached a total depth of 31,441 feet April 13, 1974, in dolomite of the Arbuckle Group.

The total cost of the well was $5.9 million. It was drilled on one of Lone Star's seismic structures in the deep portion of the Anadarko basin. Oklahoma Natural Gas Company, Michigan-Wisconsin Pipe Line Company, and Natural Gas Pipeline Company of America joined Lone Star in drilling the portion from 23,500 feet to total depth.

DRILLING THE 1 ROGERS UNIT

The 1 Rogers Unit was drilled by Loffland Brothers Company of Tulsa using the world's largest land-based drilling rig, the same rig that drilled the Baden well. Hole sizes and casing information are given in table 1, as are the records of logs run, testing data, and other pertinent statistics.

The Rogers well was not drilled as smoothly as the Baden was. After reaching total depth, the bottom-hole pressure was 24,835 pounds per square inch (psi). Drilling was done with 9.9-pound mud with 16,185 psi of hydrostatic head. A small show of high-sulphur gas under 5,500-8,500 psi pressure was detected at the surface. The gas would burn, but the volume was too small to be measured. An attempt to kill the well with 18,500 pounds of mud was successful. After the well was controlled, 99 percent of the material reaching the surface during circulation was sulphur crystals. The bottom-hole temperature was 390°F and the sulphur in solution was crystallizing. The sulphur must have crystallized at about 15,200 feet; at that depth the drill pipe parted and the remaining pipe from this depth to the bottom was left in the hole. The drillers backed off to 9,950 feet with 14-inch casing, milled out to 10,001 feet, side-tracked the hole, and redrilled to 13,202 feet. In completing the well, a zone in the granite wash from 13,000 to 13,110 feet was perforated and testing produced a flowing rate of 6 million cubic feet of gas per day on a ⅜-inch choke, with flowing tubing pressure of 1,800 psi.

[1]Geologist, Bureau of Economic Geology, The University of Texas at Austin.

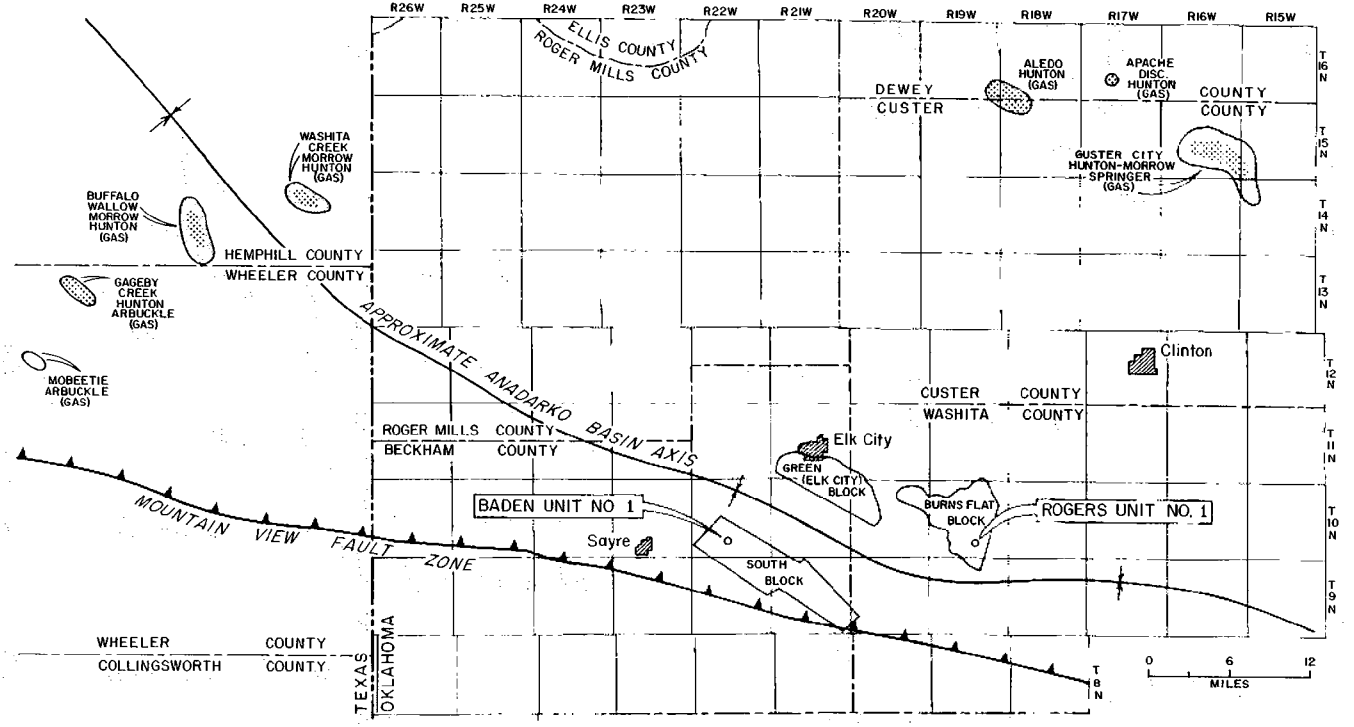

Figure 1. Map of western Oklahoma and eastern Texas Panhandle showing locations of Lone Star Producing Co. 1 Bertha Rogers Unit and 1 E. R. Baden Unit with respect to major tectonic elements, acreage blocks, and producing fields. Morrow-Springer production shown by fine stippling, and Hunton production by coarse stippling.

TABLE 1.—DRILLING AND COMPLETION DATA ON LONE STAR 1 ROGERS UNIT

Location:	C SE¼ sec. 27, T. 10 N., R. 19 W., Washita County, Oklahoma.
Elevation:	Ground level, 1,893′; derrick floor, 1,919′; kelly bushing, 1,922′.
Hole size:	17½″ to 4,700′; reamed to 26″ to 4,600′; drilled 17½″ to 14,200′; 2¼″ to 23,550′; 7⅞″ to 31,441′. Redrilled portion 7⅞″ 10,001′ to 13,202′.
Total depth:	31,441′.
Bottom-hole temperature:	390°F.
Casing depths:	30″ conductor to 117′; 20″ to 4,604′; 14″ to 14,198′; 9⅝″ to 23,550; redrilled portion 4½″ from 10,001′ to 13,202′.
Well objective:	Arbuckle Group.
Types of logs:	Induction-electric log with gamma ray (GR) and self-potential (SP) log, 114′ to 4,734′. Dual-induction laterolog with GR and SP, 4,600′ to 14,199′. Compensated neutron formation density with GR, 4,600′ to 14,208′. Integrated borehole compensation sonic with GR, 4,600′ to 14,201′. Four-arm caliper log, 4,600′ to 14,205′. Sperry Son directional survey, 0 to 14,205′. Dual-induction laterolog with GR and SP, 14,202′ to 17,689′. Compensation neutron formation density with GR, 14,202′ to 17,500′. Dual laterolog with GR, 23,560′ to 29,335′. Compensation neutron formation density with GR and caliper, 23,558 to 29,335′. Integrated borehole compensation sonic; with GR, 23,558′ to 29,320′. Dipmeter directional caliper 4-arm. 23,582′ to 27,488′. Dipmeter directional caliper 3-arm. 26,903′ to 29,319′. Seismic reference survey, shots taken at 23,500′ and 26,100′.
Testing:	Tested Arbuckle dolomite with a small show of gas to the surface. Tested granite wash from 13,000′ to 13,110′ in the redrilled hole. Estimated 3½ MCFGPD. Perforated granite wash 13,000′ to 13,110′. Acidized from 13,000′ to 13,110′ with 5,000 gals. of mud acid.
Completion:	Shut-in gas well in the granite wash.

GEOLOGY

Table 2 lists the tops and thicknesses of most of the Paleozoic units drilled in the Rogers well. The thickness of equivalent units in the Baden well are shown within parentheses in the table. An examination of table 2 reveals several thickness differences in units from the two wells. In the Rogers well the Atoka is 548 feet thinner; Morrow, 66 feet thinner; top of the Springer to the top of the Woodford is 484 feet thinner; Woodford, 66 feet thinner; Hunton, 214 feet thinner; and the Sylvan is 37 feet thinner. The Viola was not entirely penetrated in the Baden well, but in the Rogers well

TABLE 2.—GEOLOGIC UNITS PENETRATED BY LONE STAR 1 ROGERS UNIT

AGE	UNIT	TOP (FEET)	SUBSEA ELEVATION (FEET)	THICKNESS[1] (FEET)
Permian	Wellington	3,572	−1,650	
	Pontotoc	4,398	−2,476	
Pennsylvanian	Atoka	12,862	−10,940	4,640 (4,092)
	Morrow	17,502	−15,580	4,036 (3,970)
Mississippian	Springer	21,538	−19,616	
	Goddard	22,490	−20,568	
	Chester Limestone marker	23,406	−21,484	
	Meramec/Sycamore	26,097	−24,175	
	Osage	26,735	−24,813	
Mississippian-Devonian	Woodford	27,520	−25,598	252 (318)
Devonian-Silurian-Ordovician	Hunton	27,772	−25,850	1,106 (1,320)
Ordovician	Sylvan	28,878	−26,956	175 (212)
	Viola	29,053	−27,131	711
	Simpson	29,764	−27,842	1,472
	Arbuckle	31,236	−29,314	205 feet drilled
	TOTAL DEPTH	31,441	−29,519	

[1]Thickness of same units in 1 Baden Unit in parentheses.

the Viola is 189 feet thinner than its maximum surface thickness and the Simpson is 828 feet thinner than its maximum surface thickness.

In the Baden well, I postulated a minimum thickness to Precambrian basement of 45,000 feet (Rowland, 1974, p. 7). This figure was calculated by taking the top of the Viola in the Baden well and adding the maximum surface thickness of the pre-Sylvan units plus 5,000 feet of Lower and Middle Cambrian volcanics. If I use this same method for the Rogers well, adding the depth to the top of the Arbuckle (31,235 feet) to the maximum thickness of the Arbuckle Group (6,700 feet), Honey Creek (225 feet), and Reagan (450 feet), for a total of 7,375 feet, the sedimentary thickness would be 38,611 feet. If another 5,000 feet of Lower and Middle Cambrian volcanics are added, the total package to Precambrian basement could be 43,611 feet. However, since the Simpson and Viola are somewhat thinner than their maximum surface equivalents, perhaps the pre-Simpson units are also thinner.

The thickness of the sedimentary package is certainly speculative, and it could be somewhat thinner than 38,611 feet. It must be kept in mind that these drilled thicknesses may not be true, owing to structure. However, the dipmeter surveys taken indicated a minimal amount of dip.

The two deep wells drilled in the deeper portion of the Anadarko basin have not been extremely successful in terms of hydrocarbon production. They do not rule out additional deep drilling, but for the present Lone Star Producing Company has no plans for additional tests in the area. These wells have added greatly to our geologic knowledge of the deeper Anadarko basin, however, and it is hoped that more deep test wells will be drilled in the future.

Reference Cited

Rowland, T. L., 1974, The historic 1 Baden Unit and a brief look at exploration in the Anadarko basin: Oklahoma Geology Notes, v. 34, p. 3-9.

Interstate Mining Compact Commission Views Oklahoma Operations

Representatives from 22 states met in Muskogee, Oklahoma, September 4-6, for the fall meeting of the 3½-year-old Interstate Mining Compact Commission. Official attendance at the meeting increased from 83 to 100 since the commission met in Oklahoma in 1972, and the number of member states has increased from 6 to 9.

The commission met in executive session the first day and authorized funds for a movie on mining in America. The opening scenes of the movie were shot on the second day of the meeting, during a field trip to three active surface coal mines in Muskogee and Haskell Counties. Oklahoma Geological Survey geologists serving as field-trip leaders were Charles J. Mankin, Survey director, Robert O. Fay, S. A. Friedman, Kenneth S. Johnson, and John R. Roberts. A guidebook for the trip was compiled by Friedman and Johnson and distributed with the compliments of the OGS.

A large tent was pitched directly on reclaimed mined land, and a barbecue luncheon was held for some 200 field-trip participants. Ward Padgett, Oklahoma's chief mine inspector (and principal organizer of the meeting), presented a plaque to J. Paul Savage of Lone Star Steel Company, citing Lone Star for its excellence in coal-mining and mined-land-reclamation practices.

At a banquet held that evening, Oklahoma Governor David Hall (this year's commission chairman) praised the work of the commission and expressed optimism about the wise use of energy fuels and the continued practice of mined-land reclamation in Oklahoma.

The final day of the meeting, technical talks were presented by R. H. Lyddan, chief of the Togographic Division of the U.S. Geological Survey, V. E. Scheid, chairman and director of the Nevada Oil & Gas Conservation Commission, Kenneth S. Johnson, OGS geologist, and E. D. DeGraff, president of Ambionics, Inc.

—S. A. Friedman

OKCOL, A WATER-MISCIBLE MOUNTANT FOR PALYNOLOGY

L. R. WILSON[1]

A water-miscible mountant described several years ago (Wilson, 1968) has been widely used by palynologists, and further experimentation has resulted in a simpler method of preparation. Because of the mountant's acceptance, it is deemed desirable to refer to this medium by a name rather than referring to it as "the mounting medium developed by The University of Oklahoma." The name *Okcol* is proposed for the water-miscible mountant described below.

Okcol is best used with palynomorph concentrations contained in a water solution that is near neutral. It hardens on evaporation of the contained water and becomes a transparent filmlike solid. The drying causes little or no collapsing of delicate palynomorph structures, and the index of refraction is 1.49, approximately that of glycerine jelly.

The original formula for Okcol called for preparation of glycerin jelly and a gum-acacia solution and the addition of a preservative, phenol or formaldehyde. Determining the proper amount of formaldehyde proved to be too difficult to be practical; therefore its use is no longer recommended.

The formula now suggested uses a good grade of commercial glycerin jelly, securable from scientific or chemical supply companies. Commercial glycerin jelly contains sufficient phenol to function as a preservative in the final product. The other ingredient, gum acacia (white tears or powder), is available from the same sources.

Preparation of Okcol involves heating a container of glycerin jelly in hot water until the jelly is highly fluid. It is kept in that state until the gum-acacia solution is ready. Gum acacia U. S. P. is purchased as a dry flaky, granular, or powdered substance. This is slowly added to boiling distilled water until the solution becomes saturated. The fluids should be approximately the same temperature, and the two solutions should be combined 2 parts glycerin jelly to 1 part saturated gum-acacia solution. Next, the mixture is placed in a double boiler and thoroughly stirred. After the fluids are blended, the mixture is strained at least twice through a silk or nylon cloth and stored in small convenient bottles with dropper dispensers. The mountant is then ready for use.

The technique of making microscope slide mounts with Okcol has been described and illustrated by Wilson and Goodman (1964) but further emphasis should be placed on the necessity for using at least four times as much Okcol as palynomorph-concentrate solution. If that is not done, minute dry areas may develop on the slide after the medium has been dehydrated. The steps in making microscope slide preparations with Okcol are as follows:

[1]Geologist, Oklahoma Geological Survey, and George Lynn Cross Research Professor of Geology and Geophysics, The University of Oklahoma.

1. Microscope slide mounts are prepared on cover slips in order to concentrate the palynomorphs as near the surface of the upper glass as possible. Wash the cover slips in alcohol and dry them thoroughly with a lint-free cloth. Place them on labeled microscope slides in a tray that will be transferred later to a warming oven.
2. Preparing one slide at a time, place several drops of Okcol on the cover slip in the proportion of four drops of Okcol to one drop of water containing palynomorph preparation. Stir the mixture until the palynomorphs are thoroughly dispersed and then spread it evenly over the cover slip, leaving a margin of approximately one-fourth inch.
3. Transfer the cover slip (preparation side up) to a labeled microscope slide. The mount at this stage can be examined under low-power optics for dispersal of palynomorphs.
4. Arrange the microscope slide or slides on the tray, and place it in a warming oven at a temperature less than 40°C. After 20 or 30 minutes, the water in the mounts will evaporate and the preparation will be filmlike and semisolid.
5. Remove the tray containing the slides from the oven, and use a needle to test the preparation for solidity. If the preparation has hardened, remove the cover slip of each slide and place a drop of permanent mounting medium, for instance, Canada balsam, on the microscope slide. Then invert the cover slip and place it (preparation side down) on the medium. The slide can be examined under the microscope again before it is returned to the oven, set at 40°C., and warmed until the Canada balsam or similar medium is hardened. This last step may require several days before the cover slip becomes permanently fixed to the microscope slide.

References

Wilson, L. R., 1968, New water-miscible mountant for palynology: Micropaleontology, v. 14, p. 247-248.

Wilson, L. R., and **Goodman, G. J.**, 1964, Techniques of palynology—part II. Microscope-slide preparation of modern spores and pollen: Oklahoma Geology Notes, v. 24, p. 277-280.

USGS Releases Report on Mineral Concentrations in Soils

Selenium, Fluorine, and Arsenic in Surficial Materials of the Conterminous United States, by Hansford T. Shacklette, Josephine G. Boerngen, and John R. Keith, has been issued by the U.S. Geological Survey as Circular 692. This report follows the vein of the work done by Shacklette, Boerngen, and R. L. Rahill on *Lithium in Surficial Materials of the Conterminous United States and Partial Data on Cadmium,* published by the USGS in 1973 as Circular 673.

The purpose of these investigations, according to Dr. Schacklette, is "to determine if certain chemical elements are being added to soils by man's activities." Sampling is done, therefore, at sites as representative as possible of the naural condition of surface materials, and most samples analyzed are taken at depths of about 8 inches. Results show considerable variation

in natural occurrences of these elements, with high concentrations appearing regionally as the result of high content in geologic materials or as the result of weathering. These studies should prove valuable in all attempts to cope with problems related to environmental pollution of soils.

USGS Circular 692 is available free on request from the U.S. Geological Survey, National Center, Reston, Virginia 22092.

Thomas L. Thompson New Head of Oklahoma AIPG

Thomas L. Thompson, a research geologist with Amoco Production Company in Tulsa, assumed the presidency of the Oklahoma Section of the American Institute of Professional Geologists following the section's annual meeting September 7 in Norman. In addition to his service to AIPG, Dr. Thompson made several national and international tours this past year as a Distinguished Lecturer for The American Association of Petroleum Geologists.

Other new officers of the section are as follows: first vice-president and president-elect, Ralph H. Espach, Jr., consultant, Oklahoma City; second vice-president, Don E. Brown, independent, Tulsa; and secretary-treasurer, Henry Trattner, consultant, Oklahoma City. District representatives are Merrill J. Reynolds (Tulsa), John W. Erickson (Oklahoma City), and Douglas C. Brockie, of Miami, representative-at-large.

The meeting was highlighted by the appearance and participation of the institute's national president, Frank B. Conselman, of Texas Tech University, Lubbock.

The outgoing president, William D. Rose, geologist-editor for the Oklahoma Geological Survey, was presented a plaque by Gary McDaniel, on behalf of the Oklahoma Section, in acknowledgment of his service to the AIPG.

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