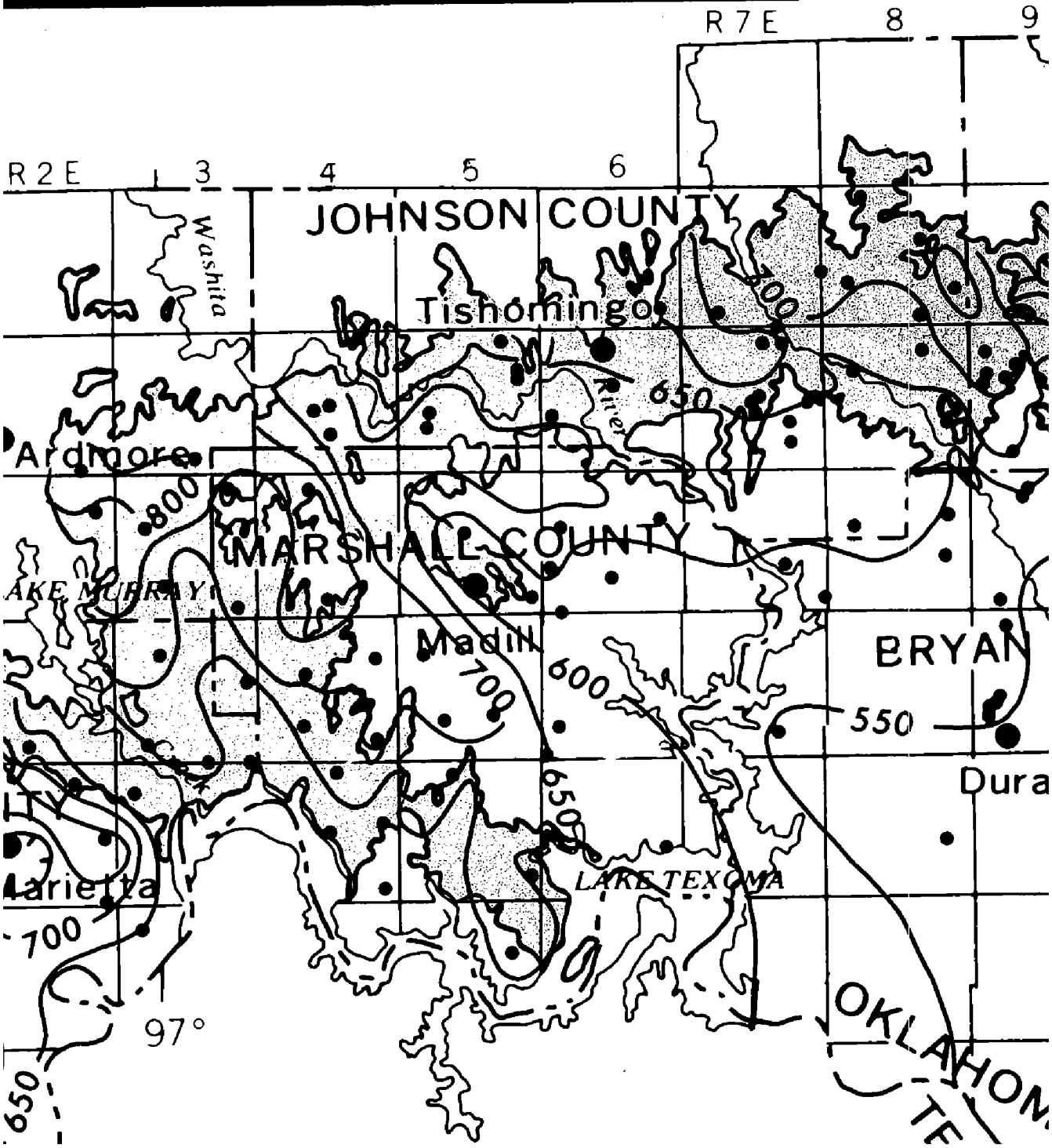
OKLAHOMA GEOLOGY NOTES



On the cover–

Report on Antlers Aquifer (Cretaceous) Published by OGS

The cover illustration, part of a potentiometric map of the Antlers aquifer, is taken from figure 8 of a report on the *Geohydrology of the Antlers Aquifer (Cretaceous), Southeastern Oklahoma*. The report was issued recently by the Oklahoma Geological Survey as Circular 81.

The circular, prepared in cooperation with the U.S. Geological Survey, was authored by Donald L. Hart, Jr., and Robert E. Davis, both hydrologists with the Water Resources Division of the U.S. Geological Survey and both formerly stationed in the Oklahoma City office of the division. Hart is presently employed by the Albuquerque, New Mexico, office of the USGS; Davis is at the Helena, Montana, branch.

The report states that the Antlers aquifer (or ground-water reservoir) consists of as much as 900 feet of principally sandstone, with lesser amounts of silt, clay, and shale. The formation is exposed over a 1,860-square-mile area in southeastern Oklahoma and is found in the subsurface in an area of 4,400 square miles in Love, Carter, Marshall, Johnston, Bryan, Atoka, Choctaw, Pushmataha, and McCurtain Counties.

High amounts of precipitation (34–50 inches a year) contribute to a high rate of recharge, making the aquifer an excellent source of ground water. Seepage from surface waters and lateral movement of subsurface water into the aquifer also contribute to recharge. The Antlers is estimated to contain some 45,100,000 acre-feet of water in the region studied. Of this amount, 31,600,000 acre-feet has dissolved-solids concentrations of less than 1,000 milligrams per liter and is of good quality for domestic, agricultural, and industrial uses.

The circular contains a folded geohydrologic map and sections of the Antlers Sandstone. The text contains numerous tables and figures incorporating data on physical, chemical, radiochemical, and conductance properties of the aquifer, plus well and spring records, precipitation figures, and structural and physical properties of the Antlers Sandstone.

Circular 81 can be obtained from the Oklahoma Geological Survey at the address below. The price is $5 for a paperbound copy, and $9 for a hardbound copy.

Elizabeth A. Ham

Oklahoma Geology Notes

Editor: Connie Smith
Editorial Staff: Elizabeth A. Ham, William D. Rose

Oklahoma Geology Notes is published bimonthly by the Oklahoma Geological Survey. It contains short technical articles, mineral-industry and petroleum news and statistics, reviews, and announcements of general pertinence to Oklahoma geology. Single copies, $1; yearly subscription, $4. All subscription orders should be sent to the Survey at 830 Van Vleet Oval, Room 163, Norman, Oklahoma 73019.

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 GEOLOGY NOTES

OKLAHOMA GEOLOGICAL SURVEY, THE UNIVERSITY OF OKLAHOMA

Contents

This publication, printed by the Transcript Press, Norman, Oklahoma, is issued by the Oklahoma Geological Survey as authorized by Title 70, Oklahoma Statutes 1971, Section 3310, and Title 74, Oklahoma Statutes 1971, Sections 231–238. 1,800 copies have been prepared for distribution at a cost to the taxpayers of the State of Oklahoma of $2,056.

EXOCHOCRINUS **IN OKLAHOMA**

Harrell L. Strimple[1]

Although *Exochocrinus* is known to be widely distributed geographically, very few details have been available about the complete cup or crown of the genus. The holotype of *E. tumulosus,* the type species, is a partial cup from Breckinridge County, Kentucky, for which a more precise locality and stratigraphic zone (other than Chesterian Series) is unknown. A second specimen described by Sutton and Winkler (1940) as *Ageneracrinus tumidorugosus* is a partial cup from the Chesterian Series of Randolph County, Illinois. Burdick and Strimple (1969) synonymized the form with *Exochocrinus tumulosus.* Strimple (1962) illustrated a restored dorsal cup as *Cryphiocrinus bowsheri* (Strimple, 1949), which is designated here as *Exochocrinus* cf. *tumulosus.*

The individual plates used in the restoration were collected from the Hindsville Limestone, early Chesterian, Craig County, northeastern Oklahoma. An illustrated infrabasal disc (Strimple, 1962, figs. 1–3) probably is neither *Cryphiocrinus* nor *Exochocrinus* but is almost certainly *Staphylocrinus.* Basal plates of that genus also have been recognized in the faunule. A few plates were recovered and were noted by Strimple (1962, p. 186) to "—exhibit unusual tumidity, so pronounced that the exterior has the appearance of a sphere." Such a condition is typical of *Exochocrinus tumulosus,* whereas the plates of the restored cup are less protuberant.

A cup illustrated here (fig. 1), which is also from Craig County, Oklahoma, has basals like those of the holotype. It appears there may be some reduction in plate tumidity with growth, so that large specimens have lost the externally spherical appearance of individual plates and have become more like *Cryphiocrinus* in general appearance. On the other hand, there may be more than one species of *Exochocrinus.* The holotype of *C. bowsheri* is smaller than typical *Exochocrinus* and lacks the pronounced tumidity of individual plates, as well as surface ornamentation.

Agassizocrinus often coexists with *Exochocrinus* and *Staphylocrinus* but differs in having a cone-shaped infrabasal circlet that commonly makes up a large part of the cup. *Staphylocrinus* has 20 uniserial arms that branch on primibrachs 1 and commonly on secundibrachs 6. A crown of *Exochocrinus* that has the same pattern of arm branching is known from the Gasper (Chesterian) portion of the Monteagle Formation of Chapman Mountain, Huntsville, Alabama (personal communication, D. W. Burdick). Both *Agassizocrinus* and *Cryphiocrinus* have 10 uniserial arms.

[1]Department of Geology, The University of Iowa, Iowa City, Iowa 52242.

Figure 1. *Exochocrinus tumulosus* (Miller) from Hindsville Limestone, Craig County Oklahoma. Dorsal cup with lower arm segments attached (SUI 47295): *A*, anterior view, ×2.25; *B*, basal view with posterior interray at base of cup, ×2.25.

Systematic Paleontology

Subclass Inadunata

Order Cladida

Suborder Poteriocrinina

Superfamily Texacrinacea

Family Staphylocrinidae Moore & Strimple, 1973

The family Staphylocrinidae is composed of a heterogeneous group of genera that have bowl-shaped cups, three anal plates in the CD interray, and uniserial arms that bifurcate on primibrachs 1 in all rays (save *Abrotocrinus*, which has a nonaxillary PBr 1 in A ray) and branch again at least one more time higher in the arms. Of concern in the present study are the genera *Staphylocrinus* and *Exochocrinus*, both of which disengage from the column in ontogeny and have very thick cup plates.

Decidedly tumid cup plates serve to distinguish *Staphylocrinus* and *Exochocrinus* readily from *Agassizocrinus* and *Cryphiocrinus* and the latter two genera have only ten arms.

Genus **Exochocrinus** Burdick and Strimple, 1969

Type species—*Eupachycrinus tumulosus* Miller, 1892.

Diagnosis.—(After Burdick and Strimple, 1969.) Dorsal cup deep, truncate, bowl-shaped, and, except for infrabasals, composed of very tumid plates; infrabasals fused into flat, nearly pentagonal disc that lies within proximal invagination formed by protuberant basal plates; basals largest elements of cup; three anal plates in CD interray.

Description.—In addition to characters given above, cup plates, except for infrabasals, bear fine to coarse granules, some of which may coalesce to form radiating ridges, and the plates are thick. Infrabasals fused into a small, nearly flat disc located in the basal invagination formed by the much swollen basals and not visible in side view of cup; small, round columnar cicatrix is preserved. Primibrachs 1 have now been observed in the illustrated specimen and are axillary. A second higher bifurcation of the arms is known to have taken place, although the specimen in which this was noted is not available.

Remarks.—The small, flat infrabasal disc that lies in a basal invagination serves to distinguish *Exochocrinus* from *Staphylocrinus,* which lacks a basal invagination and has a larger infrabasal disc. Protruding, tumid basals of *Exochocrinus* distinguish it from coeval *Cryphiocrinus.* Although *Cryphiocrinus* typically lacks a stem, *C. bowsheri* retains a narrow column that probably acted as a tether.

Agassizocrinus is often found associated with these genera and also has very thick cup plates. However, the cup plates of *Agassizocrinus* commonly lack strong tumidity, the column is detached in adult stages, infrabasals are fused in the form of a cone, and there are only 10 uniserial arms. The latter condition is also found in *Cryphiocrinus.*

Isolated basal plates of *Exochocrinus* are rather easily identified because of their bulbous structure, ornamentation, and flexed proximal portion. The plates had rather wide distribution in North America during Gasper time, but articulated cups are rare.

Included species.—*Exochocrinus tumulosus* (Miller, 1892) and *E. vapidus* (Wright, 1951).

Occurrence.—Upper Mississippian (Chesterian), North America (United States); Lower Carboniferous (Viséan), Europe (Britain).

Exochocrinus tumulosus (Miller, 1892)

Fig. 1

Eupachycrinus tumulosus Miller, 1891, p. 70, pl. 9–10 (advance sheet); 1892, p. 680, pl. 9–10.

Ageneracrinus tumulosus Sutton and Winkler, 1940, p. 563–564, pl. 67, figs. 18–19.

Exochocrinus tumulosus Burdick and Strimple, 1969, p. 12–13, pl. 1, figs. 7–8.

Ageneracrinus tumidorugosus Sutton and Winkler, 1940, p. 566, pl. 68, figs. 20–21; Burdick and Strimple, 1969, p. 12–13, pl. 1, fig. 9.

Diagnosis.—Characters of genus.

Description.—(After Burdick and Strimple, 1969.) Dorsal cup bowl-shaped, truncate and, except for infrabasals, composed of very tumid plates. Cup about 0.6 times as high as wide, with greatest width at about 0.5 height of cup, and near top of basals. Except for infrabasals, cup plates bear fine to coarse granules, some of which form confluent ridges exhibiting radial symmetry on each plate. Infrabasals are fused into nearly flat pentagonal disc, which lies within proximal invagination formed by swollen basals and is not visible in side view; dorsal cup about 4.5 times wider than infrabasal disc; circular impression left by proximal columnal occupying less than 0.5 width of infrabasal disc. Distal parts of basals extend to more than 0.7 height of cup. Length and width of basals, measured with calipers, is about equal. In side or basal views, tumidity of radials does not protrude beyond that of basals; radials are twice as wide as high, with their articular facets sloping outward and separated by enlarged interfacet area. Three plates of anal series within cup are in normal position, with radianal largest and most tumid.

Measurements.—SUI 47295, height of dorsal cup 9.0 mm, maximum width 19.3 mm.

Remarks.—Burdick and Strimple (1969, p. 13) reported the presence of isolated basal plates (SUI 32927 and 32928) from the Hindsville Limestone of Oklahoma and Arkansas. The presently considered specimen (SUI 47295) is a dorsal cup with proximal brachials of the arms attached. The cup has been abraded, and some plates slightly disoriented. Radials and primibrachs 1 are almost equidimensional. The preservation is better than that of the two previously known specimens from Kentucky and Illinois. The zones from which those specimens were recovered is unknown other than being Chesterian in age. Isolated basal plates have been identified from Gasper strata near Huntsville, Alabama (Burdick and Strimple, 1969, p. 13) and the specimens from Oklahoma and Arkansas are Gasper in age.

As noted by Strimple (1978), the cup shape and tumidity of plates of *Mantikosocrinus hemisphericus* (Worthen) is somewhat similar to *Exochocrinus tumulosus,* although there is no pronounced protrusion of basal plates, and the radials are proportionately larger in the former species. Relationship between the two species is admittedly possible but is judged to be unlikely.

Illustrated specimen.—Collected and donated by Claude Bronaugh, Afton, Oklahoma. Reposited, catalog no. SUI 47295, Geology Department Repository, The University of Iowa, Iowa City, Iowa.

Occurrence.—Railroad borrow ditch in NE¼ sec. 13, T. 25 N., R. 21 E., Craig County, Oklahoma. Hindsville Limestone, early Chesterian, Mississippian.

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Moore, R. C., and **Strimple, H. L.,** 1973, Lower Pennsylvanian (Morrowan) crinoids from Arkansas, Oklahoma, and Texas: University of Kansas Paleontological Contributions, Article 60 (Echinodermata 12), 84 p.

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Sutton, A. H., and **Winkler, V. D.,** 1940, Mississippian Inadunata—*Eupachycrinus* and related forms: Journal of Paleontology, v. 14, p. 544–567, pls. 66–68.

Wright, James, 1951, A monograph on the British Carboniferous Crinoidea: Palaeontographical Society, v. 1, pt. 3, p. 47–102, pls. 13–31.

AMSDEN, TOOMEY, BARRICK STUDY FITZHUGH MEMBER OF CLARITA FORMATION

A new circular, *Paleoenvironment of Fitzhugh Member of Clarita Formation (Silurian, Wenlockian), Southern Oklahoma,* has been released by the Oklahoma Geological Survey (OGS). Issued as Circular 83, the 54-page report was prepared by Thomas W. Amsden, stratigrapher and paleontologist with OGS; Donald F. Toomey, of Cities Service Co. in Midland, Texas; and James E. Barrick, assistant professor in the Department of Geosciences at Texas Tech University in Lubbock.

According to the authors, this study was undertaken to develop an integrated lithofacies–biofacies model of the environment at the time of deposition of the Fitzhugh Member in the region of the Arbuckle Mountains and Criner Hills of southern Oklahoma. They recognize three divisions of lithofacies: sparites, micrites, and marlstones—each distinguished by a predominant type of megafauna.

The sparites—limestones containing abundant coarse-grained calcite cement, or spar, with some micrite matrix—contain a preponderance of crinoids, although brachiopods are common. The micrites—which are made up mostly of a fine-grained crystalline matrix with little or no spar—contain numerous ostracodes and trilobites, while brachiopods are largely replaced by gastropods and cephalopods. In the marlstones—the silty, argillaceous limestones that are intergradational with the micrites—the sessile and vagrant bottom dwellers are virtually gone and only thin-walled ostracodes remain. Conodonts, foraminifers, and inarticulate

brachiopods, however, are present in all three lithofacies, with only minor variations in conodont species.

The sparites occur only in the northeastern Arbuckles; the micrites make up most of the Fitzhugh in the southeastern Arbuckles and the Criner Hills; and the marlstones are most evident in the upper Fitzhugh in the central Arbuckle area. The sparites contain less than 1 percent insoluble detritus. The quantity of insoluble terrigenous detritus increases to about 6 percent in the micrites, while in the marlstones insoluble detritus increases sharply to an average of 18 percent.

From the evidence presented, the authors have concluded that the type of fauna was determined by bottom conditions rather than depth of seas in which the organisms lived. The sparites were deposited in clear water with moderate turbidity that yielded fine, clear skeletal sands suitable for abundant life. Increased bottom turbidity of the micrite environment adversely affected attached filter feeders, and increasingly severe conditions represented by the marlstones eliminated most of the bottom dwellers.

Amsden points out that these interpretations are based on a great deal of qualitative data collected through field work, chemical analyses of samples, examination of numerous thin sections, and lithographic and petrologic examinations of samples. He stresses that interpretations are also backed by a substantial amount of quantitative data involving point counting of the organisms in all three types of lithofacies. Results of these investigations are shown on graphs, charts, tables, and plates in the circular.

This report represents completion of another stage in a long-term program of investigations of the depositional basins of Oklahoma. Other significant contributions issued recently by the survey in this project include two studies by Amsden: one on the Hunton Group of rocks in the Arkoma Basin, published as OGS Bulletin 129; and one on the Hunton Group in the Anadarko Basin, issued as OGS Bulletin 121.

OGS Circular 83 can be obtained from the Oklahoma Geological Survey by writing to the address given inside the cover. The price is $9 for a hardbound copy, and $5 for a paperbound copy.

USGS ISSUES NEW CIRCULAR

The U.S. Geological Survey has released a new edition of its Circular 777, *A Guide to Obtaining Information from the USGS*. The circular was compiled by Paul F. Clarke, Helen E. Hodgson, and Gary W. North.

With the first 19 pages of the 42-page publication devoted to descriptions of the various offices, divisions, centers, etc., of the USGS and their services, the circular is also of value in informing readers of the activities and products of the agency.

USGS Circular 777 can be obtained free on request from the Branch of Distribution, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Virginia 22304.

PETROLEUM GEOLOGISTS BUILD "ENERGY BRIDGES TO THE FUTURE"

San Francisco, the "City by the Bay," will be the site for the 1981 annual convention of The American Association of Petroleum Geologists and its divisions—the Society of Economic Paleontologists and Mineralogists (SEPM), the Energy Minerals Division (EMD), and the Division of Professional Affairs (DPA).

Hosts for the May 30–June 3 meeting will be the Pacific Section of AAPG and the Northern California Geological Society. The general chairman is Donald F. Ziegler.

This year's convention theme, appropriate to the times as well as to the site, is "Energy Bridges to the Future."

Short courses on borehole environment, techniques for presenting papers, depositional systems along continental margins, and fundamentals and applications of geothermics will be presented along with workshops on cores in deep-water clastics, and economic and legal requirements of testing prospects. Research colloquia covering stratigraphy, paleontology, sedimentology, and organic geochemistry will be offered May 30 and 31.

Technical sessions, research symposia, and poster sessions are scheduled for June 1–3. Papers presented at these sessions will include just about every subdiscipline in the field of earth sciences, with emphasis on topics applicable to exploration for petroleum and other fossil fuels.

AAPG will offer four pre- and post-convention field trips which will cover the late Mesozoic convergent margin in northern California; the Geysers Geothermal Field, which is the world's largest geothermal area; the San Andreas Fault and the metamorphic rocks of the Franciscan Complex; and lithostratigraphy and diagenesis in the Tertiary Monterey Formation in the Santa Barbara area.

SEPM field trips will include the geology of the Tres Piños–Panoche Valley–New Idria area of the central Diablo Range; a transect of the Diablo Range; biogenic structures in Bodega Bay; traverses of part of the Sacramento Valley; geology and hydrocarbon exploration of the East Bay Hills, Mount Diablo Range, and Livermore Basin; and lithofacies and sedimentology of submarine fans at Point San Pedro, Pigeon Point, and Point Lobos.

The Oklahoma Geological Survey will be represented at the 1981 convention by Charles J. Mankin, director; Kenneth S. Johnson, associate director; Thomas W. Amsden, biostratigrapher and lithostratigrapher; William E. Harrison, petroleum geologist and geochemist; S. A. Friedman, senior coal geologist; Salman Bloch, uranium and base-metals geologist and geochemist; Joseph A. Curiale, OGS research

assistant and Ph.D. candidate in the OU School of Geology and Geophysics; and Elizabeth A. Ham, associate editor.

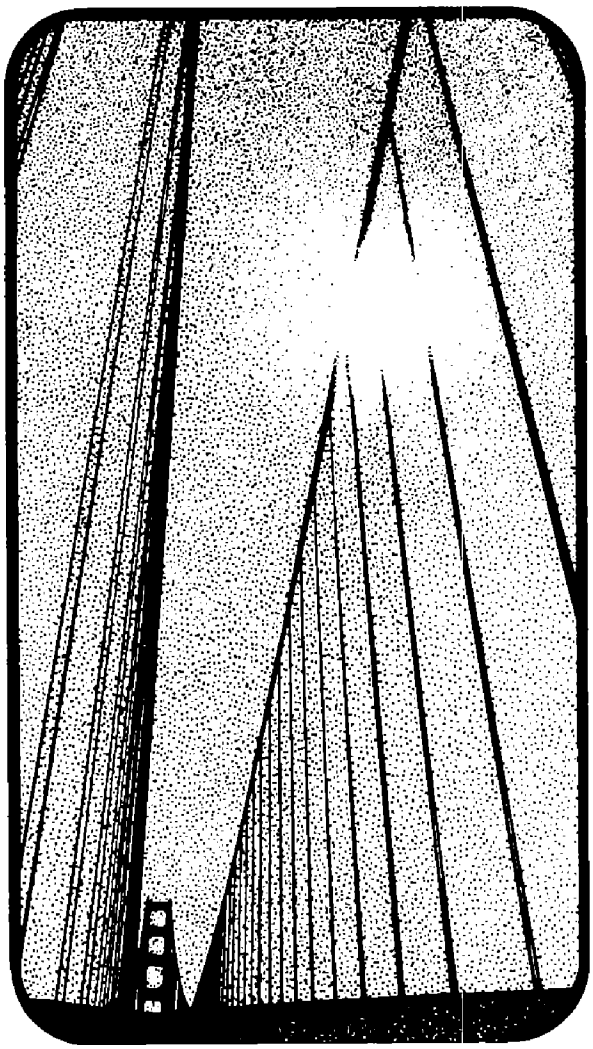
Mankin will attend a meeting on the COSUNA (Correlation of Stratigraphic Units of North America) project. He is a member of the advisory committee and a regional editor for this project, which is in the final stages of preparation of continent-wide stratigraphic correlation charts. He will also be involved in a meeting of the National Academy of Science's Continental Scientific Drilling Committee.

Johnson is scheduled to present a report on plans for the Mid-Continent Section meeting of AAPG, which will meet in Oklahoma City, September 21–22. Also, he plans to join the field trip to the San Andreas Fault and Franciscan Complex.

Friedman, as a founding member and vice-chairman of EMD, will be involved in an executive committee meeting and in the business meeting of that division. During the convention, the EMD will offer technical sessions on the uranium industry, oil shales, geothermal energy, and coal and general energy minerals.

Bloch, Curiale, OU graduate student Janina Rafalska-Bloch, Harrison, and Retha Bloodworth (of the Hazen Research Laboratory in Golden, Colorado) will present a poster session on "Uraniferous Pyrobitumens from Southwestern Oklahoma." Curiale also will deliver a paper on "Origin and Geochemical Correlation of Near-Surface Oil and Asphaltite Deposits of Southeastern Oklahoma."

Harrison and Reinhard Hesse, associate professor at McGill University in Montreal, and one of the shipboard scientists with Harrison on Leg 67 of the DSDP (Deep Sea Drilling Project) off the west coast of Central America, will offer a poster session on "Gas Hydrates Causing Poor Water Freshening and Oxygen Isotope Fractionation in Deep-Water Sedimentary Sections



ENERGY BRIDGES
TO THE FUTURE

of Terrigenous Continental Margins."

Harrison will drive to the convention in company with Uwe Tröger, professor of geology at the Technical University of Berlin, who is involved in the cooperative exchange program between the Technical University and The University of Oklahoma (see *Oklahoma Geology Notes*, v. 41, no. 1, February, 1981). Harrison and Tröger will visit the Laramie, Wyoming, offices of the U.S. Department of Energy on the return trip from San Francisco.

Ham will represent William D. Rose, OGS geologist/editor, at a meeting of the AAPG Public Information Committee, of which Rose is a member.

In addition, exhibits are planned for the Oklahoma Geological Survey, the OU Energy Resources Center (ERC), and Sigma Gamma Epsilon (SGE), national honorary geological fraternity. Mankin is director of the ERC and national secretary of SGE.

NOTES ON NEW PUBLICATIONS

Metric Map of Eufaula Quadrangle

The Eufaula Quadrangle, in east-central Oklahoma, is the area covered by the second in a series of metric regional topographic maps of Oklahoma. Published by the U.S. Geological Survey, the map represents part of a new national series of 1:100,000-scale metric maps. The maps have bar scales that show miles and feet as well as kilometers and meters.

Feature separation is achieved by subdividing mapped information elements into classes and preparing separate master drawings for each classification. This allows purchase of reproducibles containing only those map elements required for various projects.

The Eufaula Quadrangle covers an area of 95° to 96° longitude and 35° to 35.5° latitude.

Copies of the map are available from: Branch of Distribution, U.S. Geological Survey, P.O. Box 25286, Federal Center, Denver, Colorado 80225. Price: $2.

Copies of reproducibles for the various elements are available from: USGS Mid-Continent Cartographic Information Center, U.S. Geological Survey, 1400 Independence Road, Rolla, Missouri 65401. Price information given by telephone: (314) 341-0851.

Mount St. Helens Eruption

This is a preliminary aerial photographic interpretive map showing features related to the eruption of Mount St. Helens, Washington, on

May 18, 1980. Latitude 46° to 46°30′. Longitude 122° to 122°30′. The sheet measures 27 by 41 inches.

Issued as USGS Miscellaneous Field Studies Map 1254, this publication is available from the Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, Virginia 22202. Price: 75c.

Petroleum-Resource Appraisal and Discovery Rate Forecasting in Partially Explored Regions

Professional Paper 1138–A–C has recently been published by the U.S. Geological Survey.

This paper can be obtained from the Branch of Distribution, U.S. Geological Survey, 604 South Pickett Street, Alexandria, Virginia 22304. The price per copy is $4.

Water–Quality Trends in Carbonate Aquifers

Water-Resources Investigations 80-57 uses geophysical logs to estimate water-quality trends in carbonate aquifers. The 29-page report is authored by L. M. MacCary.

Order from: National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, Virginia 22161. When ordering, use NTIS number PB-80 224 124. Price: $6 hardcover; $3.50 microfiche.

Helium Resources of the United States, 1979

This publication has recently been released as Information Circular 8831 by the U.S. Bureau of Mines. The 27-page report, written by B. J. Moore, depicts estimated helium resources of the United States at 727 billion cubic feet as of January 1, 1979. These resources are divided into four categories in decreasing degrees of assurance of their existence.

Available from: Superintendent of Documents, U.S. Government Printing Office, Public Documents Department, Washington, D.C. 20402. Price: $2.

Open-file Reports—

The U.S. Department of Energy's Grand Junction Office has issued a list of reports that were placed on open file during 1980. Included in the list are:

Aerial Radiometric and Magnetic Reconnaissance Survey of Portions of New Mexico, Oklahoma and Texas, Dalhart Quadrangle, report number GJBX–46(80). Order paper copy from subcontractor: Texas Instruments, Inc.; contract number 79-285-L. Order microfiche from: Bendix Field Engi-

neering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $5 paper copy; $3.50 microfiche.

Hydrogeochemical and Stream Sediment Detailed Geochemical Survey for Wichita Uplift Region, Oklahoma, by T. R. Butz and others, numbered GJBX-66(80). Order microfiche from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $7.

Aerial Gamma-Ray and Magnetic Survey, Fort Smith Quadrangle, Oklahoma and Arkansas, report number GJBX-200(80). Order paper copy from subcontractor: EG&G geoMetrics, Inc.; contract number 80-426-L. Order microfiche from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $7.50 paper copy; $3.50 microfiche.

Uranium Hydrogeochemical and Stream Sediment Reconnaissance of the Dalhart NTMS Quadrangle, New Mexico/Texas/Oklahoma, Including Concentrations of Forty-Two Additional Elements, by T. L. Morgan, numbered GJBX-207(80). Order microfiche from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $5.50.

Aerial Radiometric and Magnetic Survey, Perryton National Topographic Map Texas/Oklahoma/Kansas, West Texas Project, report number GJBX–229(80). Order paper copy from subcontractor: Geodata International, Inc.; contract number 80-418-S. Order microfiche from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $7.50 paper copy; $3.50 microfiche.

Geological and Geochemical Aspects of Uranium Deposits: A Selected, Annotated Bibliography, Vol. 4, by J. M. Thomas and others, is numbered GJBX-230(80). Paper copy available from: U.S. Department of Energy, Grand Junction Office, P.O. Box 2567, Grand Junction, Colorado 81502. Microfiche available from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $12 paper copy; $3.50 microfiche.

Aerial Radiometric and Magnetic Survey, Woodward National Topographic Map, Oklahoma, is report number GJBX-251(80). Order paper copy from subcontractor: Geodata International, Inc.; contract number 80-148-S. Order microfiche from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $7.50 paper copy; $3.50 microfiche.

Aerial Gamma-Ray and Magnetic Survey, Nebraska/Texas Project, Tyler, Texarkana, and Waco Quadrangles of Texas, Oklahoma, Arkansas and Louisiana, is report GJBX-69(80). Order paper copy from subcontractor: EG&G geoMetrics, Inc.; contract number 79-351-L. Order microfiche

from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Price: $28 paper copy; $3.50 microfiche.

Seismic Stratigraphic Interpretation and Petroleum Exploration

Prepared by L. F. Brown, Jr., and W. L. Fisher, of the Texas Bureau of Economic Geology, this 192-page volume was released by The American Association of Petroleum Geologists (catalog number 890).

Order from: AAPG, P.O. Box 979, Tulsa, Oklahoma 74101. Price: $11.

Sedimentary Basins of the World

A single-sheet map revealing the world's sedimentary basins, this publication is color-coded according to which basins produce from "giant," "subgiant," or "supergiant" fields. The map (40 by 50 inches) is accompanied by a 24-page text that explains the occurrence of giant and supergiant oil and gas fields in the basins of the world. The text and map are being issued by The American Association of Petroleum Geologists.

Order from: AAPG, P.O. Box 979, Tulsa, Oklahoma 74101. The catalog number is 645. Price: $12 members, $15 nonmembers.

Giant Oil and Gas Fields of the Decade: 1968-1978

This book is a collection from the Houston symposium of the same name. Thirty papers highlighting the outstanding discoveries of the past 10 years are presented in the collection, which includes stratigraphic information, exploration history, and production information for each. These papers, edited by Michel T. Halbouty, provide excellent comparative studies.

Order from: AAPG, P.O. Box 979, Tulsa, Oklahoma 74101. Price: $22 ($28 to non-AAPG members). Catalog number 625.

An Assessment Report on Uranium in the United States of America

Contained in this 150-page report are U.S. Department of Energy estimates of uranium resources, supply, and demand in the United States. The report includes six microfiche of 1980 potential-resource estimates of the NURE program.

Order from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. The cost is $12. The order should be prepaid, with checks being made out to Bendix Field Engineering Corp.

Concepts and Models of Dolomitization

The 1979 SEPM Research Committee Symposium being published in this 300-page edition contains 16 papers by 31 authors. The editors are Donald H. Zenger, Pomona College, Claremont, California; John B. Dunham,

Union Oil Research Center, Brea, California; and Raymond L. Ethington, University of Missouri, Columbia, Missouri.

Order from: Society of Economic Paleontologists and Mineralogists, P.O. Box 4756, Tulsa, Oklahoma 74104. Price: $16 to SEPM-AAPG members ($20 to nonmembers). Add 4 percent sales tax for books delivered in Tulsa, and 2 percent for books delivered elsewhere in Oklahoma.

Uranium Hydrogeochemical and Stream Sediment Reconnaissance of the Dalhart NTMS Quadrangle, New Mexico/Texas/Oklahoma, Including Concentrations of Forty-Two Additional Elements

In this 108-page publication by Terrance L. Morgan and others, uranium concentrations are listed for sediment samples that were collected from 503 sites, ground-water samples from 1,547 sites, and surface-water samples from 36 sites.

The report is on open file at the Oklahoma Geological Survey offices in Norman. Or, order from: Bendix Field Engineering Corp., Technical Library, P.O. Box 1569, Grand Junction, Colorado 81502. Cost: $5.50 microfiche.

Aerial Gamma-Ray and Magnetic Survey, Fort Smith Quadrangle, Oklahoma and Arkansas

Included in this single volume are: I. Introduction; II. Geology; III. Interpretation of Geophysical Data; IV. Bibliography; and V. Appendixes. The report covers surveys flown over east-west traverse lines at a 6-mile spacing, and tie lines flown north-south at an 18-mile spacing. Ground clearance was a nominal 400 feet, and the sampling interval was 1 second.

The report is on open file at the Oklahoma Geological Survey in Norman.

Purchase option information available from: EG&G geoMetrics, Inc., Robert Fowler, 395 Java Drive, Sunnyvale, California 94086.

Energy Bibliography and Index

Compiled by Texas A&M University Library and issued by Gulf Publishing Co., this four-volume set of annotated references is available with a fifth volume that contains a cumulative index. Each of the first four volumes has a main entry section, a personal-author index, a corporate-author and report-series index, a keyword-in-title index, and a complete subject index. The publication covers all forms of energy. It is also available as an on-line data base from Systems Development Corp., Santa Monica, California.

At $295 per volume, this publication is not within reach of the usual buyer, although it would be a good reference book for everyone working in or with the energy industry.

Order from: Gulf Publishing Co., Book Division, Department 227M, P.O. Box 2608, Houston, Texas 77001. Volumes 4 and 5 have not yet been released, but orders are being accepted and will be filled upon issue.

OIL FIELDS AND COAL-MINE LANDS EXAMINED IN OGS PUBLICATIONS

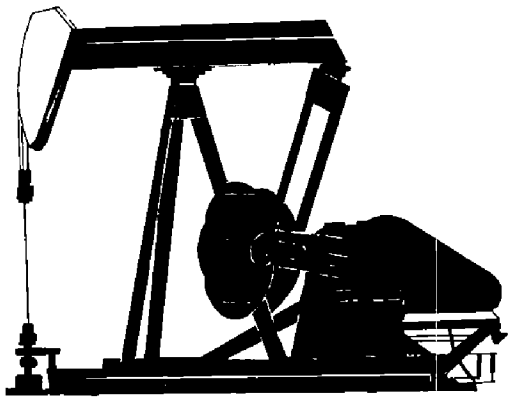
Two new publications were released recently by the Oklahoma Geological Survey as part of the Special Publication series.

Reservoir and Fluid Characteristics of Selected Oil Fields in Oklahoma, Special Publication 81-1, is an evaluation study conducted under the direction of OGS petroleum geologist and geochemist William E. Harrison.

Special Publication 81-2, *Bibliography of Abandoned Coal-Mine Lands in Oklahoma,* was undertaken at the request of, and with funding from, the Oklahoma Conservation Commission and the U.S. Department of the Interior, Office of Surface Mining. The bibliography was compiled by Kenneth S. Johnson, Claren M. Kidd, and Rachel C. Butler.

Special Publication 81-1, coauthored by Harrison and Darcia L. Routh, is a compilation of well data from 17 "giant" Oklahoma oil fields. (A "giant" field is one having a potential recovery of 100 million or more barrels of oil.)

This publication presents the results of a study begun in 1977 to provide information essential to planning and implementing enhanced-oil-recovery projects. Units included in the compilation are those in which water-flooding treatment has been utilized to aid in recovery. Data were taken from questionnaires circulated to the operators and include: producing formation, lithology, porosity, permeability, type of trapping, average depth, saturation at beginning of treatment, type of drive, pressure, gravity, salinity, chloride content of water and sulfur content of oil.

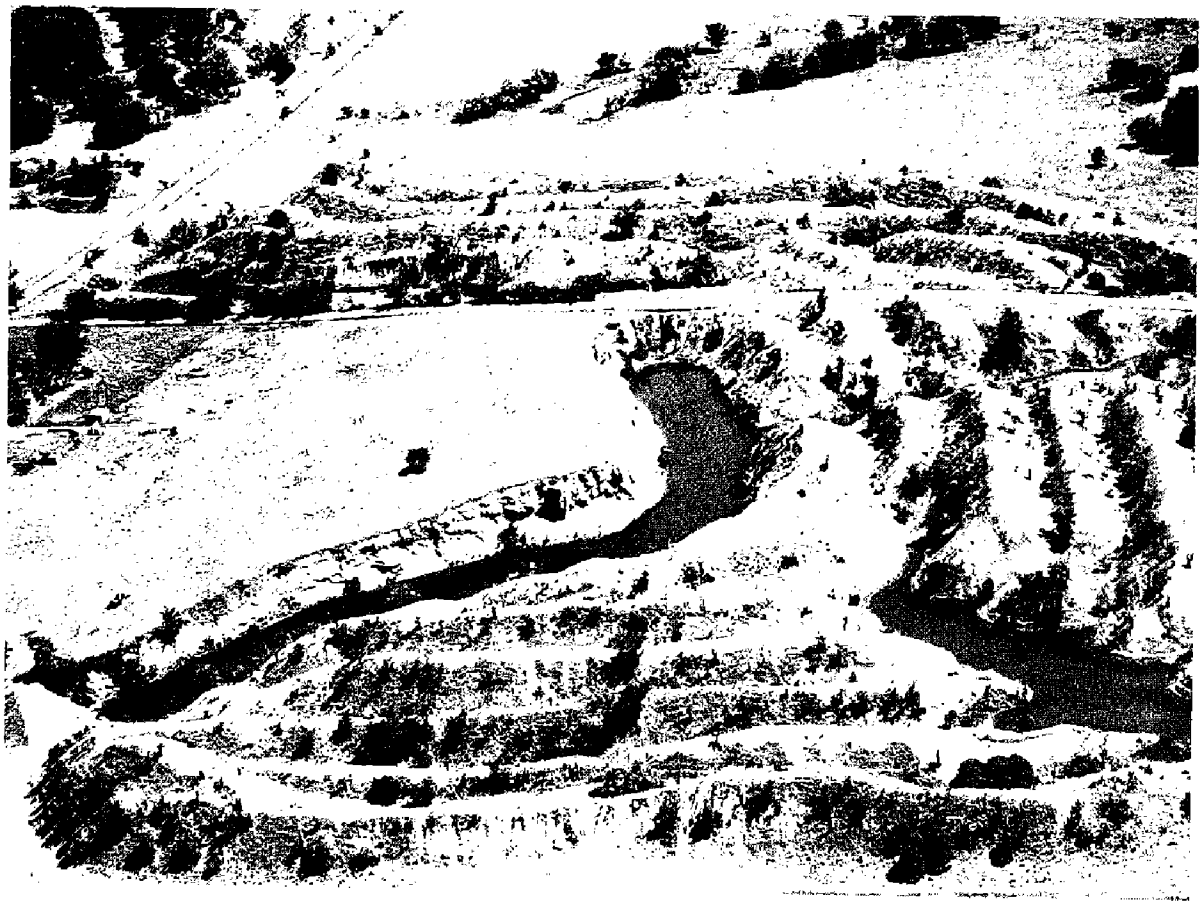


This ink drawing of an oil-well pump appeared on the cover of *Reservoir and Fluid Characteristics of Selected Oil Fields in Oklahoma,* OGS Special Publication 81-1. The artist is Roy D. Davis, of the Survey's cartographic section.

"Oklahoma oil fields will still contain more than 25 billion barrels of oil at the end of conventional petroleum production," Harrison states in his introduction to SP 81-1.

His report offers information on reservoir and fluid characteristics that are important in carrying out more sophisticated recovery programs that will help to make these resources available.

Special Publication 81-2, *Bibliography of Abandoned Coal-Mine Lands in Oklahoma,* contains bibliographic references to published reports and maps, unpublished reports, computerized data, and collections of maps, charts, and other



An aerial photo by Oklahoma Geological Survey Associate Director Kenneth S. Johnson is featured on the cover of OGS Special Publication 81-2, *Bibliography of Abandoned Coal-Mine Lands in Oklahoma.*

raw data in the public or private files of agencies and individuals.

The items entered in the bibliography are indexed according to the subjects with which they deal.

Although the emphasis is on abandoned coal lands in eastern Oklahoma, compilers Kenneth S. Johnson, Claren M. Kidd, and Rachel C. Butler have also included a number of entries that provide basic information needed for understanding and resolving the reclamation needs of the region. These entries, which may be regional or site-specific in nature, cover such subjects as coal resources, mining methods, hydrology, climate, soils, land use, vegetation, wildlife, history, and other subjects.

The Special Publication series has been designed by the OGS to bring new geologic information to the public in a manner efficient in both time and cost. The material undergoes a minimum of editing and is published for the most part as a final, author-prepared report.

These new publications can be obtained by writing to the Oklahoma Geological Survey at the address given inside the cover. The prices are: SP 81-1, $8; SP 81-2, $3.50.

OKLAHOMA ABSTRACTS

GSA Annual Meetings
Atlanta, Georgia, November 17–20, 1980

The following abstracts are reprinted from *Abstracts With Programs* of The Geological Society of America, v. 12, no. 7. Page numbers are given in brackets below the abstracts. Permission of the authors and of James R. Clark, publications manager of GSA, to reproduce the abstracts is gratefully acknowledged.

Upper Morrowan–Lower Atokan (Pennsylvanian) Conodont–Foraminifer Biostratigraphy, Southern Midcontinent, North America

PATRICK K. SUTHERLAND, School of Geology and Geophysics, The University of Oklahoma, Norman, Oklahoma 73019; WALTER L. MANGER, Department of Geology and University Museum, University of Arkansas, Fayetteville, Arkansas 72701

Recognition of a regional truncating erosional surface at the top of the Kessler Limestone Member, Bloyd Formation, has required lowering the Morrowan-Atokan Series boundary to that level and reassignment of the Trace Creek Shale to the Atoka Formation and Series. With this revision, the type Morrowan succession falls totally within zone 20 (*Millerella*) of the standard foraminifer succession, although coincidence of the foraminifer zone 20-21 boundary with the top of the Kessler Limestone cannot be demonstrated. The Kessler Limestone falls entirely within the *Idiognathoides convexus* conodont zone. However, the Wapanucka Limestone of the frontal Ouachita Mountains, south-central Oklahoma, yields additional conodont assemblages above that zone, but below strata of the type Atoka Formation. Consequently, no chronostratigraphic overlap of the type Morrowan and type Atokan Series exists, but the type Morrowan section is incomplete at its top.

The Morrowan-Atokan Marble Falls Limestone in the eastern portion of the Llano Uplift, central Texas, may be divided informally into three members. Zone 21 foraminifers, particularly *Eoschubertella*, appear unequivocally near the base of the upper member, but may extend to near the base of the middle member. Conodont assemblages in this interval are strongly homeomorphic after those of the lower Morrowan Series, but it is possible that the foraminifer zone 20-21 boundary falls within strata equivalent to the upper

Morrowan Series. *Profusulinella* has not been found in proximity to the Morrowan-Atokan boundary in either of the type regions for those Series or in the eastern Llano region. However, westward across the Llano Uplift, the Marble Falls Limestone becomes progressively younger with *Profusulinella* occurring near its base. [531]

[Dougherty] Dome: A Closer Look at a Classic Field Exercise

JERRY W. VINCENT and HARRY P. HOGE, Department of Geology, Stephen F. Austin State University, Nacogdoches, Texas 75962

[Dougherty] dome and related structures in south-central Oklahoma have been mapped by several institutions and thousands of geology students, and more than one interpretation has been published. No one is more vulnerable to embarrassment than an experienced instructor armed with published maps of a classic field exercise and years of proof of the solution from previous students. Under these circumstances it is difficult to accept contrary solutions even in the face of logical evidence. How can a bunch of rookies fail to understand such a beautiful area?

Two major faults have been omitted or mistakenly mapped in this region. A low-angle thrust along the southwestern nose of the dome and a high-angle reverse fault on the northeastern flank demonstrate the direction of primary compressional stress. Assuming the accuracy of this interpretation, other structural features of the dome, which have been interpreted in various ways, can be reoriented to represent conjugate shear and the areal view demonstrates a natural view of a nearly perfect strain ellipse.

The rookies, far from destroying a beautiful area, have helped make a classic problem an even better training exercise. Any instructor using the area however, should be careful. Students not familiar with or unduly conscious of the way things are supposed to be, often discover evidence which can embarrass the over-confident field instructor. [542]

Oklahoma State University

Geochemistry of Major and Trace Elements of the "Raggedy Mountain Gabbro Group," Wichita Mountains, Southwestern Oklahoma

SAMAD ALIPOURAGHTAPEH, Oklahoma State University, M.S. thesis, 1979, 318 S. Duncan #1, Stillwater, Oklahoma 74074

Scope and Method of Study: The Raggedy Mountain Gabbro Group crops out in Wichita Mountains, Southwestern Oklahoma. It covers approximately 150 square miles mainly in Kiowa and Comanche counties. Samples collected

from this group were analyzed for major and trace elements (Cu, Cr, Ni, Pb, Zn, Sr, Rb, Ba, and V) by both atomic absorption spectrophotometer and x-ray fluorescence spectrometer. Statistical analysis was used to study the relationship between chemical and modal analysis of the various rock types in the Raggedy Mountain Gabbro Group.

Findings and Conclusions: Geochemical and petrological-analysis of the Raggedy Mountain Gabbro Group indicated the following conclusions:

(1) Roosevelt Gabbro is distinctly different from Glen Mountain Layered Complex.
(2) "G" zone of the Glen Mountain Layered Series showed drastic chemical and mineralogical differences when compared to K, L, and M zones. Therefore, it is suggested that this zone should be a separate member of RMGG.
(3) Gabbroic rocks of Cooperton Area show similar trends to those of Roosevelts and Mt. Sheridan Gabbro.
(4) Positive correlation existed between Cr, Ni, Zn with mafic minerals while Si and Al showed high negative correlation.

Uranium Potential of the Cement District, Southwestern Oklahoma

ROY FRANK ALLEN, Oklahoma State University, M.S. thesis, 1980, 2416 Shadow Lane #69, Antioch, California 94509

Scope and Method of Study: This thesis evaluates the uranium potential of the Cement district, southwestern Oklahoma. Its purpose is to delineate specific areas for exploration prospects of uranium deposits. The Permian section, especially the Rush Springs Formation, contains strata favorable for uranium deposits. The altered red beds, caused by hydrocarbon seepage, along the axis of the Cement anticline were mapped into six diagenetic zones. Samples were collected for analyses of 30 elements, petrographic and clay mineral studies. A car-borne radiometric survey was completed throughout the area. Electric and gamma-ray logs of oil wells in the area were examined and used to construct nine cross sections to study the stratigraphy and gamma-ray anomalies. These studies were combined with a track-etch survey using Westinghouse Alpha 2 cups to define the most favorable areas for uranium deposits.

Findings and Conclusions: Three areas were determined to have favorable environments for uranium deposits. The Rush Springs Formation is the most promising. The Duncan and Garber Sandstones, the Chickasha Formation, and the Hennessey Shale contain gamma-ray anomalies and are considered favorable environments for uranium accumulation. Leases for oil and gas production in the area would prove an obstacle in the path of any uranium exploration program.

The Structural Geology of Part of the Limestone Hills in the Wichita Mountains, Caddo and Comanche Counties, Oklahoma

ABDOLALI BABAEI, Oklahoma State University, M.S. thesis, 1980, Department of Geology, Oklahoma State University, Stillwater, Oklahoma 74078

Scope and Method of Study: Purpose of the report was to map the structural elements of the limestone hills in the Wichita Mountains, southwestern Oklahoma. Major emphasis of the study was to interpret the role of regional tectonics and the nature of major fault movements in the area. Initial reconnaissance of adjacent areas was followed by 11 weeks of detailed mapping in the study area. Equal-area stereonet analysis of structural attitudes aided in interpretation of the major stress directions responsible for folding. Use was made of aerial photographs of the area obtained on a flight by Drs. D. J. Sanderson and R. N. Donovan.

Findings and Conclusions: Field work and lab analysis of structural elements in the area were directed to find the principal stress direction responsible for deformation of rocks in the Frontal Wichita fault system. Orders of fold are (a) first order folds, with amplitudes of 600 to 3,000 ft., (b) second order folds, with amplitudes of 5 to 30 ft. The Blue Creek Canyon fault (in the eastern margin of the area) is interpreted as a high-angle reverse fault in the area studied. Two periods of deformation are recognized. The first, oriented N40°E, initiated folding and high-angle reverse movements along faults. Subsequently, a N80°E stress vector induced left-lateral wrench movement on major faults in the area.

The Petrology and Depositional Environment of the Grayhorse Limestone in North-Central Oklahoma

JAMES ALAN CLARK, Oklahoma State University, M.S. thesis, 1980, 4950 Willow Creek Drive, Apt. #D–14, Jackson, Mississippi 39206

Scope and Method of Study: The Grayhorse Limestone, which crops out in north-central Oklahoma and extends, in this thesis area, from T. 15 N. to T. 29 N. and from R. 5 E. to R. 8 E., was studied by petrographic means, insoluble residues, and correlating measured sections. Samples were collected from outcrops by using maps from previous workers and were analyzed for insoluble detrital and nondetrital impurities. Differences in fossil faunas at various localities were noted for interpretation of paleoecology and depositional environments. Thin sections were used, as well as staining, to determine the mineralogic carbonate identities. Finally combining the petrographic results, the insoluble residue results, measured sections, fossil fauna

distribution, paleoecologic inferences, and other criteria, the environment of deposition was interpreted.

Findings and Conclusions: The Grayhorse Limestone is composed of two limestone beds with a shale between them. It was deposited as a biomicrite (packstone) in a warm, shallow, clear, normally-saline epicontinental marine environment. The cement varies from ferroan dolomite to calcite to ferroan calcite, reflecting depth of deposition. A facies change from a limestone to sandy dolomitic limestone to probably a dolomitic sandstone occurs southward as the Arbuckle Mountain source area is approached. A possible source for intraclasts, between T. 24 N. to T. 26 N., R. 6 and 7 E., was intertidal micrite mud from the eastern shore. Subaerial exposure of the micrite mud caused internal cracking and partial lithification. A massive foraminifera kill, caused by a sudden influx of sediment, happened at Sec. 15, T. 19 N., R. 6 E. Detritals originated from a silicic igneous source area. Most diagenetic minerals were the result of a reducing environment. Epigenetic dolomite caused obliteration of fossils from T. 15 N. to T. 18 N. Oxides formed during exposure to sea water and/or to air. Pyrite is found only in T. 28 N. and T. 29 N., R. 7 E., indicating the most reducing part of the depositional environment.

A Geochemical and Petrographic Survey of the Wellington Formation, North Central Oklahoma

DENNIS DEAN ELROD, Oklahoma State University, M.S. thesis, 1980, Department of Geology, Oklahoma State University, Stillwater, Oklahoma 74078

Scope and Method of Study: The Wellington Formation, to the west of where it crops out in north-central Oklahoma, was studied in the subsurface by geochemical and petrographic means. Well cuttings from 22 wells in Noble, Garfield, and northern Logan counties were examined and logged for lithology, color, mineralization, and sedimentary structures. The samples were also analyzed for copper, lead, zinc, manganese, and barium. The lithostratigraphic and chemical data together with electric logs were plotted and used to construct four correlation sections. A copper isoconcentration map was prepared using mean concentrations from a stratigraphic interval in the upper Wellington Formation. The distributions of the chemical populations were studied using histograms and cumulative frequency plots of the element concentrations. Grain-mounted thin sections of selected cuttings were examined and sulfide minerals analyzed for iron, copper, zinc, and sulfur using a microprobe spectrometer.

Findings and Conclusions: The Wellington Formation was deposited in a tidal flat environment under arid and predominantly oxidizing conditions. Copper mineralization occurs in beds within a less oxidized interval consisting of the upper "Midco", "Billings Pool", and lower "Antelope Flats" members of the Wellington Formation. Host rocks for the mineralization are

algal-bound dolomitic shales and green, gray, and black shaley mudstone and siltstones with thin interstratified sand layers. Copper mineralization occurs as replacement of pyrite and organic-rich material such as wood fragments, spores, and dark laminae of algal mats. No correlation was found between copper content and structural features. Copper content increases in a northward direction. The copper minerals present are apparently mixtures of anilite and djurleite, two varieties of chalcocite. The origin of copper mineralization is related to a diagenetic model in which copper-rich brines from the underlying evaporites precipitated copper upon encountering reduced conditions in the organic-rich beds in the upper Wellington Formation.

Identification of Gypsum Using Near-Infrared Photography and Digital Landsat Imagery

WILLIAM JEFFREY FLEMING, Oklahoma State University, M.S. thesis, 1980, 3289 Riverside Drive, Apt. 283, Tulsa, Oklahoma 74105

Scope of Study: Near-infrared aerial photography and digital Landsat imagery were evaluated in this study for identifying gypsum as a non-point source of water pollution and for the development of regional non-point source maps which can be used in south-central Oklahoma. A secondary objective was to assess the feasibility of using Landsat digital data to map oil field operation sites as point sources of water pollution.

Findings and Conclusions: Field investigations revealed that geobotanical anomalies were associated with gypsum outcrops and soil. Spectral signatures of the gypsum indicator plants on the high and low altitude color near-infrared photography were found to accurately delineate the vegetated gypsum outcrops and soil. Exposed non-vegetated gypsiferous soil could be distinguished but not consistently discriminated on the color near-infrared films. The gypsum outcrops and soils and oil field operation sites were not computer classified with a high degree of accuracy using Landsat digital data. The supervised and unsupervised computer processing techniques applied to the digital data suffer from limitations due to (1) lack of contrast between areas of gypsum indicator plants or oil field operation sites and surrounding vegetation and (2) the small size of the gypsum and oil field operation sites, most of which are below the cited 1.1 acre resolution limit of the Landsat satellites.

Fauna, Stratigraphy, and Paleoecology of the Foraker Limestone: Osage, Pawnee, Payne, and Lincoln Counties, Oklahoma

JOHN RAYMOND FRITTS, Oklahoma State University, M.S. thesis, 1980, 6596 Old Canton Road, Apt. 59, Jackson, Mississippi 39211

Scope and Method of Study: The Foraker Limestone forms the basal member of the Council Grove Group of the Lower Permian System of north-

eastern Oklahoma. The fauna of the Foraker Limestone was sampled and noted in an effort to determine as thoroughly as possible the taxonomic composition of the fossil assemblage. The stratigraphy was studied with the aid of several measured sections made throughout the study area. The major objective was to integrate the paleontologic and stratigraphic data into a composite picture of the Foraker Limestone's paleoecology and depositional environment. An additional objective was to produce a map of the Foraker's outcrop and ascertain how far southward the Foraker maintains its identity as a formation before grading into a sequence of continental clastics. A brief study of the carbonate petrology also was made.

Findings and Conclusions: The lowermost Americus Limestone Member was deposited in a shallow marine, carbonate shelf environment far offshore. The exceptional diversity of the fauna attests to the very stable conditions of this environment. The middle member, the Hughes Creek Shale, records a major regression which is denoted by the presence of widespread deltaic, and possibly some continental, sandstones in Lincoln, Payne, Pawnee, and southern Osage Counties; but offshore conditions prevailed further north as evidenced by the presence of fusulinid-bearing, cherty limestones. A major transgression brought on the deposition of the upper member, the Long Creek Limestone. Offshore conditions again prevailed over the study area. However, conditions were somewhat different than during the time of deposition of the Americus. The less diverse fauna suggests a more rigorous environment, probably with somewhat shallower water than during the Americus' deposition, because the Long Creek has a more sparry texture, indicating a higher energy environment, probably above wave base, that was able to winnow out the carbonate mud.

Stratigraphy, Sedimentology, and Uranium Potential of Virgilian–Leonardian Strata of the Hollis–Hardeman Basin, Oklahoma and Texas

BRYAN EDWARD LEE, Oklahoma State University, M.S. thesis, 1980, 1641 Gladstone Terrace, Oklahoma City, Oklahoma 73120

Scope and Method of Study: The distribution and physical characteristics of selected facies of upper Pennsylvanian and Lower Permian rocks were studied. Electric logs and sample logs were used to prepare maps and several correlation and stratigraphic sections. Analyses of cores and electric-log correlations were used to make inferences about depositional environments.

Findings and Conclusions: Depositional systems of Virgilian and Leonardian strata indicate a pattern of basin filling and overall marine regression. Depositional environments ranged from basinal to alluvial piedmont and fan-deltaic. Structural geology was an important influence on sedimentation, as was the climatic regime. The Wichita Mountains Uplift to the north, the Red River Arch, and probably the Ouachita Folded Belt were primary sources of clastic sediments carried into the study area. Deformation of strata during

the Paleozoic probably was complicated by two zones of weakness formed by Precambrian tectonism: the Red River Mobile Belt and the Wichita Trend. Evidence that conditions may have been favorable for uranium mineralization is: abundance of arkosic sandstones and conglomerates, abundance of carbonaceous material in cores, presence of faults and oil-productive structural traps, and proximity of a uranium-ion source, the Wichita Granite.

Petrographic and Mapping Study of the Subsurface "Oswego" Limestone in Part of the Putnam Trend, T. 15–16 N., R. 15–17 W., Dewey and Custer Counties, Oklahoma

DAVID MICHAEL MICHLIK, Oklahoma State University, M.S. thesis, 1980, 713 Crown Drive, Yukon, Oklahoma 73099

Scope and Method of Study: Depositional and geologic history of the Putnam Field "Oswego" was interpreted by using well logs, well samples, cores, and thin sections. One regional and six correlation cross sections were made which show stratigraphic variations within the "Oswego" in a 216 square-mile area. Three structure contour maps were made which show present structural configuration of the "Oswego" and Checkerboard Limestones. Two interval isopach maps indicate sediment source direction. A gross limestone isopach and isoporosity map illustrates reservoir geometry. Well cuttings, cores, and thin sections help define facies patterns and depositional history.

Findings and Conclusions: The "Oswego" is equivalent to the surface Fort Scott Formation and two members of the underlying Senora Formation. The Desmoinesian Series (Pennsylvanian) "Oswego" of the Marmaton Group in the Putnam Field is a long, narrow phylloid-algal mound complex developed at the shelf edge (hinge line) of the Anadarko Basin. Shelfward of the bank, the "Oswego" is a thin dense limestone, but basinward only a thin black shale facies is present.

The "Oswego" represents several marine transgressive-regressive sequences of cyclic deposition. The basal part (Breezy Hill and Excello) are transgressive deposits over the "Cherokee" deltaic complex. The basal part of the next overlying limestone (Blackjack Creek) is the oil and gas productive phylloid-algal mound deposit. The upper part of this unit gradationally changes to a thin dense transgressive limestone and is in turn overlain by the transgressive Little Osage Shale. The remainder of the Marmaton limestones follow this pattern until clastic detritus from the south filled in the basin and destroyed the algal buildups.

The "Oswego" is a prolific hydrocarbon reservoir and reserve estimates of all producing formations in the Putnam Field suggest that it is a potential giant.

Depositional Environments and Diagenesis of Upper Pennsylvanian Marchand Sandstones on South, East, and Northeast Flanks of the Anadarko Basin

JOHN DAVID SEALE, Oklahoma State University, M.S. thesis, 1980, Department of Geology, Oklahoma State University, Stillwater, Oklahoma 74078

Scope and Method of Study: The stratigraphic relationships, distribution, geometry, internal features and diagenesis of the Upper Pennsylvanian Marchand sandstones were studied on a regional scale. Electric logs, gamma-ray logs and compensated formation density logs were used to prepare isopach maps and stratigraphic cross sections. Analyses of cores and cross sections and isopach maps were used to interpret depositional environment. Thin section studies and scanning electron microscopy of selected samples permitted interpretation of diagenetic history.

Findings and Conclusions: The Marchand sandstones are thought to be marine sands deposited on the slope or ramp of the Anadarko basin. Evidence for this interpretation is the somewhat unique characteristics of the Marchand sandstones as seen in core study, apparent depositional topography related to the sandstones, and the relationship of the Marchand to its lateral equivalents (Layton Sandstone and Coffeyville Formation). During Marchand deposition, the Anadarko basin is thought to have consisted of a broad shallow shelf, which was a carbonate platform to the north and a deltaic platform to the east, together with a less well-defined slope-basinal area. The depositional slope on the shelf-slope transition was 0.5 to 1°. Maximum water depths for the central part of the basin were approximately 400 to 500 feet. Water depths in the area of Marchand deposition were probably 200 to 300 feet.

Diagenetically, the Marchand sandstones are thought to have gone through four main phases in alteration. Most important of these phases, from an economic standpoint, included the development of secondary porosity.

OKLAHOMA ABSTRACTS is intended to present abstracts of recent unpublished papers relating to the geology of Oklahoma and adjacent areas of interest. The editors are therefore interested in obtaining abstracts of formally presented or approved documents, such as dissertations, theses, and papers presented at professional meetings, that have not yet been published.