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OKLAHOMA GEOLOGY NOTES

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Cover Picture

USGS Traveling Exhibit Visits Langston University

On November 13-14, 1972, the U.S. Geological Survey's mobile earth-sciences exhibit visited the Langston University campus in Langston, Oklahoma, as a part of the USGS program on minority participation in the earth sciences. This effort toward acquainting minority students with career opportunities in the earth sciences is also supported by The Geological Society of America and the American Geological Institute. A number of institutions have also endorsed the program, including The University of Oklahoma.

The exhibit is housed in a portable trailer, as shown on the cover, and is supervised by Charles Cole of the USGS Denver office. Others manning the exhibit are James Doyle and Jackie Williams, also from Denver. Up to the time of the Langston visit, the trailer had traveled throughout the Southwestern and South-Central States and had received more than 10,000 visitors.

Some of the displays offered by the exhibits trailer are a topographic display including demonstration of a Kelsch plotter, a hydrologic-cycle model, a seismic display featuring the sounds of the 1971 San Fernando Valley earthquake, an atomic absorption unit, and an Apollo program display including a model of a lunar rock.

At each of the stops, local personnel from USGS and State offices have participated in the exhibit. For the Langston visit, I was invited to represent the Oklahoma Geological Survey, and James Irwin and Robert Factory of the USGS Water Resources Division office in Oklahoma City were also on hand.

By all indications, the Langston viist was one of the most successful stops on the tour thus far. The fact that both Miss Williams and Mr. Factory were Langston University alumni added to the already enthusiastic response of the 520 students who turned out to view the displays. Tentative plans call for the exhibit to visit the OU campus the week before the annual GSA meeting in Dallas this November.

—*T. L. Rowland*

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. Yearly subscription, $2.00. 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.

THE MINERAL INDUSTRY OF OKLAHOMA IN 1972[1] (Preliminary)

L. G. SOUTHARD[2]

The value of minerals produced in Oklahoma in 1972 was $1,221 million, a net gain of 2.7 percent over 1971, according to the U.S. Bureau of Mines. Gains in value were made in all mineral fuels with the exception of petroleum. Mineral-fuels value collectively supplied 93.1 percent of the total value of minerals produced. Nonmetallic minerals supplied 6.6 percent of the total value of all minerals produced in 1972.

MINERAL FUELS

The value of mineral fuels, excluding helium, rose to $1,129 million, 1.5 percent above the value in 1971. The quantity of petroleum produced fell below 1971 production by approximately 5 million barrels, for a 2.3 percent decline, despite high monthly oil-production allowables. Petroleum accounted for 58 percent of the total value of all minerals. The value of coal, natural gas, natural gasoline and cycle products, and LP gases increased 8.8 percent, or by about $33.9 million. The value of helium increased 6.6 percent above that of 1971. Midland Co-operatives, Inc., was unable to obtain sufficient crude-oil feedstocks to operate its Cushing refinery at capacity during 1972. The Oklahoma Corporation Commission issued orders declaring 20 cents per thousand cubic feet to be the minimum price of natural gas to prevent waste through premature abandonment of gas wells. This order is being challenged in the courts.

NONMETALS

Nonmetals increased in value 21.6 percent over the previous year, or by about $14.4 million. Cement output and value increased 34.7 percent and 38.8 percent, respectively. The values for clays, gypsum, sand and gravel, and stone increased, but those for bentonite, lime, salt, and volcanic ash declined.

METALS

The value of metals increased 5.5 percent over 1971. Copper output increased 7.1 percent, and production of silver, the only other metal produced in 1972, declined slightly.

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[1]Prepared December 18, 1972, in Division of Fossil Fuels, U.S. Bureau of Mines.

[2]Minerals specialist, U.S. Bureau of Mines, Washington, D.C.

Table 1.—Mineral Production in Oklahoma[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 (preliminary) Quantity	1972 (preliminary) Value (thousands)
Clays[2] (thousand short tons)	845	$ 1,255	861	$ 1,280
Coal (bituminous) (thousand short tons)	2,234	15,004	2,600	17,900
Gypsum (thousand short tons)	1,022	3,073	1,178	3,866
Helium				
High-purity (million cubic feet)	123	4,305	175	6,120
Crude (million cubic feet)	270	3,240	160	1,920
Natural gas (million cubic feet)	1,684,260	273,945	1,733,000	299,809
Natural-gas liquids:				
LP gases (thousand 42-gallon barrels)	27,540	56,732	27,600	59,100
Natural gasoline and cycle products (thousand 42-gallon barrels)	14,187	40,856	14,700	43,660
Petroleum (crude) (thousand 42-gallon barrels)	213,312	725,611	208,400	708,560
Sand and gravel (thousand short tons)	5,713	8,259	6,398	9,382
Stone (thousand short tons)	19,449	27,125	21,693	31,222
Zinc (recoverable content of ores, etc.) (short tons)	WW	WW	-----	----
Value of items that cannot be disclosed: bentonite, cement, copper, lime, salt, silver, tripoli, and volcanic ash	XX	30,111	XX	38,638
Total	XX	$1,189,516	XX	$1,221,457

WW Less than ½ unit. XX Not Applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite.

Correlation of the Everton Formation (Ordovician) of Arkansas with the Burgen and Tyner Formations of Oklahoma

Raymond W. Suhm[1]

INTRODUCTION

Wells in Madison and Washington Counties, Arkansas (fig. 1), were studied as part of an effort to correlate outcrops of the Everton Formation of northern Arkansas with exposures of the Burgen Sandstone and Tyner Formation in Cherokee County, Oklahoma.

Previously, the Burgen Sandstone was believed to be equivalent to the St. Peter Sandstone of northern Arkansas (Taff, 1905; Snider, 1915; Giles, 1930; Edson, 1927; Weller and McQueen, 1939). This discrepancy lies, in part, with the correlation of the Burgen Sandstone with a sandstone exposed in northwestern Arkansas erroneously identified as the St. Peter by Purdue and Miser (1916). This sandstone was originally named the Newton Sandstone Member of the Everton Formation by McKnight (1935). Investigators unaware of McKnight's finding sometimes refer to this sandstone as the St. Peter and correlate it with the Burgen Sandstone of Oklahoma.

[1]Assistant professor, Geography-Geology Department, Texas A & I University, Kingsville.

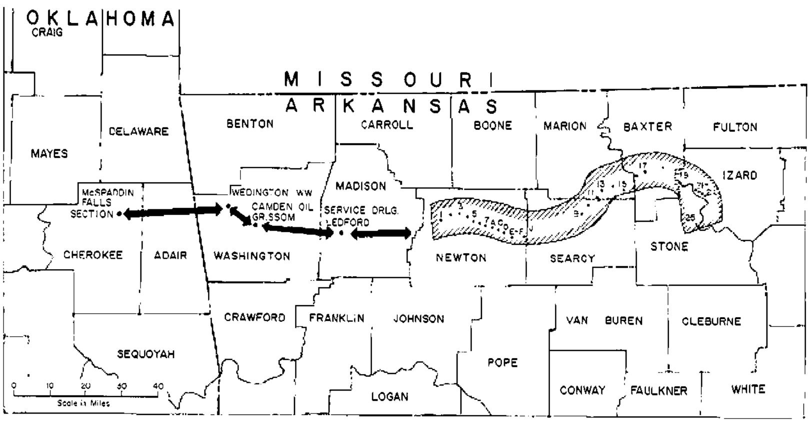

Figure 1. Map showing locations of measured geologic sections and wells used in tracing Everton Formation of Arkansas to Burgen and Tyner formations of Oklahoma. Sections 1-16 are along Buffalo River, and sections 17-25 are along White River. Geologic sections A-J, on Buffalo River, are from Glick and Frezon (1953).

Evidence is herein submitted supporting an Everton to Burgen and Tyner correlation. This was suggested, without documentation, by Frezon (1962, p. 48).

EVERTON FORMATION

The Everton Formation was named by Ulrich (*in* Purdue, 1907), who examined limestone and sandstone exposures near the town of Everton, Boone County, Arkansas. South of the type section, Suhm (1970) studied the Everton as exposed in bluffs formed by the Buffalo and White Rivers. The Everton was found to consist of an intertonguing complex of sandstone, limestone, and dolomite (fig. 2). This study also allowed previously established Everton members to be placed in their proper vertical and lateral stratigraphic position within the formation. These members are: Sneeds Dolomite Member (originally called the Sneeds Limestone by Purdue and Miser, 1916), Calico Rock Sandstone Member (Giles, 1930), Newton Sandstone Member (McKnight, 1935), and the Jasper Member (McKnight, 1935; Glick and Frezon, 1953). The Kings River Sandstone Member, a name proposed by Purdue and Miser (1916), was not found to be a diagnostic unit. Three informal members are introduced as a result of this study: limestone-sandstone member A, limestone-sandstone member B, and dolomitic sandstone-dolomite member C.

The quartz sandstones of the Everton Formation are fine to coarse grained and resemble the St. Peter sandstones where they are calcareous or slightly siliceous. Dolomitic sandstones are also common in the Everton Formation. The limestones range in texture from calcarenite to calcilutite and resemble the limestones of the Plattin Formation (Middle Ordovician) of the Midcontinent. The dolomite is commonly dense to medium crystalline and secondary after limestone. However, mud-cracked, intraclastic, penecontemporaneous dolomite occurs in some Everton zones.

The Everton is about 350 feet thick in the westernmost part of the Everton outcrop belt and thickens eastward to more than 650 feet. It is disconformable between the Powell Dolomite (Canadian Series) below, and the St. Peter Sandstone (Chazyan Series) above. However, in some areas the St. Peter and part of the Everton have been removed by extensive, irregular pre-Chattanooga erosion (fig. 2).

A Chazyan age for the Everton seems well-established. Although sparsely fossiliferous, some Everton beds contain abundant ostracodes, pelmatozoan stems, gastropods, cephalopods, and trilobite fragments. Templeton and Willman (1963, p. 159) considered the fauna collected by Purdue and Miser (1916) and equated the Everton with the Chazyan Crown Point Limestone of New York. The brachiopods collected by Cooper (1956) were assigned to the Marmor Stage, which is equivalent to the Chazy Group studied by Kay (1962, p. 1421). Conodonts recently studied by Golden (1969) and the writer were found to be representative of an early Middle Ordovician fauna.

BURGEN SANDSTONE

The Burgen Sandstone, named by Taff (1905), crops out in por-

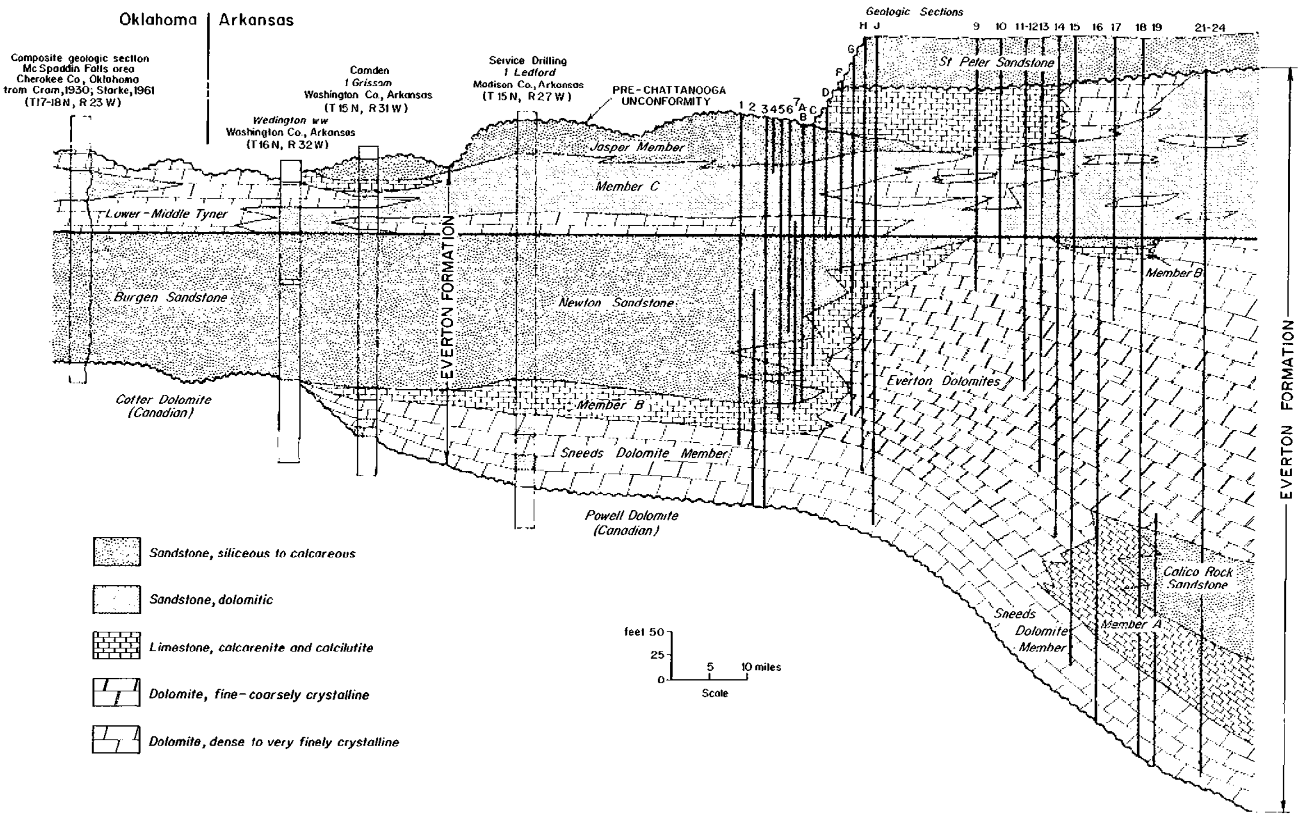

Figure 2. Cross section of Everton Formation from northern Arkansas to northeastern Oklahoma. Locations of wells and geologic sections shown in figure 1. Datum is top of Newton-Burgen Sandstone.

tions of Cherokee, Adair, and southern Delaware Counties, Oklahoma. Because this sandstone is massive and light colored, with fine- to medium-sized quartz grains, it is easily confused with the well-known St. Peter Sandstone of the Midcontinent.

The Burgen Sandstone ranges in thickness from 110 to over 136 feet near McSpaddin Falls, Cherokee County, Oklahoma (Starke, 1961, p. 13), thinning appreciably northward to extinction in Delaware County, Oklahoma (Huffman, 1965, p. 109). The Burgen disconformably overlies the Cotter Dolomite (Canadian Series) and is overlain conformably by the Tyner Formation where the Tyner has not been removed by pre-Chattanooga erosion.

Although generally unfossiliferous, a few Chazyan cephalopods were found in the Burgen (Ulrich, *in* Cram, 1930, p. 537-538).

TYNER FORMATION

Taff (1905) named the Tyner Formation for exposures of shale, dolomite, and limestone above the Burgen Sandstone and below the Chattanooga Shale, along Tyner Creek in northeastern Oklahoma. Cram (1930, p. 542-543) divided the Tyner Formation into 3 units: (1) Lower Tyner sequence, 10-20 feet of interbedded dolomite and green shale, with a Chazyan fauna, that is conformable on the Burgen Sandstone; (2) Middle Tyner unit, 40-60 feet of unfossiliferous green shale; and (3) Upper Tyner sequence, 10-40 feet of cherty dolomitic limestone with a basal chert bed that is unconformable on the Middle Tyner shales.

The Lower Tyner, and probably the Middle Tyner, are calculated to be Chazyan in age, as based on the presence of conodonts, ostracodes, cephalopods, and trilobites (Cram, 1930; Harris, 1957, 1964; Huffman and Starke, 1960, p. 268-271; Starke, 1961, p. 18). Disney and Cronenwett (1955), Ireland (1965, p. 75), and Schramm (1964, p. 1166; 1965, p. 27) believed that the Burgen and the lower part of the Tyner are also Chazyan.

The Upper Tyner fauna indicates a late Black River or early Trenton age and is correlated with part of the Plattin Formation (Huffman, 1958, p. 24).

CORRELATION OF EVERTON WITH BURGEN AND LOWER-TO-MIDDLE TYNER

The Everton Formation, as exposed in northern Arkansas, was correlated with Burgen-Tyner outcrops in northeastern Oklahoma through the study of three wells in Madison and Washington Counties, Arkansas (figs. 1, 2). A complete Everton interval was found in (1) Service Drilling Co. No. 1 Ledford, sec. 23, T. 15 N., R. 27 W., Madison County, Arkansas; (2) Camden Oil Co. No. 1 Grissom, sec. 17, T. 15 N., R. 31 W., Washington County, Arkansas; and (3) Wedington Water Well, sec. 9, T. 16 N., R. 32 W., Washington County, Arkansas.

As shown in figure 2, in western Arkansas, the Everton in outcrop consists of 5 members. From bottom to top, they are Sneeds Dolomite Member, limestone-sandstone member B, Newton Sandstone Member, dolomitic sandstone-dolomite member C, and Jasper Member. Westward from the outcrop, the Everton dips into the subsurface in Madison and Washington Counties, Arkansas. Here, the Sneeds Dolomite and limestone-sandstone member B wedge out, possibly truncated by the overlying Newton Sandstone. The Newton Sandstone and member C persist, however, and maintain their thickness westward into Oklahoma. The Newton Sandstone of Arkansas equates with the Burgen Sandstone of Oklahoma. The dolomitic sandstone and dolomite of member C of the Everton in Arkansas correlate with the dolomite, dolomitic sandstone, and shale of the lower and middle part of the Tyner Formation of Oklahoma. The Jasper Member is truncated by pre-Chattanooga erosion west of the Camden Oil Co. No. 1 Grissom well and is not present in northeastern Oklahoma.

PROPOSED EVERTON-SIMPSON RELATIONSHIPS

Statler's excellent diagrammatic cross section (1965, fig. 28), redrawn with slight modifications on the left half of figure 3, shows the relationships between the Simpson Group and the Burgen and Tyner formations and allows generalizations to be made concerning Simpson equivalents in Arkansas.

The Burgen Sandstone and part of the Tyner Formation, established as equivalents of the Newton Sandstone and member C of Arkansas, are generally agreed to be equivalent to the Oil Creek Formation of the Simpson Group (Cram, 1930, p. 12; Disney and Cronenwett, 1955; Schramm, 1964, p. 1166; 1965, p. 28; Starke, 1961; Statler, 1965, p. 198).

The Joins Formation is the basal unit of the Simpson Group and is stratigraphically below the Oil Creek Formation. The Joins is tentatively correlated with the Sneeds Dolomite Member of the Everton Formation of Arkansas. The Joins Formation and Sneeds Dolomite Member occupy an increasingly basinal position where deposition was more continuous. The Joins Formation is absent in northeastern Oklahoma.

The McLish Formation of the Simpson Group overlies the Oil Creek Formation and consists of basal sandstones and overlying carbonates and shales. The McLish is correlated with the Jasper Member of the Everton Formation, which also consists of basal sandstones and overlying carbonates. This correlation is, in part, verified by the similarities between brachiopods of the Jasper and McLish (Cooper, 1956, p. 117, and chart 1). McLish equivalents are absent in northeastern Oklahoma, apparently owing to the extensive pre-Upper Tyner (Bromide) and pre-Chattanooga erosion. Schramm (1964, p. 1166; 1965, p. 29), however, suggested that the McLish was equivalent to the Middle Tyner.

The Bromide is the uppermost formation of the Simpson Group and consists of an extensive basal sandstone, the so-called First Wilcox, and overlying carbonates and shales. In Arkansas, the First Wilcox is equivalent to the St. Peter Sandstone, and the Bromide lithologies are correlated with the Joachim and Plattin formations. The Bromide Formation appears to be correlative with the carbonates of the Upper Tyner of northeastern Oklahoma, which unconformably overlie the

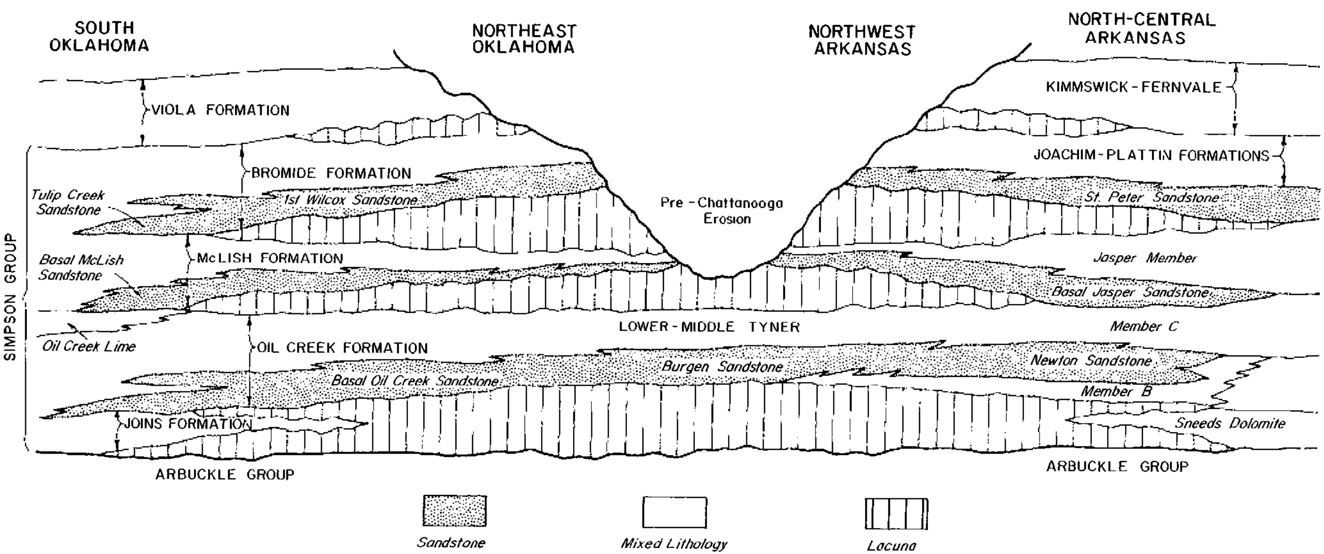

Figure 3. Diagrammatic cross section showing postulated Middle and Upper Ordovician stratigraphic relationships between Oklahoma and Arkansas. Left half after Statler (1965, fig. 28).

Middle Tyner (Huffman, 1958, p. 24; Cram, 1932). The St. Peter Sandstone is absent in northeastern Oklahoma. (See Ireland (1965) and Holden (1965) for partial corroboration of this interpretation.)

CONCLUSIONS

The correlation of the Burgen Sandstone with the St. Peter Sandstone has been found to be erroneous. The Everton Formation and its members have been traced from Arkansas to northeastern Oklahoma and found to be equivalent to the Burgen Sandstone and the lower part of the Tyner Formation. In addition, the formations of the Simpson Group have been tentatively traced into Arkansas. Perhaps a better understanding of these Simpson equivalents will lead to the discovery of potential petroleum-bearing rocks in Arkansas.

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AAPG and GSA Sectional Meetings Scheduled

The joint meeting of the Southwest Section of The American Association of Petroleum Geologists and the Society of Exploration Geophysicists, Mid-Western Societies, will meet March 14-16 in Fort Worth, Texas. The theme of the meeting will be "Exploration Challenges of the Seventies." Inquiries concerning the meeting should be made to Edd Riddle, Jr., Perry R. Bass, Inc., 1211 Fort Worth National Bank Building, Fort Worth, Texas 76102.

The annual meeting of the South-Central Section of The Geological Society of America will be held at Little Rock, Arkansas, on April 5-7. Interested persons should contact GSA headquarters, 3300 Penrose Place, Boulder, Colorado 80301.

The GSA North-Central Section annual meeting is scheduled for April 12-13 at Columbia, Missouri, with the regular sessions preceded and followed by 1-day field trips. Information on this meeting may be obtained from Clayton H. Johnson, Department of Geology, University of Missouri, Columbia, Missouri 65201.

The New AGI *Glossary of Geology*

The long-awaited new edition of the *Glossary of Geology* is now in print. Edited by Margaret Gary, Robert McAfee, Jr., and Carol L. Wolf, the *Glossary* was published by the American Geological Institute late in 1972.

The present volume has a completely different look from the two volumes that preceded it, the original *Glossary of Geology and Related Sciences,* published in 1957, and *Glossary of Geology and Related Sciences, with Supplement,* published in 1960. As useful as these earlier volumes were, incorporating some 14,000 and 18,000 entries, respectively, they are overshadowed by the effectiveness of the new *Glossary,* which lists some 33,000 cross-referenced terms, compiled by more than 175 specialists in the geological sciences. Not surprisingly, the new *Glossary* is a much more imposing tome than its predecessors, having a shelf thickness of some 2 inches, compared with the 1¼ inches of the 1960 edition.

A definite improvement over the first *Glossary* is the listing of the terms in boldface type with the first letter lowercased except for proper names. Thus the user is no longer in the dark as to whether a term should be capitalized, as was the case with the first edition and most of the second edition.

Ian Campbell, state geologist emeritus of California, has provided a lucid and informative foreword, in which he recounts the history of the whole glossary project and points out the scope of the terminology as being a product of the tremendous expansion of knowledge in the geological sciences during the sixties.

A valuable asset is the addition of a bibliography in the back section, listing more than 1,500 references.

Printed in an easy-to-read sans-serif type, the 876-page *Glossary of Geology* can be ordered, at a cost of $22.50, from Department 309, American Geological Institute, 2201 M Street NW, Washington, D.C. 20037. Don't be thrown by the price; it is safe to say that this volume is worth a great deal more in terms of its usefulness—in fact, most geologists will find it indispensable.

—*William D. Rose*

National Petroleum Council Issues Final Report in Energy Series

The energy crisis, long predicted by the petroleum industry, government agencies, and farsighted academicians, is upon us with sufficient force that its reality is now acknowledged even by media unconnected with fuel suppliers. It is more fully recognized by industries and individuals who have already experienced the effects of shortages.

The resolution of this growing dilemma is surely not hastened by saying "I told you so" or applying power pressures but by appraising the problem and searching for solutions. This is what the National Petroleum Council has essayed to accomplish in a 3-year study undertaken by 200 experts of the energy industries. Previous installments of this appraisal of the situation through 1985 were discussed in *Oklahoma Geology Notes* (v. 32, p. 10, 51, 134). The final report in this series has recently been released by the Council.

This report predicts increasing demands at an average rate of 4.2 percent per year during the 1971-85 period and a dependence on imported oil and gas increasing through 1975 to 20 to 25 percent of total energy requirements. An evaluation is made of 3 major options for achieving a long-term balance between supply and demand: (1) more emphasis on development of domestic reserves, (2) greater reliance on foreign imports, and (3) restrictions on energy-demand growth.

Restraints on consumption are rejected as altering lifestyles and adversely affecting employment, economic growth, and consumer choice; the Council finds efficient use of energy and improvement in energy preferable to restriction.

Importing fuels means increasing dependence on the political and economic policies of other countries, further imbalance in the balance of trade for this country, and the expense plus environmental risks of building more and larger carriers for transport and modifying ports to accommodate them.

The solutions recommended by the Council involve development of a coordinated national energy policy, continuation of import quotas for oil and uranium, accelerated leasing of public lands, continued tax incentives, increased prices, greater reliance on coal-fired and nuclear power plants, "realistic" environmental standards, and expanded research.

A summary report, *U.S. Energy Outlook—A Report of the National Petroleum Council,* is available at a cost of $6.50. The more detailed findings are contained in *U.S. Energy Outlook—A Report of the National Petroleum Council's Committee on U.S. Energy Outlook,* available at a cost of $15 softback or $17.50 hard cover. Both can be ordered from Director of Information, 1625 K Street NW, Washington, D.C. 20006.

—*Elizabeth A. Ham*

Allan Bennison Compiles AAPG Maps

Allan P. Bennison, a consultant in Tulsa, has been engaged to take over compilation for The American Association of Petroleum Geologists geological-highway-map project and will work under the direct supervision of R. H. Dott. The Texas map should be available soon, and the Pacific Northwest sheet is about three-fourths completed.

These maps, plus the five maps previously announced, can be ordered as released from AAPG headquarters, P.O. Box 979, Tulsa, Oklahoma 74101, at a cost of $1.50 each for folded maps and $1.75 each for rolled maps. Folded maps are also available from the Oklahoma Geological Survey for $1.50 each.

Underground Waste Management Findings Issued; Mineral Economics Symposium Also in Print

AAPG Memoir 18, *Underground Waste Management and Environmental Implications (1972)*, has recently been published under the joint sponsorship of The American Association of Petroleum Geologists and the U.S. Geological Survey. Edited by T. D. Cook, the volume contains the proceedings of the First Symposium on Underground Waste Management and Environmental Implications—36 papers plus discussion and an index, approximately 500 pages in all.

The price to AAPG and SEPM members is $20; nonmembers will be charged $25. Copies (cloth) can be ordered from The American Association of Petroleum Geologists, P.O. Box 979, Tulsa, Oklahoma 74101.

A second symposium volume, *Proceedings of the Mineral Economics Symposium (AAPG 1972)*, is being released by the Mineral Economics Institute of the Colorado School of Mines. Permission to publish the material was granted by AAPG. The work is about 70 pages long and contains the proceedings of a symposium on mineral economics held at the 1972 AAPG-SEPM annual meetings in Denver. The special committee for the symposium was chaired by Thomas C. Hiestand.

The symposium was divided into a session on mining and minerals policy and one on exploration and development of the fuels and energy group of mineral resources, 1970-75. Information incorporated pertains to present legislation, progress toward a national minerals policy, and the outlook for petroleum, natural gas, coal, uranium, and oil shale.

Orders for the volume should be sent to Publications Department, Colorado School of Mines, Golden, Colorado 80401. Single copies are $3.00 within the United States and $3.50 outside the United States.

New Scientific Journal to Be Published by USGS

The first issue of the *Journal of Research of the U.S. Geological Survey* is scheduled to appear this month. Volumes will appear bimonthly and will contain papers written by USGS scientists, engineers, and technicians on various subjects in geology, hydrology, topography, and related earth sciences.

The *Journal* will supersede the "short papers" chapters of the former Geological Survey Research (Annual Review) series of professional papers and will help make results of USGS research more readily available to the scientific community.

The cost of an annual subscription, before July 1, 1973, is $8.50 (for 6 issues, domestic; plus $2.25 for foreign mailing). Single copies are $1.50. The *Journal* may be purchased from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Checks or money orders should be made payable to Superintendent of Documents.

New OGS Bulletin Issued on Viola Brachiopods

Articulate Brachiopods of the Viola Formation (Ordovician) in the Arbuckle Mountains, Oklahoma is the title of a bulletin released at the end of January by the Oklahoma Geological Survey.

Written by Leonard P. Alberstadt, the study describes 37 brachiopod species, including 9 new species, from the Viola Formation in Pontotoc, Coal, Johnston, Carter, and Murray Counties, south-central Oklahoma. The report is based on the author's doctoral dissertation, which was prepared at The University of Oklahoma. Dr. Alberstadt is now teaching in the Department of Geology at Vanderbilt University, Nashville, Tennessee.

The Viola Formation was separated into three informal units, on the basis of lithology. The middle and upper units were found to contain most of the brachiopods, but the only persistent assemblage zone occurs in the top part of the upper unit. The Viola brachiopod fauna is compared to those of the Montoya Group of west Texas and New Mexico, the Maquoketa Group of Iowa, the Richmond Group of the Ohio Valley, and the upper Bighorn Formation of Wyoming.

As a sidelight, many readers will recognize stalwarts of the Survey and the OU School of Geology and Geophysics immortalized in new species names, to wit: *Megamyonia mankini, Hesperorthis rowlandi,* and *Platystrophia sutherlandi.*

The 90-page report includes 38 figures and 9 fossil plates. Released as Bulletin 117, it can be ordered from the Oklahoma Geological Survey, 830 Van Vleet Oval, Room 163, Norman, Oklahoma 73069. Paper-bound copies are $5.50 apiece, and cloth-bound copies are $6.50.

Wedding Bells for Our Associate Editor

Rosemary Kellner is now Rosemary Croy. The Oklahoma Geological Survey's associate editor gained a new husband and a new name on December 16 in a simple ceremony in Norman with several family members present.

Her husband, Jim, who is a legislative researcher at the State Capitol, has just earned a master's degree in Political Science from The University of Oklahoma. They will continue to live in Norman.

Congrats from the whole staff to the newlyweds!

Delocrinus brownvillensis STRIMPLE FROM THE VICINITY OF FAIRFAX, OKLAHOMA

ROGER K. PABIAN[1] AND HARRELL L. STRIMPLE[2]

INTRODUCTION

Delocrinus brownvillensis Strimple was described in 1949 (p. 22-23, pl. 4, figs. 1-4) on the basis of specimens collected from Brownville Limestone (Pennsylvanian, upper Virgilian[3]) exposures in the railroad cut at Kief, about 7 miles west of Strohm, in Osage County, Oklahoma. Moore and Plummer (1939, p. 286-288) described *Delocrinus vulgatus* and designated as paratype a specimen (KU 4584=USNM 140969) from the Harpersville Formation, Young County, Texas. They also reported the occurrence of *D. vulgatus* in the Brownville Limestone near Strohm in Osage County, Oklahoma.

Strimple (1949, p. 22-23) indicated that the figured holotype (Plummer Collection P-10325) of *Delocrinus vulgatus* was not conspecific with the figured paratype (USNM 140969), and the paratype was subsequently assigned to the species *Delocrinus brownvillensis*. *D. brownvillensis* was described on the basis of two dorsal cups (Holotype D-28=USNM 54691; paratype 844=USNM 54692). Material collected recently by Strimple and C. C. Branson adds to our knowledge of *Delocrinus brownvillensis* Strimple: specimens collected include a nearly complete crown, a dorsal cup with lower portions of arms on the *C* and *D* rays, and a dorsal cup. Aberrant or atavistic arm development is shown in one specimen.

SYSTEMATIC DESCRIPTION

Delocrinus brownvillensis STRIMPLE, 1949

Delocrinus vulgatus, fig. 1A-C (present article); Moore and Plummer (partim), 1939, p. 286-288, pl. 18, fig. la-e, fig. 2, fig. 2a, b.
Delocrinus brownvillensis STRIMPLE, 1949, p. 22-23, pl. 4, figs. 1-4; 1962, p. 109-110.

Description.—Dorsal cup is medium low, bowl shaped, with a distinct, but not deep, wide basal concavity (fig. 1). The 5 infrabasals are small and restricted to upper portion of basal concavity; distal extremities slope at about 45 degrees. Proximal ends of the 5 basals continue slope of the infrabasals; this area bears fine granules on the

[1]Research geologist, Conservation and Survey Division, University of Nebraska, Lincoln.
[2]Research associate and curator, Department of Geology, The University of Iowa, Iowa City.
[3]Wilde (1971, p. 376) has suggested that the Brownville Limestone be placed in the basal Permian, rather than in the Upper Pennsylvanian, on the basis of the occurrence of a Wolfcampian fusulinid, **Triticites (Leptotriticites).**

larger 2 specimens but is smooth on smaller crown. *AB, BC, DE,* and *EA* basals are pentagonal, whereas *CD* basal is hexagonal—truncated for the reception of large, hexagonal anal-*X* plate. Basals recurve about midway, and mid-portions form basal plane of cup. Basals curve upward and distally reach about one-third height of cup. Proximal portions of five epaulette-shaped radials slightly above basal plane, same slope as basals. Mid-portions of radials very slightly bulbous; distally, radials curve inward at summit of cup. *C* and *D* radials separated by anal plate. Fine granules are at distal ends of radials on large specimens, but this area is nearly smooth on small crown.

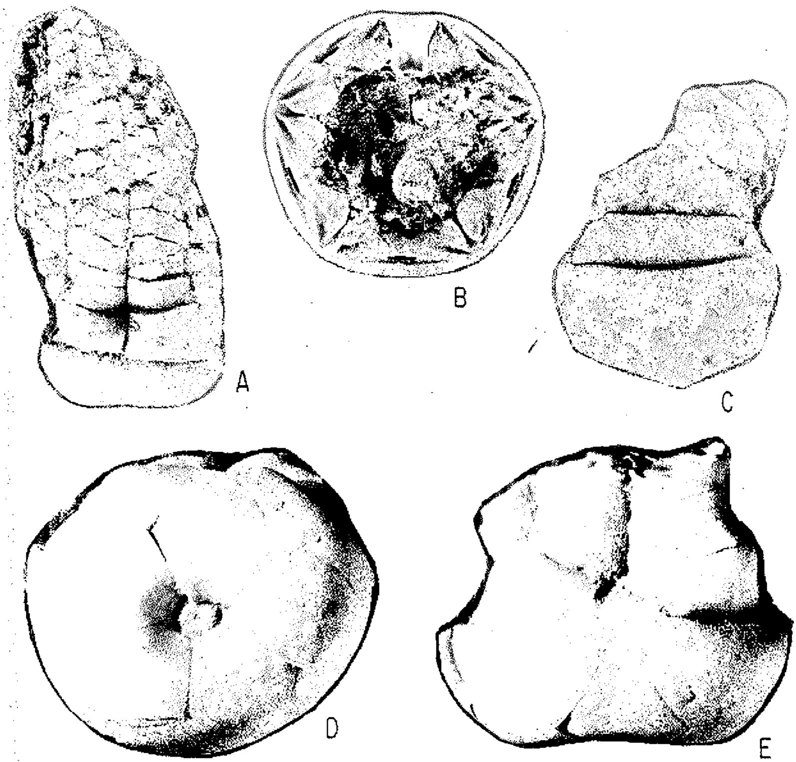

Figure 1. Delocrinus brownvillensis Strimple.

- **A.** Crown, SUI-36252, showing arm development on E and A rays ×1.5.
- **B.** Dorsal cup, SUI-36253, showing nature of arm-articulating facets, ×1.4.
- **C.** Aberrant specimen, SUI-36254, showing radial plate, nonaxillary first primibrachial, and axillary second primibrachial, ×2.
- **D, E.** Basal and posterior views, respectively, of mature, partial Crown, OU 4578, ×2.

Arm-articulating facets wide, well-defined features. Outer marginal ridge sharp; fairly deep outer ligament furrow. Outer ligament ridge finely denticulate and adjacent to deep ligament pit. Transverse ridge is broad and bears a number of well-defined denticles. Oblique ridge is short, denticulate, and separated from transverse ridge by a deep lateral furrow. Muscle area slopes inward to a broad central pit that is divided into two smaller pits; it connects to a broad, intermuscular notch by way of a wide, poorly defined, intermuscular furrow. Lateral ridge is very sharp, and adsutural slope is vertical or overturned.

Axillary primibrachials are epaulette shaped and somewhat protruded. On small specimens primibrachial is smooth, but a few larger specimens have fine granules near radials and secundibrachials. At either the second or third secundibrach, arm segments become interlocking, biserial elements. The longest arm has 23 secundibrachials.

Sutures between cup plates are distinct but not impressed. Fine lines next to sutures on adjacent plates may give cup a nearly "stitched together" appearance under high magnification.

Columnar cicatrix is round and bears about 28 crenellae and a pentalobate lumen.

Remarks.—Though some cup plates are slightly ornamented, ornamentation appears restricted to individuals in gerontic stages. Slight ornamentation in inconspicuous locations does not warrant placing *Delocrinus brownvillensis* in *Graffhamacrinus.*

A radial plate (SUI 36254) bears the lower portions of an arm. This specimen is aberrant or atavistic, since it has a non-axillary first primibrachial followed by an axillary second primibrachial but is identical in all other respects to the radial plate of *Delocrinus brownvillensis*. The axillary second primibrachial appears to have a scar from a healed fracture. Interradial sutures on this specimen are denticulate and bear a hollow area that appears to be connected to the outside of the cup in two areas (fig. 2A). The radial-basal suture is also denticulate and hollow. Several nodes exist inside each suture (fig. 2B).

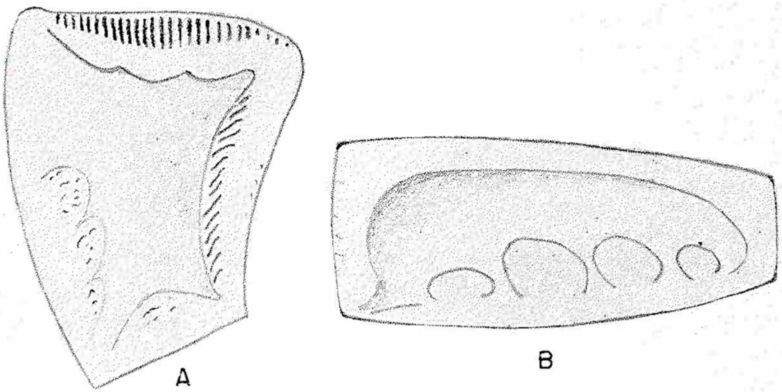

Figure 2. Delocrinus brownvillensis **Strimple. A, B. Facets on radial plate for interradial sutures and radial-basal sutures, SUI-32654, ×5.**

TABLE 1.—MEASUREMENTS (IN MM) OF *Delocrinus brownvillensis*[1]

	SUI-32652	SUI-32653	OU-4578
Length of crown	36.0 (minimum)	---	---
Diameter of dorsal cup			
(posterior-anterior)	15.8	23.3	[2]25.0
(maximum)	17.3	24.3	27.0
Height of dorsal cup			
(posterior)	7.1	10.9	[2]12.0
(anterior)	---	9.5	10.1
AB basal			
(length)	6.6	10.0	11.8
(width)	6.6	9.3	9.7
A radial			
(length)	---	8.9	10.7
(width)	10.0	14.4	15.6
Anal-**X**			
(length)	4.0	6.8	---
(width)	2.7	4.9	---
Diameter of infrabasal circlet	3.7	5.3	5.1
Height of basal concavity	---	3.7	---

[1]Measured along surface of curvature.
[2]Approximate measurement.

Repositories.—The holotype (S-4691) and paratype (S-4692) are reposited in the Springer Collection, U.S. National Museum, Washington, D.C. One hypotype (USNM-140969=KU-4584) is reposited in the U.S. National Museum. Hypotypes SUI-32652, SUI-32653, and SUI-32654 are reposited in the invertebrate paleontological collections of The University of Oklahoma.

Occurrence.—Brownville Limestone Member, Wood Siding Formation, Wabaunsee Group, Virgil Series, Pennsylvanian, about 7 miles west of Strohm, Osage County, Oklahoma.

References Cited

Moore, R. C., and **Plummer, F. B.**, 1939, Crinoids from the Upper Carboniferous and Permian strata in Texas: Texas University Publication 3945, 468 p., 21 pl., 78 figs.

Strimple, H. L., 1949, Studies of Carboniferous crinoids: Palaeontographica Americana, v. 3, no. 23, p. 22-27, pl. 4, figs. 1-8.

________ 1962, Crinoids of the Brownville Formation: Oklahoma Geology Notes, v. 22, p. 109-110.

Wilde, G. L., 1971, Phylogeny of Pseudofusulinella and its bearing on early Permian stratigraphy: Smithsonian Contributions to Paleobiology, no. 3, p. 363-379.

OKLAHOMA ABSTRACTS

AAPG-SEPM Regional Meeting, Gulf Coast Section
Corpus Christi, Texas
October 11-13, 1972

The following abstract is reprinted from the September 1972 issue, v. 56, of the *Bulletin* of The American Association of Petroleum Geologists. Page numbers appear in brackets below the abstract. Permission of the author and of A. A. Meyerhoff, managing editor, is gratefully acknowledged.

Plate Tectonics and Origin of Caribbean Sea and Gulf of Mexico

J. L. WALPER and C. L. ROWETT, Department of Geology, Texas Christian University, Fort Worth, Texas

Previously published reconstructions of the late Paleozoic "fit" of crustal plates and continents fail to explain many geologic features present in the southwestern U.S., Mexico, Central America, and northern South America. In particular, they fail to consider major geologic and tectonic continuities of Paleozoic age observable in the Southern Appalachians, the Ouachita and Marathon fold belts, the fold belts of southern Mexico and Central America, and the eastern Andean mountain belt of northern South America, as well as the significance of many major transcurrent fault systems or megashears that cross these regions.

With the well-documented joining of Africa-North America as a control for the positioning of South America relative to North America, this report suggests a somewhat different "fit" than any heretofore proposed. Instead of truncating North America in northern Mexico and filling in the Gulf of Mexico with fragments as is most commonly done, this reconstruction wraps Mexico and Central America around the western margin of South America, thus placing in juxtaposition the major tectonic belts of both continents. There is evidence that indicates that the Late Ordovician Taconic orogeny was an arc-continent collision rather than a continent-continent collision as has been suggested previously. Similar evidence indicates that the late Paleozoic Ouachita and Marathon orogenies were arc-continent collisions. Correlative periods of deformation for both of these orogenies have been documented from many places in northern and northwestern South America.

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.

The early Paleozoic history of the Cordilleran mobile belt appears to have been independent from that of the eastern mobile belt. In the late Paleozoic, however, these mobile belts seem to have become coupled tectonically to produce regional stresses that were released along several major megashears. In southern and southwestern North America these include the Wichita and Texas megashears; a third megashear is probably present in northern Mexico. Late Paleozoic movement on these fault zones produced numerous basins and uplifts throughout these regions.

Modifications of the model proposed by Malfait and Dinkleman for the origin of the Caribbean region include the opening of a sphenochasm in the Gulf of Honduras, and regional tensional and compressional stresses resulting from the clockwise rotation of North America. The Gulf of Mexico and the present dislocated positions of the Ouachita and Marathon fold belts are the result of an opening sphenochasm under the present Mississippi embayment and the westward displacement of the Ouachita and Marathon fold belts by left lateral movement on the Wichita and Texas megashears.

[1904-1905]

GSA Annual Meetings, Minneapolis, Minnesota November 13-15, 1972

The following abstracts are reprinted from the Annual Meetings Program of The Geological Society of America and Associated Societies, v. 4, no. 7. Page numbers are given in brackets below each abstract. Permission of the authors and of Mrs. Jo Fogelberg, managing editor of GSA, to reproduce these abstracts is gratefully acknowledged.

Permian Copper-Shale Deposits of Southwestern Oklahoma

KENNETH S. JOHNSON and WILLIAM E. HAM (deceased), Oklahoma Geological Survey, Norman, Oklahoma 73069

More than 50 occurrences of the "red-beds" type of copper deposit are known in Oklahoma, but the most important of these are 2 thin beds of copper-bearing shale in the Flowerpot Formation of Permian age exposed near Creta and Mangum in the southwestern part of the State. The two copper shales commonly range in thickness from 6 to 18 inches, and their grade is 0.5 to 4.45 percent copper. The Creta deposit is being strip mined; it averages 9 inches thick, and the mined ore is about 2 percent copper. The Mangum deposit is currently under development; it averages 14 inches thick and about 1.4 percent copper.

The flat-lying ore beds are medium-gray, laminated, silty shales containing chalcocite as the primary ore mineral and malachite at and near the outcrop. The two copper shales extend 3 to 6 miles along the outcrop and an unknown distance back from the outcrop. They are several feet apart, stratigraphically, and their exposures are about 15 miles apart. In some ways they are similar to the Kupferschiefer of

Germany and the Nonesuch Shale in the White Pine district of Michigan.

The host shales apparently were deposited in a brackish-water or shallow-marine environment, and syngenetic or early diagenetic copper mineralization may have occurred by replacement of pyrite.

[555]

Alteration of Tertiary Volcanic Ash, Western Oklahoma

DAVID M. PATRICK, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi 39180, and CHARLES J. MANKIN, Oklahoma Geological Survey, Norman, Oklahoma 73069

The Ogallala Formation of Pliocene age in western Oklahoma is a sandstone containing some conglomerate layers and lenses. At least 3 volcanic ash deposits and 1 bentonite deposit are present in the lower part of the formation. These lenticular deposits are up to 18 feet in thickness and have a known areal extent ranging from 300-600 acres.

The volcanic ash deposits are composed of silt-sized glass shards. Each deposit grades downward to bentonitic clay at the base. This textural change is accompanied by a downward increase in degree of shard alteration, which is also evident in the bentonite deposit.

Chemical analyses reveal that both the volcanic ash and bentonite deposits exhibit a downward decrease in SiO_2, Na_2O, and K_2O and an increase in CaO, Fe_2O_3, and MgO. The alteration product of the rhyolitic glass is a Ca-montmorillonite. No other crystalline alteration products are present in either the ash or bentonite, although zeolites are locally present in the subjacent sediments.

The SEM reveals that individual glass shards exhibit from 1 to 3 alteration zones. Chemical analyses of these zones show a loss of SiO_2, Na_2O, and K_2O, and a gain of CaO, MgO, and Fe_2O_3 toward the outer surface of the alteration zone. The montmorillonite is forming on the shard surface and exhibits some optical continuity.

Ground water moves downward and laterally through the porous sandstone and ash deposits. This ground water is believed to be responsible for alteration of the glass shards to montmorillonite and for changes in the bulk chemistry of the ash deposits.

[622-623]

Rock and Soil Discrimination by Low Altitude Airborne Gamma-Ray Spectrometry in Payne County, Oklahoma

THERESA FLYNN SCHWARZER and JOHN A. S. ADAMS, Department of Geology, Rice University, Houston, Texas 77001

A gamma-ray survey by helicopter at altitudes of less than 100 feet was conducted to demonstrate the feasibility of mapping a geologically complex area of sedimentary rocks on the basis of Th, U and K "signatures." The data were viewed from both a pedological and a lithological approach. The chemical similarity between *in situ* soils and underlying bedrock allowed the identification of lithologies and the discrimination of lithologic contacts from the air. A sequence of sedimentary formations was established on the basis of shale content. Quantitative estimates of % clay were made using the Th contents which are observed to be a reliable indicator of clay (shale) content. Application of cluster analysis to the airborne data produced groupings corresponding to marine shales, continental deltaic sands, and carbonates, respectively. Transported soils were distinguishable from *in situ* soils and hence, common lithologies of the area. For mapping purposes, spectral data converted to concentrations are superior to count rate and/or total radioactivity. Ratioed data in the study area were relatively insensitive to lithologic changes.

[658-659]

Paleoecology, Biostratigraphy, and Faunal Chemistry of a Pennsylvanian Age Asphaltic Limestone, Arbuckle Mountains, Oklahoma

RICHARD L. SQUIRES, Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California 91109

Paleoecological and chemical analyses have been obtained on a well preserved marine invertebrate fossil assemblage of mid-Desmoinesian age. Quantitative elemental constituents and their spatial distributions for various shell layers were obtained with an electron probe. Mineralogical data were obtained by means of infrared spectroscopy and chemical staining.

Most of the fossils occur as fragments in several asphalt-impregnated skeletal debris grainstones which are shallow water, current-agitated channel deposits that occur in an inner shelf marine environment. Surrounding fusulinid- and brachiopod-bearing wackestones and mudstones were deposited in slightly deeper, less current-agitated environments.

Early asphaltization of the channel grainstones resulted in the preservation of the mineralogies of the various fossil skeletons. New information on these mineralogies includes the following. The orthocone nautiloids *Pseudorthoceras knoxense* and *Michelinoceras directum* and a scaphopod consist of aragonite. Aragonite also occurs in the inner layers of *Chaenocardia ovata, Trachydomia whitei,* and *Naticopsis wortheni,* whereas their outer layers consist of calcite. Skeletons of two foraminifera, *Chaetetes* aff. *favosus,* two cryptostome bryozoa, and four ostracodes consist of calcite. Moderately high magnesium contents occur in the calcites of the stereom areas of echinoid spines.

[675]

THE UNIVERSITY OF OKLAHOMA

The Feasibility of Detecting Lithologic Variations Using a Modified Magnetotelluric Method

GARY A. CREWS, The University of Oklahoma, M.S. thesis, 1972

The detection of lithologic variations that might control hydrocarbon accumulations is a challenging problem in Geophysics. It is the purpose of this thesis to investigate the feasibility of detecting rock variations using a modified magnetotelluric method proposed in 1966 by Yungul. This method uses simultaneous measurement of time varying electric potentials at two locations to provide data relating to contrasts in electrical properties of formations, but eliminates the technical problems associated with true magnetotelluric methods.

Field studies conducted using the modified method in areas of known lithologic variation gave results suggesting differences in electrical properties which could be related to lithologic variations. Although more data are needed before this method is proven, this study suggests that it is feasible to detect lithologic variations at depth. Some results obtained might be interpreted in respect to formation anisotropy and or rock properties with or without pore fluid changes.

Subsurface Stratigraphic Analysis, Late Ordovician to Early Mississippian, Oakdale-Campbell Trend, Woods, Major, and Woodward Counties, Oklahoma

JOHN W. ISOM, The University of Oklahoma, M.S. thesis, 1972

The studied area includes Townships 22-24 North, Ranges 13-19 West in contiguous portions of Woods, Woodward, and Major Counties, Oklahoma. The objectives of the study are: (1) the reconstruction of the paleotopography on the Hunton erosional surface; (2) the delineation of possible porosity-permeability trends within the Hunton Group; (3) the determination of the relationship of structure, porosity-permeability trends, and paleotopography to the accumulation of petroleum; (4) completion of detailed field studies of the major Hunton producers in the area.

The Hunton Group in the area of investigation consists dominantly of dolomite and dolomitic limestones and ranges in thickness from 17 feet to 407 feet. The Hunton Group is divisible into three Zones (A, B, and C) on the basis of electrical and gamma ray log characteristics related to a lithological zonation. In general, it is believed that only the Silurian portion of the Hunton Group is present in this area. The Hunton Group lies with apparent conformity on the underlying Ordovician Sylvan shale and is unconformably overlain by the Kinderhook-Woodford shale sequence.

The structural configuration of the Sylvan shale is that of a southwesterly dipping homocline modified by several south plunging structural "noses." Three small faults and one structural closure are the only features which break the fairly regular surface. This same structuring is reflected at the Hunton level.

As defined by variations in the thickness of the Kinderhook-Woodford shale sequence, a dendritic stream system was developed upon the Hunton surface during the post-Hunton, pre-Woodford hiatus. These streams channeled deeply in the Hunton Group, removing substantial thicknesses of strata and outlining a well-developed paleodrainage pattern.

The best porosity and permeability in the Hunton Group are in the basal portion of Zone A. Near the subcrop edge of this interval and near faulting the porosity and permeability are particularly well developed. This zone accounts for most of the Hunton production in the area.

A combination of structure, porosity-permeability development, and paleotopography have resulted in the formation of several petroleum accumulations in the Hunton Group. Ten fields in the area are producing or have produced from the Hunton. As of January, 1972 the cumulative production from the Hunton fields in the area was approximately 5 million barrels of oil and 58 billion cubic feet of gas. This production is dominantly from the basal portion of Zone A where it subcrops beneath the Hunton unconformity. The area has the potential for many other similar type accumulations.

Fred Dix Named AAPG Executive Director

Fred A. Dix, Jr., staff geologist with Mobil Oil Corporation, Houston, Texas, has recently been announced as the new executive director of The American Association of Petroleum Geologists by the association's president, James E. Wilson. The position had been vacant for a year.

Dix earned B.S. and M.S. degrees from Rutgers University and was employed as a geologist with Standard Oil Company of California prior to signing on with Mobil. He has been active in AAPG affairs for several years and is presently serving as AAPG treasurer, succeeding the late H. B. Renfro.

The new executive director has been especially interested in well and drilling statistics, serving on AAPG and American Petroleum Institute committees. He has written several articles on North American drilling activity that have appeared in recent volumes of the AAPG *Bulletin*.

Timely Information on Crude-Oil Production Available

The U.S. Bureau of Mines has announced a new publication, *World Crude Oil Production Annual,* an addition to the Bureau's *Mineral Industry Survey* series. Key world statistics will become available in this *Annual* 6 to 9 months sooner than has been possible in the *Minerals Yearbook* and *International Petroleum Annual.*

The new series was necessitated by the impending crisis in the shortage of energy resources, which makes it imperative that all pertinent energy data be reported as quickly as possible.

A single copy of the publication can be obtained free from Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh, Pennsylvania 15213. Persons interested in receiving future copies should write to the Chief, Division of Technical Reports, U.S. Bureau of Mines, Ballston Tower No. 3, Wilson Boulevard, Arlington, Virginia 22203.

USGS Proposes National Land-Use Classification System

Recent developments in high-altitude aircraft and satellite photography, remote-sensing techniques, and improved methods of interpretation have greatly increased the potential for land-use analysis and have led geographers of the U.S. Geological Survey to propose a new, standardized, national land-use classification system. The proposed system is explained in USGS Circular 671, *A Land-Use Classification System for Use with Remote-Sensor Data.* Dr. James R. Anderson, chief geographer for the USGS, is the senior author.

The classification is based on broad categories of land use numerically coded into general divisions—urban and built-up land, agricultural land, rangeland, forest land, water, nonforested wetland, barren land, tundra, and permanent snow and icefields—plus 30 subdivisions and is "open-ended" to serve as a foundation for more detailed development on regional, state, and local levels.

The circular is available, free upon request, from the Director, U.S. Geological Survey, Washington, D.C. 20242.

Field Trip through Southern Oklahoma

The Shreveport Geological Society will sponsor a field trip April 12-14 to study the Paleozoic geology of southern Oklahoma. The trip will focus specifically on rocks in the Arbuckle and Ouachita Mountains and vicinity that are surface equivalents of rocks in the deep subsurface of the Gulf Coast province, especially those units that might provide hydrocarbon traps or reservoirs.

Robert O. Fay of the Oklahoma Geological Survey will be one of the field-trip leaders and will summarize the general geology of the region at Lake Murray Lodge, near Ardmore, on the evening of April 12.

The first day's route, on April 13, will traverse the Arbuckle Mountains, including a 4-mile walking tour through the spectacular I-35 roadcuts, and will end that evening at McAlester.

The April 14 itinerary calls for the group to travel southward and southeastward through the Ouachita Mountains and on back to Shreveport.

Persons interested in going on the trip should contact A. H. Trowbridge, P.O. Box 5424, Shreveport, Louisiana 71105.

To the Oklahoma City Geological Society: Thanks!

Last spring the executive committee of the Oklahoma City Geological Society approached the Oklahoma Geological Survey with "an offer that we couldn't refuse": the society wanted to purchase 800 copies of the June 1972 issue of *Oklahoma Geology Notes,* at cost, for mailing to the membership. Subscription forms were inserted in each, and the plan was carried out.

The result was an increase in our circulation—some 75 new subscriptions. Incredibly, we find that requests are still filtering in.

We offer our special thanks to Gary McDaniel and Sherrill Howery, who were instrumental in crystallizing this plan to broaden our circulation base, and extend our appreciation to the entire OCGS executive committee for their support.

OKLAHOMA GEOLOGY NOTES

Volume 33 February 1973 Number 1

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