

*John B. Ram*

HISTORY OF THE EASTERN SECTION  
OF  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

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ORGANIZATION MEETING  
EASTERN SECTION - AAPG



Society members attending organization meeting of new Eastern Section, held May 11, 1969, at Flying Carpet Motor Inn, at Greater Pittsburgh Airport.

*Top row, left to right:* PATRICK J. BURNS, Appalachian Geol. Soc., PHILIP L. MARTIN, Appalachian Geol. Soc., E. T. HECK, Northern Appalachian Geol. Soc., ROGER G. LUDWIG, Pittsburgh Geol. Soc., and VINCENT E. NELSON, Geol. Soc. of Kentucky.

*Middle row, left to right:* NEILSON RUDD, Illinois

Geol. Soc., WILLIAM HENNINGTON, Ohio Geol. Soc., THOMAS F. RITTER, Eastern District, AAPG, and PAUL W. GARRETT, JR., Pittsburgh Geol. Soc.

*Bottom row, left to right:* JAMES K. VINCENT, Indiana-Kentucky Geol. Soc., RALPH L. MILLER, Geol. Soc. of Washington, D.C., BEVERLY L. CHAMPION, Michigan Basin Geol. Soc., JOHN T. GALEY, Pittsburgh Geol. Soc., and FRANKLYN R. ENGLER, Pittsburgh Geol. Soc.

HISTORY  
EASTERN SECTION  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

Frank Conselman's proposal in the winter of 1968-69, for an Eastern Section which would complete U. S. Regional AAPG coverage, was enthusiastically received by the Pittsburgh Geological Society and several individuals including George V. Cohee, John T. Galey, Lee C. Lamar, Ralph L. Miller and Thomas F. Ritter. Tom Ritter canvassed all geological societies within the area of the proposed Section for their indication of interest. The Indiana-Kentucky, Ohio and Pittsburgh Societies favored the formation of the Section; the Michigan Basin, Northern Ohio and Northern Appalachian Societies were undecided and the others indicated no interest or gave no reply.

During the 1969 national AAPG Convention at Dallas, the representatives of all the AAPG affiliated and one non-affiliated Society of the area of the proposed Section met April 16 to determine their interest to organize. The vote was unanimously in favor. Frank Conselman, AAPG President, urged that this be accomplished at the earliest possible date. John Galey was elected to chair a Steering Committee for this purpose and the date of Sunday, May 11, 1969, was set for a meeting to draft Articles for Organization.

While the date chosen for the meeting was Mother's Day, representatives of each of the affiliated and one non-affiliated Society numbering fourteen came to the Flying Carpet Motor Inn at the Greater Pittsburgh Airport to draft Articles. These people

who comprised the Steering Committee were as follows:

Patrick J. Burns, Appalachian Geological Society  
Beverly L. Smith Champion, Michigan Basin Geological Society  
Franklyn R. Engler, Pittsburgh Geological Society  
John T. Galey, Convenor of Meeting, Pittsburgh Geological Society  
Paul W. Garrett, Jr., Pittsburgh Geological Society  
Edward T. Heck, Northern Appalachian Geological Society  
Willard M. Hennington, Ohio Geological Society  
Roger G. Ludwig, Pittsburgh Geological Society  
Philip L. Martin, Appalachian Geological Society  
Ralph L. Miller, Geological Society of Washington  
Vincent F. Nelson, Geological Society of Kentucky  
Thomas F. Ritter, Petroleum Exploration Society of New York  
Neilson Rudd, Illinois Geological Society  
James K. Vincent, Indiana-Kentucky Geological Society

Discussion revealed a number of obstacles to preparing Articles which were acceptable to all. They were: whether membership in the Section was to be by individual or Society; whether financial responsibility rested with the Societies or with the individual AAPG members within the area of the Section since many AAPG members were not members of Societies; whether Society Presidents not members of AAPG or AAPG elected Delegates should be members of the governing Council and whether or not the name Eastern Section, which belonged to the New York City group, could be made available and thus give congruity to the name of the new Section. As a result, the Articles could not be completed. However, all representatives remained in favor of forming the Section.

George Cohee and Ralph Miller, Paul Garrett, Jr., Gilmor Hamill, Roger Ludwig, Ralph Ross, Grover Schrayer and John Galey, with suggestions from the AAPG legal counsel, Charles Chapel, Esq. of Tulsa, Oklahoma, worked out a draft of Articles dated March 11, 1970 believed to satisfy all concerned. Copies of these were sent to representatives of each of the Societies in order that they could comment before a meeting arranged for April 16, 1970 at Hotel Roanoke, Roanoke, Virginia, preceding the Appalachian Geological

Society's Field Trip to the Central Appalachian Silurian. The AAPG Vice President and Executive Director plus representatives of seven of the nine Societies attended. These seven Societies accepted the new draft of the Articles. They were the Appalachian Geological Society, Indiana-Kentucky Geological Society, Illinois Geological Society, Geological Society of Kentucky, Michigan Basin Geological Society, Ohio Geological Society and Pittsburgh Geological Society.

The Chairman of the Steering Committee was instructed at this meeting to prepare a petition to the AAPG Executive Committee, Kenneth Crandall, President, to indicate the seven Societies had accepted the Articles and request recognition as the Eastern Section AAPG. The New York group had previously relinquished its name and assumed the name of Petroleum Exploration Society of New York. The petition was prepared on June 12, 1970, mailed to the AAPG Executive Committee and accepted at its meeting in Calgary, June 21, 1970.

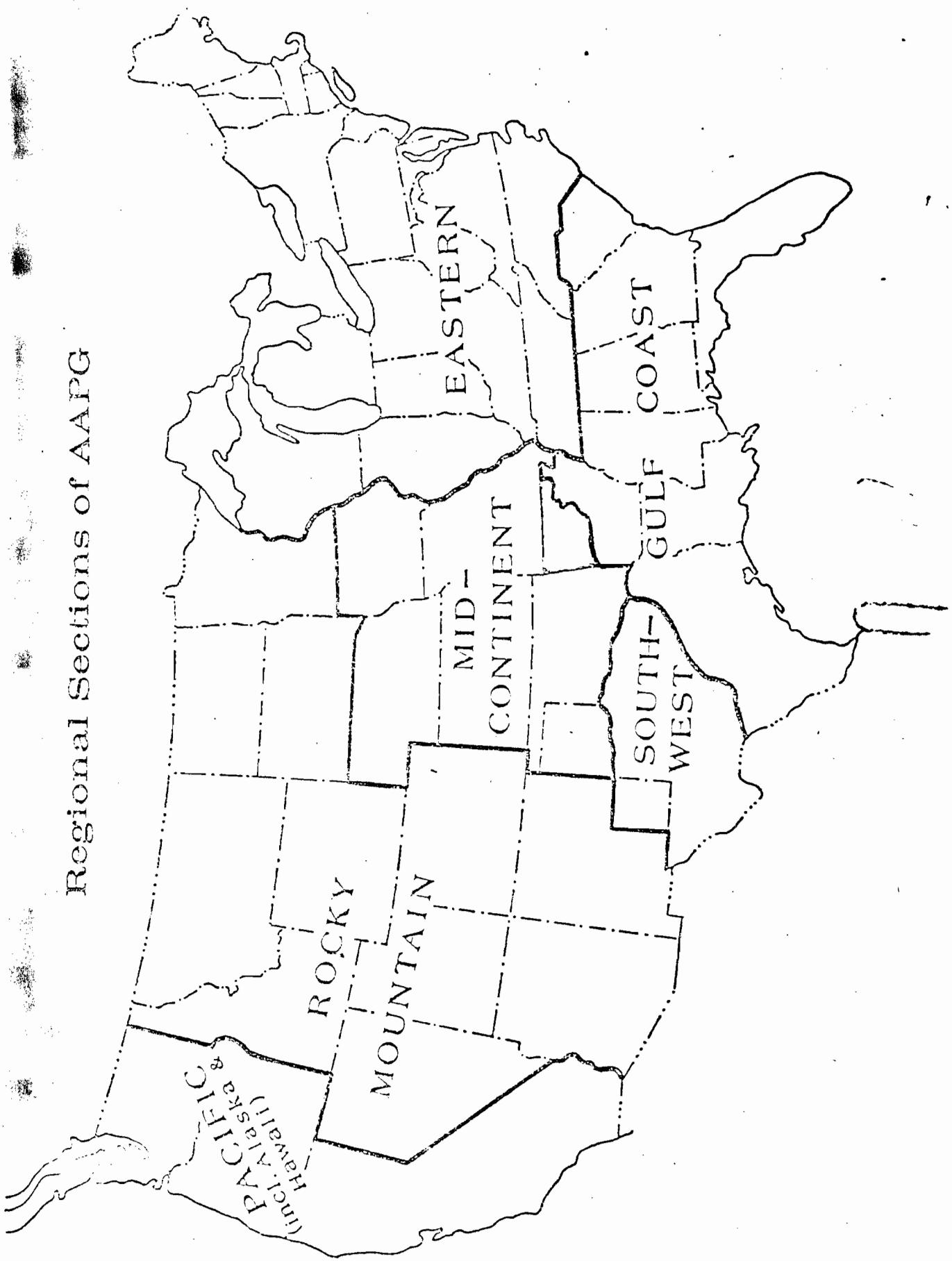
Shortly thereafter, the Delegates of the new Section met in the Spanish Room of the Sheraton-Summit Hotel, Calgary. The principal discussion was of the means by which the New York group and the Geological Society of Washington could be brought into the Section. Section officers were elected. They were John Galey, President; Lee Lamar, Vice-President and Franklyn Engler, Secretary-Treasurer. These men were delegated the responsibility of amending the Articles to make them acceptable to the New York and Washington Societies.

Engler, Lamar and Galey met on September 8, 1970 and resolved the objections of the New York group. Lamar presented the revised Articles to the Petroleum Exploration Society of New York at its next meeting, September 24, 1970. They were formally accepted by unanimous vote at their following meeting, October 22.

The Geological Society of Washington, which contained a very small percentage of AAPG members, was concerned that some of its funds might be used for Section purposes. This was a simple matter to resolve. The Articles were redrafted under date January 28, 1971, by Galey with assistance from George Cohee, Wallace DeWitt, Ralph Miller, Gordon Wood and they were accepted by the Geological Society of Washington. This brought a happy ending to a marathon negotiating and drafting session.

A map showing the states included in the various Regional Sections is shown on the following page.

## Regional Sections of AAPG



Geological Societies  
Composing  
the  
Eastern Section  
of  
The American Association of Petroleum Geologists

Appalachian Geological Society  
Geological Society of Washington  
Illinois Geological Society  
Indiana-Kentucky Geological Society  
Kentucky Geological Society  
Michigan Basin Geological Society  
New York State Geological Association  
Ohio Geological Society  
Petroleum Exploration Society of New York  
Pittsburgh Geological Society

PAST AND PRESENT OFFICERS  
EASTERN SECTION  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

	<u>1971-72</u>	<u>1972-73</u>	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>
President	John T. Galey	Gordon H. Wood, Jr.	Donald Parks	James H. Fisher	William C. MacQuown, Jr.
Vice President	Lee C. Lamar	John R. Ebright	James H. Fisher	William C. MacQuown, Jr.	Ralph L. Miller
Secretary-Treasurer	Frank R. Engler	Patrick J. Burns	Porter J. Brown	Porter J. Brown	Porter J. Brown
Advisor*	John T. Galey	John T. Galey	John T. Galey	Gordon H. Wood, Jr.	Gordon H. Wood, Jr.
	<u>1976-77</u>				
President	Ralph L. Miller				
Vice President	James A. Noel				
Secretary	Vincent E. Nelson				
Treasurer	Larry D. Woodfork				
Advisor	Gordon H. Wood, Jr.				
Advisor Elect	Porter J. Brown				

\*Three year term.

**MEETINGS**  
**EASTERN SECTION**  
**THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS**

<u>Year</u>	<u>Location</u>	<u>General Chairman</u>	<u>Host Society</u>	<u>Host Society President</u>	<u>Attendance</u>	<u>Theme</u>
1972	Columbus, Ohio	James A. Noel	Ohio Geological Society	James A. Noel	276	New Oil & Gas from Mississippi to Atlantic.
1973	Atlantic City, N.J.	George C. Grow, Jr.	Petroleum Exploration Society of N.Y.	R. L. Fuchs	408	East Coast Offshore System Baffin Bay to the Bahamas.
1974	Pittsburgh, Pa.	John T. Galey	Pittsburgh Geological Society	Samir Kahoury	273	Appalachian Energy.
1975	East Lansing, Mich.	James H. Fisher	Michigan Basin Geological Society	Wayne E. Moore	311	Reefs & Evaporites
1976	Lexington, Ky.	Vincent E. Nelson	Geological Society of Kentucky	Basel Doerhoerfer, III	244	Basin-Arch Relationships
<u>Year</u>		<u>Field Trips</u>	<u>Field Trip Leaders</u>			
1972	Silurian of the Cincinnati Arch Area	Pennsylvania Deltas in Ohio and Northern West Virginia	A. Janssens			
1973	None		Alan C. Donaldson			
1974	Marine Units in the Lower Conemaugh of Pennsylvania and Ohio	Trip to Gypsum Mine	Jack Donahue & Harold B. Rollins			
1975	Selected Structural Features and Associated Dolostone Occurrences in the Vicinity of the Kentucky River Fault System.		Paul Catacosinos			
1976	Stratigraphic Evidence for Late Paleozoic Tectonism in Northeastern Kentucky		Douglas F. B. Black & Donald C. Haney			
			Garland R. Denver, Norman Hester and Harry Hoge			

LEVORSEN AWARD

Eastern Section  
The American Association of Petroleum Geologists

The E. I. Levorsen Award is a plaque given at the regional meeting of the Sections of The American Association of Petroleum Geologists for the best paper with particular emphasis on creative thinking toward new ideas in exploration.

- 1972 Sigmund Snelson, co-author Hans Widmer, "Subsurface Data Bearing on the Tectonic Style of the Valley and Ridge Province."
- 1973 C. F. Upshaw, co-authors W. E. Armstrong, W. B. Creath, E. J. Kidson, G. A. Sanderson, J. H. Craig, F. M. Gradstein, J. Van Hinte, W. A. N. Jenkins, S. A. J. Pocock, F. L. Staplin, and J. A. Sulek, "Biostratigraphic Framework of the Grand Banks."
- 1974 Douglas G. Patchen, co-authors Richard Smosna and Hugh Buchanan, "Stratigraphy and Petrology of the Middle Silurian McKenzie (Lockport) Formation in West Virginia and Adjacent Areas."
- 1975 B. Charlotte Schreiber, co-authors Raimondo Catalano and Edward Schreiber, "An Evaporitic Lithofacies Continuum - Continental to Subaqueous Deposits."
- 1976 Dr. G. R. Keller, co-authors R. K. Soderberg, M. L. Ammerman and A. F. Bland, "Geophysical and Tectonic Study of the Moorman Syncline and the Rome Trough and Their Relation to the Cincinnati Arch."

28 January 1971

CONSTITUTION  
OF THE EASTERN SECTION OF  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

Article I. Name

The name of this organization shall be the Eastern Section of the American Association of Petroleum Geologists (AAPG).

Article II. Purpose

This Section is formed to unite the AAPG affiliated societies within the geographic region, as defined by the Association, for the purpose of sponsoring technical meetings and publications and otherwise furthering the objectives of the Association.

Article III. Membership

Membership in this Section is restricted to affiliated geological societies within the regional boundaries as defined by the AAPG. However, the member societies may make other affiliations.

Article IV. Section Council

a. The affairs of the Section shall be administered by a Section Council, all active members of AAPG.

b. The Section Council shall consist of the Society Delegates as defined in Article III of the By-Laws of AAPG. Each affiliated local geological society shall be entitled to one Delegate for up to twenty-five (25) members of the Association and to one (1) additional Delegate for each additional one hundred (100) members, or major fraction thereof, allocated to that society for voting purposes.

Article V. Officers

The officers of this Section shall be a President, Vice-President, and Secretary-Treasurer, elected annually by and from the members of the Council.

Article VI. Committees

No Committee structure is provided in order to avoid duplication of activities normally carried on by member societies, or the AAPG. Ad Hoc committees may be appointed as prescribed in the By-Laws.

## Article VII. Meetings

The Section Council shall meet annually, for the purpose of electing Section Officers; the Section's representative to the Advisory Council of the AAPG; and such other business as the council considers necessary. The Section Council may meet at such additional times as necessary.

## Article VIII. Scientific Assembly

The Section may conduct regional meetings to present technical programs for the benefit of the member societies. The location of the meeting shall be selected by the Section Council.

## Article IX. Finances

Finances required shall be recommended by the Secretary-Treasurer for the officers to the council. Following adequate prior notice to the member societies, a two-thirds (2/3) majority of council members present and voting will be required for approval. Any funds required shall be proportional to the number of AAPG members in each member society. Such assessments shall be collected from individual AAPG members and forwarded to the Eastern Section. A Member society assumes no financial responsibility to the Eastern Section of AAPG.

## Article X. Amendments

Amendments to these Articles may be made by a two-thirds (2/3) vote of the Section Council, following adequate prior notice to the member societies with a request for instructed voting.

## Article XI. Disposition of Assets

The Section is a non-profit organization. In the event of the dissolution of the section, any assets remaining shall be donated to the Association to be used in a manner prescribed by the members of the section remaining at time of dissolution or, in the event no allocation is made, in any manner which the Association shall deem to be in its own best interest.

## Article XII. By-Laws

The Section Council shall draft By-Laws, which must be approved by a three-fourth (3/4) majority vote of the Section Council.

EASTERN SECTION  
OF  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS  
BY-LAWS

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NAME

ARTICLE I      This organization shall be known as "Eastern Section of The American Association of Petroleum Geologists", and it is hereinafter referred to as the "Section".

OBJECT

ARTICLE II      Section 1. The object of this Section is to promote the scientific and educational aspects of geology; to provide for the professional needs of the geologists; to unite the AAPG affiliated societies in the eastern region as defined by the Association into a Section of the American Association of Petroleum Geologists, for the purpose of sponsoring technical meetings and publications and otherwise furthering the objectives of the Association.

Section 2. The Eastern Section is a non-profit organization and no portion of the net earnings inures to the benefit of any private individual or member.

MEMBERSHIP

ARTICLE III      Section 1. Membership in the Section shall be of two types consisting of affiliated geological societies known as Member Societies and individual geologists known as Members.

A. Member Societies shall be geological societies in the Eastern region of the United States of America who have ratified and adopted the Articles for Organization making up the Section prior to June 30, 1973, and who are affiliated with the American Association of Petroleum Geologists, and shall include The Appalachian Geological Society, Geological Society of Washington, Illinois Geological Society, Indiana Kentucky Geological Society, Kentucky Geological Society, Michigan Basin Geological Society, Ohio Geological Society, Petroleum Exploration Society of New York, Pittsburgh Geological Society and any

other societies hereinafter approved for membership. Additional Member Societies may be admitted for this Section upon written request by the officers of the society seeking admission and by a two-thirds vote of the Council.

- B. Members shall include all active members and life members of the Association residing in the eastern region of the United States of America and who are not members of affiliated societies.

Section 2. Any Member Society may withdraw from the Section upon written request by the Officers of that Member Society, provided that the Society making the request for withdrawal is not financially indebted to the Section.

#### SECTION COUNCIL

**ARTICLE IV**      Section 1. The affairs of the Section shall be administered by a Section Council, all active members of AAPG.

- A. The Section Council shall consist of the President, Vice President, Secretary-Treasurer and the Society Delegates as defined in Article III of the By-Laws of AAPG.

Section 2. Voting on all matters shall be restricted to the officers and the delegates from each Member Society, who shall be entitled to one (1) vote each. In the absence of duly chosen and accredited delegates for a particular Society Member, the alternate delegates shall be eligible to vote.

Section 3. The normal business matters of the Section Council shall be determined by a majority of a quorum of the officers and representatives present, subject to any exceptions hereinafter set forth. For business purposes a quorum shall consist of at least sixty (60) per cent of the total Section Council membership. Timely notices shall be given by the President in advance of each meeting. Nothing in the By-Laws shall be construed as infringing upon or in any way limiting the normal prerogatives of each Member Society as regards to internal administration, operations, and policy. Each Member Society may act independently of the organization whenever it desires to do so.

#### OFFICERS

**ARTICLE V**      Section 1. The officers of the Section shall be a President, a Vice President, A Secretary-Treasurer. The

officers shall serve for a term of one (1) year and shall take office on the 1st day of July following each annual meeting.

Section 2. The President shall be the principal executive officer of the Section and shall in general supervise and control the business and affairs of the Section. He shall preside at all meetings of the members and of the Council. In general he shall perform all duties incident to the office of President and such other duties as may be prescribed by the Council from time to time.

Section 3. The Vice President shall assume the duties of the President in his absence or incapacity, and shall perform all other duties designated by the President. In order for continuity of the Section's business, the Vice President shall be considered as President-elect and shall become President following his term as Vice-President.

Section 4. The Secretary-Treasurer shall keep the records and books of account of the Section and keep minutes of all meetings. He shall perform all other duties that usually pertain to this office or are delegated to him by the Council. The Secretary-Treasurer shall send out all notices of meetings and shall conduct the correspondence of the Section except as otherwise provided, and in the absence of the President and Vice President he shall assume the duties of the President. He shall have the custody of all the monies and securities of the Section. He shall keep regular books. All monies of the Section shall be deposited by him in such depositories as shall be selected by the Council. In addition, he shall perform all duties usually pertaining to his office or delegated to him by the Council and he shall present a financial statement to the Council at the annual meeting. Checks on the council funds must be signed by the Treasurer and/or the President.

Section 5. Nomination: The President shall, on or before October 1st, appoint a nomination committee consisting of the presidents of three Member Societies who will consult with the non-represented Member Societies. No society shall repeat on the nominating committee until all other member societies have had the opportunity to serve on this committee. The nominating committee shall be instructed to transmit to the Secretary by December 1st, the names of two or more nominees for the office of Vice President (President-elect) and Secretary-Treasurer. All nominees shall be AAPG members. No Vice Presidential nominee may be nominated from the Member Society of which the section Vice President is a resident member. Announcement of these nominees shall be printed in the AAPG Bulletin.

Section 6. Election: Ballots carrying the names of the nominees for each office shall be prepared by the Secretary and mailed to all AAPG members residing within the Section's boundaries. The names of said nominees shall be arranged alphabetically for each office. The ballot shall be mailed along with a Section addressed envelope to each Member by February 1st. The ballots received by the Secretary on or before March 15th shall be counted by a ballot committee appointed by the President. Election to office shall be by a plurality of the votes cast for each office.

MEETINGS

ARTICLE VI

Section 1. The Section Council shall meet annually to conduct such business as the council considers necessary. The Section Council may meet at such additional times as necessary.

Section 2. The Counselor to the President's Advisory Council of the AAPG shall be elected by the Section Council as follows:

Every third year, four (4) months prior to the annual meeting, the Section President shall appoint a nominating committee to nominate two (2) candidates for the office from the current members of the Council. The Counselor then to be elected by ballot at the annual meeting.

Section 3. The Section will conduct conventions at least every two (2) years to present technical programs for the benefit of the member societies. The time and place of such conventions shall be determined by the Section Council which shall give due consideration to promoting maximum attendance. The places of convention shall be rotated among the metropolitan centers in the region deemed capable of meeting convention requirements. Responsibility for each convention shall be delegated by the Section Council to a convention committee appointed by the President and approved by the Council, or to a Member Society, or to Member Societies acting jointly, such responsibility to be exercised as part of the general supervision of the Section and to be subject to the consent of the Society or Societies concerned.

FINANCES

ARTICLE VII

Section 1. Finances required shall be recommended by the Secretary-Treasurer for the officers to the council. Following adequate prior notice to the member societies, a two thirds (2/3) majority of council members present and voting

will be required for approval. Any funds required shall be proportional to the number of AAPG members in each member society. Such assessments shall be collected from individual AAPG members and forwarded to the Eastern Section. A member society assumes no financial responsibility to the Eastern Section of AAPG.

Section 2. The funds of the Section shall be disbursed by the Treasurer under the supervision and guidance of the Section Council. All policy matters affecting such disbursement for other than purely routine expenses shall require the two-thirds (2/3) approval of the Section Council. All Section funds shall be deposited in a bank which operates under Federal Deposit Insurance Corporation regulations.

Section 3. The Section is a non-profit organization. In the event of the dissolution of the Section any assets remaining shall be donated to the Association to be used in a manner prescribed by the members of the Section remaining at time of dissolution or, in the event no allocation is made, in any manner which the Association shall deem to be in its own best interest.

#### AMENDMENTS

#### ARTICLE VIII

Section 1. Amendments to these By-Laws may be proposed by the Section Council, or by any two Member Societies, at any time. Such amendments proposed by Member Societies must be submitted in writing to the Section Council which shall then vote either to table the amendment or to refer it to the Member Societies for ratification, such vote to require two-thirds (2/3) approval by the Section Council. If approved by the Council, each Member Society shall have a period of sixty (60) days, excluding June, July and August, in which to indicate its ratification or disapproval of such proposed amendment. Failure of a Member Society to take action on a proposed amendment within such sixty-day period shall be considered tantamount to approval thereof. An affirmative vote of three-fourths (3/4) of the Member Societies shall be necessary for approval of the proposed amendment.

#### MISCELLANEOUS

#### ARTICLE IX

Section 1. Robert's Rules of Order shall govern all meetings of the Section, except as otherwise provided herein.

Section 2. The object of the Section shall be to operate as a non-profit organization for the purpose of providing a regional cooperative arrangement among AAPG members and AAPG affiliated geological societies of the eastern U. S. for the advancement of the profession of petroleum geology.

Section 3. The Section shall be operated as a non-profit organization. It shall issue no instruments of debt, pay no salaries, and have no corporate seal.

April 19, 1973

FIRST ANNUAL MEETING

COLUMBUS, OHIO

1972

First Annual Meeting  
Columbus, Ohio  
1972

The first annual meeting of the Eastern Section was held May 24-27, 1972 at the Sheraton Hotel, Columbus, Ohio. The theme for this meeting was "New Gas and Oil from the Mississippi to the Atlantic". Mr. John T. Galey, the Section President, requested and received an advance of \$1,500.00 each from the Columbia Gas System and the Consolidated Natural Gas System to finance this meeting. The advances were returned after the meeting. There were 276 registered for the meeting.

Mr. James A. Noel was the General Chairman for the first meeting. He was also the president of the Ohio Geological Society, which was the Host Society for the meeting.

The first annual meeting had a gross income of \$12,198.50 with expenses of \$9,385.75 for a net profit of \$2,812.75 which was turned over to the Eastern Section treasury. One-third of the profit or \$937.58 was returned to the Ohio Geological Society in January, 1976.

Attached is a copy of the minutes, committee chairman, and program for the Columbus meeting.



# The American Association of Petroleum Geologists

MINUTES FOR THE MEETING OF THE EASTERN SECTION OF THE  
A.A.P.G. HELD AT 3 P.M. ON MAY 24, 1972, TAFT ROOM,  
SHERATON HOTEL, COLUMBUS, OHIO

Roll was called and thirteen delegates were present. Mr. Galey announced a quorum.

Visiting dignitaries from national headquarters included Sherman Wengard, President, A.A.P.G. and James Wilson, President-elect, A.A.P.G.

Mr. Galey announced that the meeting for 1973 in Atlantic City, New Jersey was in effect, and the New York society was moving ahead with the necessary preparations. The meeting will be held at the Chalfonte-Haddon Hall Hotel in Atlantic City April 23-25, 1973. The theme chosen for the meeting is "East Coast Offshore Symposium."

The Secretary-Treasurer reported that \$1,500 each had been advanced by Columbia Gas and Consolidated Gas to fund the Ohio meeting. \$2,000 has been advanced to the convention, and \$1,000 presently is in the section account.

The banking situation was discussed in light of the new officers not being residents of Pittsburgh. Mr. Wood made a motion that the bank account be placed in an either/or condition. The secretary-treasurer would be one accepted signature, and the other accepted signature would be the Pittsburgh Geological Society President or delegate. The motion was seconded by Lee Lamar and passed unanimously.

Mr. Galey confirmed the position of Dick Meyers as acting chairman of the national meeting in Washington, D. C. in 1977. This appointment had been made in Denver subject to acceptance by U.S.G.S. and the society of Washington, D. C. The two parties have agreed.

The nominating committee comprised of three members, George Cohee, Lee Lamar, Jim Noel, and John Galey reported their new slate of officers as follows:

Gordon H. Wood, Jr. - President  
John R. Ebright - Vice President  
Patrick J. Burns - Secretary-Treasurer

Mr. Nelson made a motion that the officers be elected as proposed by the nominating committee. Mr. Lindholm seconded the motion, and the officers were elected unanimously.

Mr. Galey reiterated the proposal put forth in Denver to send envelopes to members to solicit contributions for the Eastern section.

Discussion was held relative to sounding out the individual societies about hosting the 1974 meeting of the Eastern section.

Additional questions introduced to be resolved are:

For purposes of the convention does the Eastern section want to combine with the G.S.A. or S.E.P.M.?

Does the Eastern section want individual societies to combine to present a meeting?

A Eastern section newsletter was proposed, but the general consensus of the delegates was to delay publication until the financial position is better.

It was moved and seconded that the meeting be adjourned. The motion carried unanimously.

Respectfully submitted,

Franklyn R. Engler  
Secretary-Treasurer



**THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS**

**EASTERN SECTION**  
**FIRST ANNUAL MEETING**

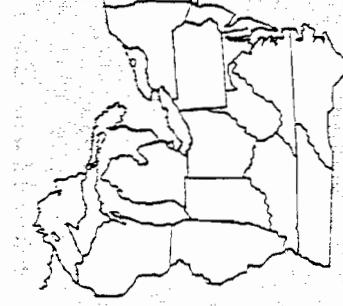
Columbus, Ohio, May 26-27, 1972

Host: Ohio Geological Society

Convention Headquarters: Sheraton-Columbus Motor Hotel

**PROGRAM AND ABSTRACTS**

**EASTERN SECTION**  
**FIRST ANNUAL MEETING**



**CALENDAR**

**WEDNESDAY, MAY 24**

12:00 noon - Dutch Luncheon; Eastern Section Officers, Delegates, Committee Chairmen, and National Officers. Taft Room  
1:30 p.m. - Eastern Section AAPG Delegates Meeting. Garfield-Myles Room  
3:00-7:00 p.m. - Registration. Terrestrial Promenade  
5:30-7:00 p.m. - Welcoming Party. Mars-Jupiter Room

**THURSDAY, MAY 25**

7:00 a.m. - Speakers' Breakfast; Chairmen, Speakers, Moderators, and Presiding Officers for Thursday. Harrison Room  
8:00 a.m. - Registration. Terrestrial Promenade  
8:30-11:30 a.m. - Welcoming and Keynote Addresses. Symposium on Appalachian Structure. Venus-Mars Room  
12:00 noon - AAPG Luncheon. Harrison Room  
1:20-5:10 p.m. - Symposium on Appalachian Structure (continued). Venus-Mars Room  
8:00 p.m. - Informal discussion session. Jupiter Room

**FRIDAY, MAY 26**

7:00 a.m. - Speakers' Breakfast; Chairmen, Speakers, Moderators, and Presiding Officers for Friday. Harrison Room  
8:30-11:45 a.m. - Symposium on Appalachian Stratigraphy and Production. Venus-Mars Room  
1:45-4:00 - Symposium on Appalachian Stratigraphy and Production (continued). Venus-Mars Room  
4:00 p.m. - Leversen Committee Meeting. McKinley-Harding Room

**SATURDAY, MAY 27**  
Field Trip 1 - Silurian of Northwestern Ohio  
Field Trip 2 - Pennsylvanian Deltas in Ohio and Northern West Virginia

**HOST SOCIETY OFFICERS**

Sheraton-Columbus Motor Hotel  
Columbus, Ohio

**May 24, 25, 26, 27, 1972**

**OHIO GEOLOGICAL SOCIETY**

*President—JAMES A. NOEL, Wright State University  
Vice-President—WILLARD M. HENNINGTON, Columbia Gas Transmission Corporation  
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### WELCOME TO COLUMBUS

The Ohio Geological Society is honored to be the first to extend a warm welcome to a meeting of the Eastern Section of the American Association of Petroleum Geologists. I believe the program our committee has assembled is one that will intrigue all and will challenge the concepts long held concerning Appalachian geology. I feel that this meeting is the beginning of a new era in the geology and exploration for petroleum in the Eastern Section area.

It is only fitting that new ideas and concepts should come from the area where so much of our science was born and matured. I didn't know until just last week that structural consulting had its beginning in the Eastern Section area. In 1836 John Alexander, geologist and engineer, used "horizontal curves" to show the "configuration of the ground and the principal coal beds" in his prospectus for a charter for the Georges Creek Mining Company in Maryland. Where would oil geologists be without Mr. Alexander?

All the committee members have worked diligently to make your stay here an enjoyable one. Whatever success the meeting enjoys will be due to the time and talent of these people.

So welcome to Columbus and may your stay be memorable and meaningful.

James A. Noel  
*General Chairman*  
1972 Eastern Section AAPG Convention

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**EXHIBITS**

Exhibits are situated in the Terrestrial Promenade on the second floor.

Exhibitors are:

Bidwell Division of Seismograph Service Corporation—Tulsa, Oklahoma  
Halliburton Services—Duncan, Oklahoma  
Ohio Division of Geological Survey—Columbus, Ohio  
The Ohio State University, Department of Geology—Columbus, Ohio  
Pennsylvania Geological Survey—Harrisburg, Pennsylvania  
Seismic and Digital Concepts, Inc.—Houston, Texas  
West Virginia Geological Survey—Morgantown, West Virginia

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**LADIES ENTERTAINMENT**

The Ladies' Hospitality Room is located in the Terrestrial Lounge at the west end of the second floor and will be open for coffee, cards, and conversation from 9 to 5, Thursday and Friday.

WEDNESDAY EVENING, MAY 24 - Following registration, join your husbands at the Welcome Cocktail Party and then dine at one of Columbus' many gourmet restaurants. Be sure to wear your name tag.

THURSDAY, MAY 25, 11:00 a.m. - 3:00 p.m. - A bus tour of historic German Village in the heart of Columbus, including luncheon at one of its noted restaurants and time for visiting the many fascinating shops. The bus will leave the Sheraton promptly at 1:00 a.m. Be sure to bring your ticket.

THURSDAY EVENING, MAY 25 - Another evening on the town. Let us guide you to one of Columbus' many night spots.

FRIDAY, MAY 26 - At your leisure for sightseeing and shopping.

## 6 FIELD TRIPS

**FIELD TRIP 1:** Silurian of northwestern Ohio. Saturday, May 27. Host: Ohio Geological Society  
Leader: CHARLES F. KAILE AND JACK C. FLOYD, Department of Geology, Bowling Green State University, Bowling Green, Ohio

The overall purpose of this field trip is to provide participants with an opportunity to become acquainted, or better acquainted, with the general geology of the Silurian rocks in northwestern Ohio. Particular attention will be devoted to what is known and what is not known about the stratigraphy of these rocks and to problems associated with surface and subsurface correlations. It will be shown that these rocks provide models for many of the problems associated with the study of dolomites in general. Participants will have an opportunity to learn about the stratigraphic and environmental usefulness of color and of various sedimentary structures in these rocks. The typical petiflial nature of caprock rocks will be contrasted with the typical subtidal nature of Niagara rocks in terms of textures and of sedimentary structures.

The trip will leave from the Sheraton-Columbus Motor Hotel at 7:30 a.m., Saturday, May 27. Transportation will be by bus and private cars. First stop will be the type section of the Tyndale Formation (junction of U.S. 23 and Tyndale Creek), where some may wish to join the trip. Return to Columbus by approximately 6:30 p.m. Cost: \$10 for all participants. Transportation is desired, lunch, field guide.

**FIELD TRIP 2:** Pennsylvanian Deltas in Ohio and northern West Virginia. Saturday, May 27. Host: Appalachian Geological Society  
Leader: ALAN C. DONALDSON, Department of Geology, West Virginia University, Morgantown, West Virginia  
Coordinator: MAI COLM H. O'BRIEN, Pennzoil United, Parkersburg, West Virginia

Outcrop exposures of Pennsylvanian-age sediments indicate lithogenic characteristics suggesting a complex of incandering rivers depositing their relatively large loads of clastic material in a shallow quiet inland sea or bay. Observed sediments are part of a composite of deltaic and marine sediments. Many classic forms of deltaic environment are recognized: lower delta plain, delta front, prodelta and bay. Constructive and destructive features of typical lobate delta sedimentation are illustrated.

Participants who have attended the convention will leave Columbus by bus at 4:00 p.m., Friday, May 26, for Steubenville, Ohio. A banquet will be held that evening at the Holiday Inn in Steubenville. The trip, by bus only, will begin at Steubenville at 8:00 a.m., Saturday, May 27, and will return there the same day at approximately 4:30 p.m. Return to Columbus will be by bus with arrival at approximately 7:30 p.m. Cost: \$25, includes transportation, banquet, lunch, and field guide.

## TECHNICAL PROGRAM SUMMARY

All sessions in Venus-Mars Room

### THURSDAY MORNING, MAY 25

President: JAMES A. NOEL, General Chairman

1. Introduction of new Eastern Section officers, 1972-1973  
Franklin R. Engler, Secretary-Treasurer  
Lee C. Lauer, Vice-President  
John T. Gally, President

8:30

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2. JAMES C. DONNELLY, II, President, Marathon Oil Co., Findlay, Ohio: Welcoming address

8:35

3. SHERMAN A. WENGERT, President, AAPG, Albuquerque, New Mexico: Remarks

8:45

4. JAMES E. WILSON, JR., President-elect, AAPG, Denver, Colorado: Remarks

8:50

5. VINCENT E. MCKELVEY, Director, U.S. Geological Survey, Washington, D.C.: Keynote address

8:55

### SYMPOSIUM ON INDUSTRY AND ENVIRONMENT

Presiding: DONALD J. NORLING, Ranney Water Systems, Galion, Ohio

1. LEWIS R. TUCKER: The potential impact of oil development on the ecology and environment of the middle Atlantic offshore area

9:20

2. J. R. JACKSON, JR.: The impact of environmental impact statements

9:45

3. GEORGE C. GROW, JR.: Recent exploratory activities and future potential--northeastern area

10:15

### SYMPOSIUM ON APPALACHIAN STRUCTURE

Presiding: ROBERT B. IRWIN, State Geologist, West Virginia Geological Survey; JOHN P. PATTON, State Geologist, Indiana Geological Survey

10:45

1. ANDREW GRISCOM: Structure in the northern Appalachians from aeromagnetic and gravity data

10:50

2. JOEL S. ATKINS: Tectonic framework of the southern Appalachians--evidence from gravity and magnetic data

11:20

### LUNCHEON BREAK

11:50

### THURSDAY AFTERNOON, MAY 25

### SYMPOSIUM ON APPALACHIAN STRUCTURE (continued)

Presiding: WALLACE W. HAGAN, State Geologist, Kentucky Geological Survey; LARRY D. WOODFORD, West Virginia Geological Survey

1:20

Moderator: JOHN RODGERS  
3. JOHN E. JOHNSTON: Remote sensing as a tool for interpreting structural geology in the Appalachians

1:25

4. GORDON L. WOOD, JR.: Tectonics of the Folded Appalachians of Pennsylvania as deduced from the anatexitic region

1:55

5. KENNETH J. ENGLUND: Central Appalachian tectonics as indicated by structural features in carbonaceous rocks

2:25

6. RALPH L. MILLER: Hydrocarbon accumulations in the Folded Appalachians of the south

2:55

7. SIGMUND SNEISON: Subsurface data bearing on the tectonic style of the Valley and Ridge Province

3:25

8. M. GORDON FREY: Influence of Salina salt on structure in the New York-Pennsylvania portion of the Appalachian Plateau

3:55

9. MICHAEL J. CLIFFORD: The role of Silurian salt

<b>In absence between deep and shallow structures in Ohio</b>	4:25	<b>11. Discussion of Appalachian stratigraphy and production.</b>	9
<b>10. Discussion of Appalachian structure. JOHN RODGERS, moderator</b>	4:55	<b>CLIFFTON HEATHCOTE</b>	2:50
		<b>JACK C. FLOYD, Department of Geology, Bowling Green State University, Bowling Green, Ohio</b>	3:20
		<b>ALAN C. DONALDSON, Department of Geology, West Virginia University, Morgantown, West Virginia</b>	
<b>SATURDAY, MAY 27</b>			
		<b>FIELD TRIPS</b>	
		<b>1. Silurian of northwestern Ohio. Leaders: CHARLES F. KAILEY and CLIFFTON HEATHCOTE, moderator</b>	
		<b>JACK C. FLOYD, Department of Geology, Bowling Green State University, Bowling Green, Ohio</b>	
		<b>2. Pennsylvania delta in Ohio and northern West Virginia. Leader: ALAN C. DONALDSON, Department of Geology, West Virginia University, Morgantown, West Virginia</b>	
<b>THURSDAY EVENING, MAY 25</b>			
<b>INFORMAL DISCUSSION SESSION (refreshments available)</b>	8:00		
<b>FRIDAY MORNING, MAY 26</b>			
<b>SYMPOSIUM ON APPALACHIAN STRATIGRAPHY AND PRODUCTION</b>	8:30		
<b>President: ROBERT H. ALEXANDER, Consulting Geologist, Columbus, Ohio; HORACE R. COLLINS, Chief, Ohio Division of Geological Survey</b>			
<b>Moderator: CLIFFTON HEATHCOTE, Consolidated Gas Supply Corporation, Clarksville, West Virginia</b>			
<b>1. ARTHUR M. VAN TINE: Stratigraphy and potential prospects of Devonian reefs in New York</b>	8:45		
<b>2. WALTER R. WAGNER: Growth faults in the Upper Cambrian and Lower Ordovician rocks of western Pennsylvania</b>	9:15		
<b>3. FREDERICK AN CHEN and LARRY D. WOODFORK: Lithologies of the Clifty and Chambersburg in the central Appalachians</b>	9:45		
<b>4. A. JANSENS and J. R. EBRIGHT: Stratigraphy and economic potential of Cambrian and Lower Or- devonian rocks in Ohio</b>	10:15		
<b>5. EDWARD N. WILSON: Stratigraphic framework of relatively unexplored section, Devonian to base- ment, in eastern Kentucky</b>	10:45		
<b>6. O. D. WEAVER: Predictions of future exploratory drills in the Appalachian Basin</b>	11:15		
<b>LUNCH-ON BREAK</b>	11:45		
<b>FRIDAY AFTERNOON, MAY 26</b>			
<b>SYMPOSIUM ON APPALACHIAN STRATIGRAPHY AND PRODUCTION (continued)</b>			
<b>President: RICHARD D. SOUTT, Blaze Oil and Gas, Inc., Wooster, Ohio; RICHARD A. STRICKLE, Ohio Division of Geological Survey</b>			
<b>Moderator: CLIFFTON HEATHCOTE</b>			
<b>7. RONALD J. BEARDS: Silurian geology of Lake Erie and associated gas production</b>	1:15		
<b>8. KENNETH J. McSOHLLA: Reciprocal deposition within Niagara and early Cayugan (Silurian) car- bonates and evaporites, northern Michigan Basin</b>	1:20		
<b>9. J. G. BILLMEIR and W. E. BILLMEIR: Economic potential of offshore oil and gas exploration in the United States portion of Lake Erie</b>	1:50		
<b>10. DAVID AS G. PATCHIN: Stratigraphy and petrog- raphy of the Upper Silurian Williamsport Sandstone,</b>	2:20		

## ABSTRACTS OF PAPERS

**BEARDS, RONALD J., Ontario Department of Mines, Ottawa, Canada**

**Silurian Geology of Lake Erie and Associated Gas Production**

No abstract available.

**BULMER, E. G., One-Ilio Gas & Oil, Inc., Irlington, Ontario, Canada, and BULLIER, W. E., Petroleum Consultant, Chabain, Ontario, Canada**

**Economic Potential of Offshore Oil and Gas Exploration in the United States Portion of Lake Erie**

This paper will attempt to establish the volume of crude oil and natural gas reserves which are economically recoverable from the areas underlying the United States portion of Lake Erie. Consideration will be given not only to those reserves which are economically significant at present market prices, but also to those which will become profitable as the price paid for both crude oil and natural gas in the eastern United States moves upward to levels comparable to those for oil and gas produced from alternative sources.

The availability of present and future markets for oil and gas produced locally, the history of exploration, development, and production in the Lake Erie area, and costs and problems related to offshore operations and production in Lake Erie are examined in detail. The reserves of crude oil and natural gas recoverable from each potentially productive formation are estimated and allocated by formation to the offshore area occupied by each state which owns mineral rights underlying Lake Erie.

From this investigation, conclusions are reached which indicate the volumes of crude oil and natural gas reserves which can be economically recovered both at present market prices and at anticipated increased prices in the future, which indicate the economic potential of offshore oil and gas exploration in the United States portion of Lake Erie, and which indicate the relative importance of these reserves to producers, processors, refiners and state governments. Finally, recommendations are made relevant to the present and/or future need to develop the anticipated offshore oil and gas resources which underlie Lake Erie and relevant to the need to re-evaluate the status of offshore drilling and exploration in the United States portion of the Great Lakes.

**CHEN, PING-FAR, and WOODFORK, LARRY D., West Virginia Geological Survey, Morgantown, West Virginia**

*Lithologies of the Chazy and Chambersburg in the Central Appalachians*

The post-Buckmantown and pre-Martinsburg rocks of the central Appalachians comprise numerous formations. For the purpose of regional stratigraphic analysis, these rocks can be subdivided into two major units, the Chazy Group at the bottom and the Chambersburg Group above.

The major deposited during Chazy time was located in central Pennsylvania. A medial high divided it into a shallower western portion and a more deeply subsiding east portion. Another broad deposencenter existed in central West Virginia. Areas surrounding that deposencenter received gradually varying amounts of sediments. With few exceptions the limestone facies of the Chazy covers the area southward of the local deposencenter in central West Virginia. Northwestward, dolomite and clastic facies occur, but limestone remains the most important lithology. Areas with higher clastic and dolomite ratios appear to be rather limited.

**During Chambersburg time, a deposencenter existed along the Appalachian Valley. Along that axis two separate deposencents existed in western Virginia. Maximum deposition occurred toward the southwest. An axis of thinning of the "the Adirondack axis") bordered the Appalachian Valley deposits to the west along its northern portion. However, this positive trend died out to the south and, therefore, the "Tazewell axis of thinning" appears to have been non-existent. A large broad deposencenter (Allegheny synclinum) also extended from central West Virginia into eastern Kentucky. Carbonates (almost all limestone) are the most important Chambersburg facies, but facies with higher clastic ratios occur in parts of the Appalachian Valley of Virginia, an isolated area in West Virginia, and a narrow belt in Ohio.**

**The Trenton Limestone has produced oil in the Blue Hill and Bear Hill fields in Lee County, Virginia. The Trenton-Black River limestone section has produced gas in numerous old fields in western New York. A number of gas shows have been reported from Middle Ordovician carbonates in West Virginia. Additional hydrocarbon reserves should be found in the Middle Ordovician carbonates of the central Appalachians. Areas of local dolomitization and fracture porosity related to structure are considered to be the most promising prospective areas.**

**CLIFFORD, MICHAEL J., Ohio Division of Geological Survey, Columbus, Ohio**

*The Role of Silurian Salt in Discordance between Deep and Shallow Structure in Ohio*

Interpretations of deep fore-Cayugan structure from either shallow structure or seismic information should include an evaluation of the different roles played by the Silurian Cayugan salt beds underlying the central portion of the Appalachian Basin. Four distinct types of salt involvement are identified in Ohio: thin-skinned thrusting along salt beds (southern Ohio), salt-flowage structure (Columbus County), solution-collapse structure (Ashland County), and diapire over pre-existing structure (Summit and Stark Counties). Explorationists should be aware of these effects to prospect profitably for deep pay in the Appalachian area.

**ENGELUND, KENNETH J., U.S. Geological Survey, Washington, D.C.**

*Central Appalachian Tectonics as Indicated by Structural Features in Carboniferous Rocks*

Regional structural features, including the hinge line on the west flank of the Appalachian basin, are reinterpreted on the basis of data assembled from recent geologic mapping and subsurface studies of Carboniferous rocks in eastern Kentucky and adjacent areas of West Virginia, Virginia, and Tennessee. The easterly trending Irvine-Paint Creek fault system has been recognized as a major feature affecting late Paleozoic sedimentation in this part of the basin. Except for slight stratigraphic thinning across a few of the associated anticlines, there is little evidence of hinge-line thickening at or near the fault system or of growth-fault development during the deposition of Carboniferous strata. Structural and stratigraphic features suggest that the Irvine-Paint Creek fault system is largely postdepositional and that hinge-line development actually occurred along the intersecting Wavyline arch. This feature was identified by Woodward in 1961 in lower Paleozoic rocks of Ohio and northeastern Kentucky, but the extent and thickness trends of Mississippian formations beneath the basal Pennsylvanian unconformity show that the flexure was also positive in late Paleozoic time. Distribution patterns of these formations indicate that

**12** The Waverly arch is more extensive than previously indicated, extends southward across eastern Kentucky into northern Tennessee, and approximately parallels the Cincinnati arch 50-60 miles to the west.

**FREY, M., GORDON, Chevron Oil Company, New Orleans, Louisiana**

*Influence of Salina Salt on Structure in the New York-Pennsylvania Portion of the Appalachian Plateau*

The Silurian salt serves as a decollement zone above which the younger sedimentary section is involved in a series of folds. The southeastern limb of each of these folds is generally oversteepened. Beds older than the Salina salt are apparently not involved in the folding, as evidenced by seismic data. A comparison of the folds in this area made with those in other areas underlain by bedded salt factors controlling salt-influenced structures include (1) thickness of salt layer, (2) manner of deposition of overburden, and (3) angle of slope of salt-sediment surface during deposition of overburden.

**GRIFFIN, ANDREW, U.S. Geological Survey, Menlo Park, California**

*Structure in the Northern Appalachians from Aeromagnetic and Gravity Data*

No abstract available.

**GROW, GEORGE C., JR., Transcoastal Gas Pipeline Corporation, Newark, New Jersey**

*Recent Exploratory Activities and Future Potential—Northeastern Area*

No abstract available.

**JACKSON, J. R., JR., Humble Oil and Refining Company, Houston, Texas**

*The Impact of Environmental Impact Statements*

No abstract available.

**JANSSENS, A., Ohio Division of Geological Survey, Columbus, Ohio, and E. BRIGGS, J. R., The East Ohio Gas Company, Cleveland, Ohio**

*Stratigraphy and Economic Potential of Cambrian and Lower Ordovician Rocks in Ohio*

Fine-grained to conglomeratic basal Mt. Simon Sandstone (0-350 ft) is overlain in western Ohio by fine-grained glauconitic Eau Claire Sandstone (200-600 ft) and in eastern Ohio by Rose Run and poorly sorted sandstone (190-750 ft). The Rose Run is overlain by the Conasauga Formation (10-400 ft), consisting of siltstone, sandstone, limestone, dolomite, and southward thickening prodelta shale. Eau Claire and Conasauga are overlain by a dolomitic sandstone (0-170 ft) derived from the north; in northeastern Ohio the equivalent rocks are dolomite and discontinuous sandstone. The Knox Dolomite (0-1200 ft) overlies these beds and in eastern Ohio includes the Rose Run sandstone (100-120 ft). Both Rose Run and dolomitic sandstone subcrop below the Knox unconformity as potential traps.

**Only one show (gas) has been recorded from the Mt. Simon. Younger sandstones (Rose, Conasauga, dolomitic, Rose Run, and unnamed sandstone in the Knox) are potential reservoirs where they have a structure or form stratigraphic traps (porosity pinches, facies boundaries, erosional knobs below the Knox unconformity). Gas and oil have been produced from the Knox from both structural and stratigraphic traps.**

**Prime exploration areas are north-central Ohio, where sediments were deposited close to the shoreline, and eastern Ohio, currently active, where secondary porosity below the Knox unconformity has created gas reservoirs.**

**JOHNSTON, JOHN E., U.S. Geological Survey, Washington, D.C.**

*Remote Sensing as a Tool for Interpreting Structural Geology in the Appalachians*

The science of remote sensing of the earth's surface with special cameras and other instruments that measure reflectance and/or emission of energy in the electromagnetic spectrum has had nearly exponential growth since the early 1940's. Since the mid-1950's scientists and engineers gradually have become aware of and interested in utilizing remote sensor technology in the natural sciences. This technology, developed principally from classified military projects, has been used only in unclassified civilian projects in natural sciences and earth resource fields during the past decade. Applications of remote sensing that have been advanced and tested include geologic use of cameras and Apollo satellite photography, Nimbus AVCS (advanced very high resolution camera system) and thermal infrared scanners data, as well as data from a number of aerial systems.

Remote sensor systems which have received attention in ecology and allied disciplines are: (1) black and white (B/W) photography (panchromatic and infrared); (2) color and color infrared (IR) photography; (3) multispectral scanner (MSS) images (from near-ultraviolet to far-infrared infrared); (4) side-looking radar (SLAR or SAR) images; and (7) passive microwave scanner (PMS) images. Several of these systems have been tested from aircraft and spacecraft over parts of the Appalachians and adjacent regions. Remote sensing image data, processed by various data extraction techniques, and used with ancillary data (ground observations, etc.) have provided useful information related to regional structures such as joint patterns, drainage patterns, fault traces, and rock types.

The application of geological remote sensing is in its infancy, however, and these tests are not meant to imply that remote sensing is or will be a panacea for all the problems of Appalachian structural geology, but surely a combination of selected sensing systems can provide additional information for a well-balanced scientific approach to the problems of the Appalachians. Remote sensors provide synoptic views of large areas and of conditions that cannot be perceived either by the unaided eye or by field observations. These include surface distributions of heat, moisture, open water, and vegetative vigor differences, all of which are useful to the geologist.

**MESOLELLA, KENNETH J., Amoco Production Company, Houston, Texas**

*Reciprocal Deposition within Niagaran and Early Cayugan (Silurian) Carbonates and Evaporites, Northern Michigan Basin*

**Time-stratigraphic relationships within Silurian strata of the northern Michigan Basin provide a model for reciprocal deposition of carbonates and evaporites. The Niagaran of the basin interior consists of crinoidal hematite**

**12** The Waverly arch is more extensive than previously indicated, extends southward across eastern Kentucky into northern Tennessee, and approximately parallels the Cincinnati arch 50-60 miles to the west.

**HARRY M. GORDON**, Chevron Oil Company, New Orleans, Louisiana  
*Influence of Salina Salt on Structure in the New York-Pennsylvania Portion of the Appalachian Plateau*

The Silurian salt serves as a decollement zone above which the younger sedimentary section is involved in a series of folds. The southeastern limb of each of these folds is generally oversteepened. Beds older than the Salina salt are apparently not involved in the folding as evidenced by seismic data. A comparison of the folds in this area is made with those in other areas underlain by bedded salt. Factors controlling salt-influenced structures include (1) thickness of salt layer, (2) manner of deposition of overburden, and (3) angle of slope of salt-climent surface during deposition of overburden.

**GRISSOM, ANDREW U.S. Geological Survey, Menlo Park, California**  
*Structure in the Northern Appalachians from Aeromagnetic and Gravity Data*

No abstract available.

**GROW, GEORGE C., JR., Transcontinental Gas Pipeline Corporation, Newark, New Jersey**  
*Recent Exploratory Activities and Future Potential-Northeastern Area*

No abstract available.

**JACKSON, J. R., Humble Oil and Refining Company, Houston, Texas**  
*The Impact of Environmental Impact Statements*

No abstract available.

**JANSSENS, A., Ohio Division of Geological Survey, Columbus, Ohio, and KIRKBRIDGTON, J. R., The East Ohio Gas Company, Cleveland, Ohio**  
*Stratigraphy and Economic Potential of Cambrian and Lower Ordovician Rocks in Ohio*

Fine-grained to conglomeratic basal Mt. Simon Sandstone (0-350 ft) is overlain in western Ohio by fine-grained glauconitic Eau Claire Sandstone (200-600 ft) and in eastern Ohio by Rose Run dolomite and poorly sorted sandstone (170-250 ft). The Rose is overlain by the Conasauga Formation (40-400 ft), consisting of limestone, sandstone, dolomite, and southward thickening prodelta shale. Eau Claire and Conasauga are overlain by a deltaic sandstone (0-70 ft) derived from the north, in northeastern Ohio the equivalent rocks are dolomite and discontinuous sandstone. The Knox Dolomite (0-1200 ft) overlies these beds and in eastern Ohio includes the Rose Run sandstone (100-120 ft). Both Rose Run and dolomite sandstone occur below the Knox unconformably as potential traps.

Only one show (gas) has been recorded from the Mt. Simon. Younger sandstones (Rose, Conasauga, deltaic, Rose Run, and unnamed sandstone in the Knox) are potential reservoirs where they have structure or form stratigraphic traps (porosity pinches, facies boundaries, erosional highs below the Knox unconformity). Gas and oil have been produced from the Knox from both structural and stratigraphic traps.

Prominent exploration areas are north-central Ohio, where sediments were deposited close to the shoreline, and eastern Ohio, currently active, where secondary porosity below the Knox unconformity has created gas reservoirs.

**JOHNSTON, JOHN E., U.S. Geological Survey, Washington, D.C.**

*Remote Sensing as a Tool for Interpreting Structural Geology in the Appalachians*

The science of remote sensing of the earth's surface with special cameras and other instruments that measure reflectance and/or emission of energy in the electromagnetic spectrum has had nearly exponential growth since the early 1940's. Since the mid-1950's scientists and engineers gradually have become aware of and interested in utilizing remote sensor technology in the natural sciences. This technology, developed principally from classified military projects, has been used only in unclassified civilian projects in natural sciences and earth resource fields during the past decade. Applications of remote sensing that have been advanced and tested include geologic use of Gemini and Apollo satellite photography, Nimbus AVCS (advanced vidicon camera system) and thermal infrared scanner data, as well as data from number of aerial systems.

Remote sensor systems which have received attention in geology and allied disciplines are: (1) black and white (B/W) photography (panchromatic and infrared), (2) color and color infrared (IR) photography, (3) multiband (MTI) photography, (4) thermal infrared (TIR) scanner images, (5) multispectral scanner (MSS) images (from near-ultraviolet to far-infrared), (6) side-looking radar (SLR or SAR) images, and (7) passive microwave scanner (PMS) images. Several of these systems have been tested from aircraft and spacecraft over parts of the Appalachians and adjacent regions. Remote sensing images, data, processed by various data extraction techniques, and used with ancillary data (ground observations, etc.) have provided useful information related to regional structures such as joint patterns, drainage patterns, fault traces, and rock types.

The application of geological remote sensing is in its infancy, however, and these tests are not meant to imply that remote sensing is or will be a panacea for all the problems of Appalachian structural geology. But surely a combination of selected sensing systems can provide additional information for a well-balanced scientific approach to the problems of the Appalachians. Remote sensors provide synoptic views of large areas and of conditions that cannot be perceived either by the unaided eye or by field observations. These include surface distributions of heat, moisture, open water, and vegetative vigor differences, all of which are useful to the geologist.

**MISOLELLA, KENNETH J., Amoco Production Company, Houston, Texas**

*Reciprocal Deposition within Niagaran and Early Cayugan (Silurian) Carbonates and Evaporites, Northern Michigan Basin*

Time-stratigraphic relationships within Silurian strata of the northern Michigan Basin provide a model for reciprocal deposition of carbonates and evaporites. The Niagaran of the basin interior consists of clinoformal hemispherical

bionomics. Toward the basin margin the bimimetic barrier and loose their bimimetic character. A belt of pinnacle reefs marks the approach to the basin margin. The Niagara pinnacle reefs have a lower crinoidal zone and an upper coral-algal zone. At the basin margin the Niagara thickens rapidly into a dolomitized barrier reef complex. The barrier reefs were constructed mainly by corals and massive stromatoporoids which prograded basinward over thick skeletal forereef carbonates.

Niagara barrier and pinnacle reef construction was halted in the early Cayuan by an episode of evaporative deposition. Karst features within Niagara carbonates suggest subsurface exposure of the barrier and pinnacle reefs at this time during a period of lowered sea level. Return of high sea level caused cessation of evaporative deposition and rejuvenation of the pinnacle reefs; also, finger reefs developed along the margin of the former barrier reef trend. However, the renewed reef development was of a considerably different biotic character. These early Cayuan reefs possess a lower massive encrusting algal zone and an upper luminescent stromatoporoid-stromatoporite zone. Corals are notably absent. Reef development again was halted by evaporative deposition followed by another episode of carbonate deposition generally devoid of reef rejuvenation.

RALPH L., U.S. Geological Survey, Washington, D.C.

#### *Hydrocarbon Accumulations in the Folded Appalachians of the South*

In the Folded Appalachians of the south most of the petroleum interest and all of the oil and gas production have been within or close to a unique structural feature, the Cumberland Overthrust block. This large mass includes parts of Virginia, Kentucky, and Tennessee. Displacement of the block to the northwest is about 11 miles along its southwest edge in Tennessee and about 4 miles along its northeast edge in Virginia. Rocks of all systems from Cambrian to Pennsylvanian are involved, totalling approximately 20,000 feet in thickness. Oil has been produced from rocks of Ordovician age and gas from rocks of Devonian and Mississippian ages. Other targets exist.

Two reasons are adduced to account for the fact that hydrocarbon accumulations persist in rocks subjected to such extensive displacement. First, gravity sliding earlier than tectonic lateral slides seems best to explain the structural relations from surface to basement. Thus, the "overthrust" rocks were under little if any more compressional stress during faulting than before it, and they have not been compacted, recrystallized, or cemented to an extent precluding effective porosity. Second, the Pine Mountain Fault, which underlies the block, is a bedding plane fault throughout most of its extent, but locally it crops upward from one weak zone to another. Four weak zones that favored localization of the fault plane are known. Only at and northwest of the camps are older rocks piled on younger, resulting in abrupt thickening of the sedimentary section. Representative structure sections across the block will be presented.

PATCILL, DOUGLAS G., West Virginia Geological Survey, Morgantown,  
West Virginia

#### *Stratigraphy and Petrography of the Upper Silurian Williamsport Sandstone, West Virginia*

The Upper Silurian Williamsport Sandstone at the type section in Grant County, West Virginia, is typically composed of very fine-grained green and brown sandstone with some siltstone and shale. A local carbonate member, the Cedar Cliff Limestone, is present in the middle of the formation in nearby

outcrops in western Maryland. To the north in Pennsylvania, the Williamsport can be traced into the Moyer Ridge Sandstone, which is a member of the Bloomsburg Formation. Eastward, in the eastern Pennsylvania and Maryland border, the Williamsport pinches out in the middle of the nonmarine red Bloomsburg facies. Farther south the Williamsport undergoes a facies change into clean well-sorted marine sandstone. The subsurface continuation of this sandstone extends to the Ohio border, where it has recently been found to be an important reservoir for natural gas.

Sandstones of the Williamsport in the subsurface are very fine to fine grained, subrounded to rounded, well sorted, and texturally mature and immature. In general, sandstone is most abundant in the upper half of the unit, whereas carbonates become intercalated with sandstone layers in the lower half. Syndiotactic quartz overgrowths serve as the primary cement in the upper part of the formation, but dolomite becomes important lower in the section. Gypsum, anhydrite, and halite are minor cements. Intergranular porosity is greatest near the top of the formation.

The immature sandstones and siltstones of the Williamsport in northeastern West Virginia probably were deposited on low-energy mud flats in front of the Bloomsburg Delta. Sediments were supplied by rivers from source lands farther east in Pennsylvania. The limestone and hematitic beds of the Cedar Cliff Limestone are interpreted as having been deposited in a lagoon associated with this tidal flat. Farther south, the clastic, coarser, more mature sandstones were deposited in a barrier island-coastal complex. Regression of the shoreline spread a blanket of sand over the underlying subtidal to intertidal McKeenzie Formation. As the shoreline and barrier island complex regressed westward the lagunal sediments of the Wills Creek Formation were superposed on the clean sand of the Williamsport.

Gas accumulation in the Williamsport is due to a combination of stratigraphic and structural trapping. Salt water is present downdip in all fields, and up-dip porosity and permeability decrease where the sandstone thins westward. Gas flows in this formation are the greatest recorded in the Appalachian basin, making the Williamsport the most important deep target for drillers in West Virginia. Future exploration should examine the possibility that continuation stratigraphic and structural traps exist near the eastern edge of the sand body in central West Virginia and near the southwestern sandstone pinchout in south-central West Virginia.

SNEILSON, SIGMUND, Shell Development Company, Midland, Texas

#### *Subsurface Data Bearing on the Tectonic Style of the Valley and Ridge Province*

Selected seismic lines and well data in the Valley and Ridge Province between the Anthracite Region, Pennsylvania, and the Pine Mountain Region, Virginia-Kentucky, support the hypothesis that the region is characterized by a thin-skinned style of deformation.

TUCKER, LEWIS R., Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York

#### *The Potential Impact of Oil Development on the Ecology and Environment of the Middle Atlantic Offshore Area*

A story is made of the calculable impact of oil drilling and exploitation on the environment in the mid-Atlantic offshore area. The approach taken is that of a factual study, not one based on biased concepts. First the relationship of oil pollution to the overall pollution problem is considered; then the possible

direct consequences of oil drilling and exploitation itself. Examples are taken from actual known oil pollution occurrences, both natural and manmade. The pollution from natural means is shown to have very little impact on ecology. The record also shows that manmade pollution caused by drilling and exploitation in marine areas is, except in local areas, both short lived and not very persistent.

The loss of oil through transport petroleum or petroleum products produces effects as large as or larger than any exploitation effects; these effects will increase as larger quantities of oil are exploited, though they can be lessened by strict enforceable rules.

As a conclusion the idea is expressed that all interested groups must work together to lessen any possible adverse effects upon the entire economy; they must not take opposite polarized attitudes.

VAN TYNE, ARTHUR M., New York Geological Survey, Albany, New York  
*Sedimentology and Potential Prospects of Devonian Reefs of New York*

Reefs are found in the outcrop sections of several Lower and Middle Devonian units in New York State. The most prominent of these occurs in the Edgecliff Member of the Onondaga Limestone Formation.

The Onondaga Limestone was first described and named by James Hall of the New York Geological Survey in 1839. The present fourfold division of the Onondaga, in descending order, Seneca, Monckhouse, Nedlow, and Edgecliff, was proposed by Oliver in the early 1950's. This type section is located in Oneida County, New York. In the subsurface the uppermost Seneca Member is a massive limestone and can only be separated from the similar underlying Monckhouse Member by the presence of the Tioga bentonite bed, which gives a characteristic peak on the gamma ray log.

The Seneca is absent in the central-southern part of New York, where a pronounced thinning of the Onondaga occurs. The Monckhouse is a massive cherty limestone and is also missing in the extreme central-southern part of New York in the above-mentioned area of thinning. The Nedlow is a shaly cherty limestone and is persistent throughout the state and in the area of thinning, except over known subsurface reefs in the underlying Edgecliff.

The lowermost Onondaga member, the Edgecliff, is a coarse-grained lithology to grayish-white biostromal limestone in an area from northeast-southwestward through central New York.

In eastern and southeastern New York this unit is represented by an argillaceous facies, whereas in western New York it is a highly cherty facies. The Edgecliff shows a pronounced thinning in the central and southern portions of New York and in north-central Pennsylvania, where it is mostly 10 feet or less in thickness. In the southwestern portion of this thin area three subsurface reefs of Edgecliff age, all 120 to 200 feet thick and containing gas, have been discovered since 1967. At least 21 smaller reefs are known in the outcrop section of this member in eastern New York, one in central New York and two in the Buffalo area. The reefs were found in a clear-water shallow subtidal environment on the Edgecliff platform.

Biostromal facies and reefs are also present on the outcrop in several zones in the Middle Devonian Hamilton Formation, which overlies the Onondaga. Most important of these zones are in the Ludlowville Member of the Hamilton in the Syracuse area of central New York. Two of these zones, the Jochua and Steghorn Point, occur over an area of 40 and 120 square miles, respectively, according to Oliver. No reef buildup in these zones has been encountered in drilling as yet, but no systematic search has been made for diatom in the subsurface.

Several smaller reefs are known from outcrops of the Helderberg Formation of the Helderberg Group in central New York and northwesten New Jersey.

WAGNER, W. R., Pennsylvania Geological Survey, Pittsburgh, Pennsylvania  
*Growth Faults in the Upper Cambrian and Lower Ordovician Rocks of Western Pennsylvania*

The Upper Cambrian Gatesburg formation of northwestern Pennsylvania (Frie, Crawford, Mercer Counties) is almost 1,000 feet thick and consists of calcareous sandy dolomite, two 100- to 150-foot thick sandstone units, previously called Upper Sandy and Lower Sandy Members (Wagner, 1966), occur at the top and middle of the formation. One hundred twenty-five miles to the southeast a outcrop in central Pennsylvania, the Gatesburg is 1,500 feet thick and is similar in lithology to the northwestern Pennsylvania strata. Recent drilling between these two areas indicates that the Gatesburg thickens to over 1,900 feet and is of different lithology in the intermediate area. The two sandstone units of northwestern Pennsylvania are replaced by dolomitic, a sandstone body, 200 to 350 feet thick, occurs stratigraphically below the position of the sandstone units of northwestern Pennsylvania. Apparently no strata represent this thick sandstone in northwestern Pennsylvania. The additional thickening and the different lithology of the Gatesburg strata in this intermediate area are the result of deposition in a northeast-trending basin whose western edge is interpreted to be a growth fault.

Lower Ordovician (Brockwayton) dolomites and limestones thicken from zero in northwestern Pennsylvania to over 3,500 feet in central Pennsylvania.

The thickening also results from a growth fault which trends northeast and lies east of the fault in the Upper Cambrian rocks.

WALKINS, JOEL S., Department of Geology, University of North Carolina, Chapel Hill, North Carolina  
*Tectonic Framework of the Southern Appalachians—Evidence from Gravity and Magnetic Data*

A plate tectonics model comprised of three major subduction zones explains many major geological anomalies and geological structures observed in the southern Appalachians. The Brevard zone is thought to mark the southeastern boundary of a major Caledonian subduction zone. Many thrust faults of the Blue Ridge and eastern Smoky Mountains are thought to root in this zone. A subduction zone extending along the western margin of the Blue Ridge in Virginia and Smoky Mountains in Tennessee is thought to be an extension of the Brevard zone. A minimum of 55 km crustal shortening has been calculated for the Brevard zone in western North Carolina. Minor subduction occurred along the Blue Ridge-Smoky Mountain zone during the Hercynian orogeny. The main focus of the Hercynian subduction is thought to have been the Knoxville zone, so named because the basement subcrop of the zone passes beneath Knoxville, Tennessee. Most thrust faults along the Cumberland Plateau-Valley and Ridge boundary are thought to root in this zone. The amount of subduction seems to have been less than that of the Caledonian orogeny. Each inferred subduction zone coincides with northeast-southwest linear gravity lows and parallel discontinuities in the magnetic field. Basement anticlines occur northwest of the Ureard and Knoxville zones.

SECOND ANNUAL MEETING  
ATLANTIC CITY, NEW JERSEY  
1973

SECOND ANNUAL MEETING  
ATLANTIC CITY, NEW JERSEY  
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The second annual meeting of the Eastern Section was held in the Chalfonte-Haddon Hall Hotel, Atlantic City, New Jersey, April 23-25, 1973. The theme for this meeting was titled "East Coast Offshore Symposium from Baffin Bay to the Bahamas". The Petroleum Exploration Society of New York was the host society for the meeting and Mr. George C. Grow, Jr., was the General Chairman. Mr. Robert L. Fuchs was President of the host society.

The Petroleum Exploration Society of New York gave the Eastern Section \$500.00 of the profits from the meeting.

There were 408 registered for the meeting.

Selected papers from this meeting were published in a "Special AAPG Foundation Issue" dated June, 1974.

Attached are the minutes and a copy of the program for the Atlantic City meeting.



# The American Association of Petroleum Geologists

Minutes of the Annual Business Meeting

of the

Eastern Section

of the

The American Association of Petroleum Geologists

Atlantic City, New Jersey

April 24, 1973

Chalfonte-Haddon Hall Hotel

Minutes  
Annual Business Meeting  
Eastern Section  
The American Association of Petroleum Geologists  
Atlantic City, New Jersey - April 24, 1973

The meeting was called to order at 1:30 p.m. by Eastern Section President Gordon Wood. The following delegates were in attendance:

J. E. Wilson, AAPG - Denver, Colorado  
Edward E. Rue, Consultant - Mt. Vernon, Illinois  
Porter J. Brown, Columbia Gas System - Charleston, W. Va.  
John F. Partridge, Consultant - Casper, Wyoming  
Fred Dix, AAPG - Tulsa, Oklahoma  
Harry H. Emmerich, Mobil - Pet. Expl. Society of N.Y. - New York  
J. R. Ebright, East Ohio Gas Co. - Cleveland, Ohio  
R. J. Bernhagen, Ohio Dept. Natural Resources - Columbus, Ohio  
James A. Noel, Wright State University - Dayton, Ohio  
Lee C. Lamar, Pet. Expl. Society of N.Y. - Colts Neck, N.J.  
Franklyn R. Engler, Pittsburgh Geol. Society - Pittsburgh, Pa.  
Patrick J. Burns, Appalachian Geol. Society - Parkersburg, W. Va.  
Gordon H. Wood, Jr., Geol. Society of Washington - Washington, D.C.  
Wallace DeWitt, Jr., Geol. Society of Washington - Washington, D.C.  
Kenneth J. Englund, Geol. Society of Washington - Bethesda, Md.  
Donald A. Parks, Pet. Expl. Society of N.Y. - New York City  
John T. Galey, Pittsburgh Geol. Society - Somerset, Pa.  
J. D. Tompkins, Candidate V-P AAPG - Abilene, Texas  
David A. Bench, AAPG - Tulsa, Oklahoma  
Harry Schimmel, Pet. Expl. Society of N.Y. - New York City  
Thomas Fitzgerald, Pet. Expl. Society of N.Y. - New York City  
G. R. Schoonmaker, Marathon Oil - Finley, Ohio  
Herbert Davis, AAPG - Oklahoma City, Oklahoma  
Maxine Phillips, AAPG - Tulsa, Oklahoma

President Wood reported that his activities during the year representing the Eastern Section that he had attended as many of the Member Society meetings as possible. The volume of correspondence concerning the Eastern Section business, particularly with the AAPG Headquarters in Tulsa, demanded most of his attention. The newly formed Georgia Geological Society had been invited to join the Eastern Section, however, no reply had been received from them to date. President Wood commented on the lack of response from the member societies in general.

Vice President Ebright reported that the Pittsburgh and Michigan Basin Societies had offered to host the 1974 and 1975 Section meetings respectively in response to his inquiries. The 1977 meeting will be held in conjunction with the National Convention in Washington, D.C. Several societies are considering hosting the 1976 meeting on a cooperative basis. Vice President Ebright further stated that both the Pittsburgh and Michigan Basin Societies have stipulated in their agreement to host the Sectional meetings that the Section provide "seed money".

Vice President Ebright, as chairman of the By-laws Committee, which was composed of John Mason and Pat Burns, distributed copies of the proposed By-laws for the delegate consideration. President Wood instructed the delegates to study the By-laws in conjunction with the Constitution and consult with their respective societies concerning the proposed By-laws.

Secretary-Treasurer Burns reported that the Ohio Geological Society, which hosted the first Eastern Section meeting in 1972, had realized a gross income of \$12,198.50 with expenses of \$9,385.75 for a net profit of \$2,812.75 which had been turned over to the Eastern Section treasury. The loan of \$1,500 each from the Columbia Gas Corporation and the Consolidated Gas Supply Corporation has been repaid.

The legal firm in Pittsburgh, engaged by John Galey to handle the income tax filing for the Eastern Section, judged it to be expedient for the Section to pay \$619.00 in income taxes which the firm has paid on behalf of the Section. Although the Section is a non-profit organization and the tax payment will be refunded upon the proper filing by the Section, the payment was necessary because of the unavoidable delays in billings to the Ohio Society

for some of the expenses incurred for the first Eastern Section meeting. Therefore, there was insufficient time for the non-profit status filings prior to the tax due date. The motion by Rue, seconded by DeWitt, to reemburse the legal firm for the \$610.00, pay the legal fees and file for the refund was passed.

The nominating committee Chairman, James Noel, reported the nominees for the 1973-74 year to be:

President - Donald A. Parks, of the Petroleum Exploration Society of New York

Vice President - James H. Fisher, of the Michigan Basin Geological Society

Secretary-Treasurer - Porter J. Brown, of the Appalachian Geological Society

President Wood suggested that consideration should be given in choosing Section officers that the Eastern Section president should be a member of the host Society for the Eastern Section meeting during his term of office. Motion to elect the nominees by acclamation was made by John Daley, seconded by Frank Engler and passed by unanimous vote.

John Galey discussed the tentative plans of the Pittsburgh Geological Society for hosting the Eastern Section meeting in 1974 with the tentative dates as April 18-19 and a field trip to be held on the 20th and 21st. The tentative theme for the meeting under consideration is "Energy Resources of the Appalachian Basin". Motion by Ed Rue, seconded by Harry Emmerich to confirm the Pittsburgh and Michigan Basin Geological Societies as hosts for the 1974 and 1975 meetings respectively and to supply "seed" money was passed.

Discussion concerning distribution of profits from the Section meetings brought several suggestions ranging from donating all of profit to the Eastern Section treasury, or to the AAPG Foundation

or a percentage split between the Section and the host Society or Societies. President Wood commented on the necessity of the Section to be financially capable of "seeding" at least two annual meetings or maintain a suggested treasury of approximately \$5,000.00. President Wood suggested that President-elect Parks appoint an ad hoc committee to study the financial needs of the Section and a policy proposal for handling the funds of the annual Section meetings. Vice President Ebright was directed to notify the Michigan Basin Society that they had been approved for hosting the 1975 meeting and John Galey was instructed to notify the Pittsburgh Geological Society of their approval as host Society of the 1974 meeting.

The By-law committee was reactivated by the appointment of John Mason, chairman, Ed Rue and Pat Burns as members; additional members will be appointed from the Kentucky and Indiana Societies.

President Wood authorized President-elect Parks to conduct an Eastern Section business meeting in Anaheim, California at the National Convention.

It was moved by Parks, seconded by DeWitt that the bank account remain in the Pittsburgh Bank and that John Galey and Secretary-Treasurer-elect, Porter J. Brown, be authorized to sign checks as "either/or". Any unusual disbursement of funds should be authorized by the president in writing to the Society treasurer. Motion passed.

President Wood remarked that due to the withdrawal of the National Science Foundation of funds for the American Geological Institute the House of Delegates meeting at the annual convention

in Anaheim, California would be presented with proposals for the AAPG to shoulder a heavier burden in funding and guiding the AGI. He strongly suggested that all delegates examine the issues and possibilities with their respective societies and receive detailed instructions prior to the Anaheim meeting.

Meeting adjourned.

Respectfully submitted:

Secretary-Treasurer  
Patrick J. Burns

APRIL 23-25, 1973

TECHNICAL PROGRAM



EAST COAST  
OFFSHORE SYMPOSIUM

Baffin Bay to the Bahamas

Challone-Haddon Hall Hotel

Atlantic City

New Jersey

April 23-25, 1973

Sponsored by  
**Easton Section of AAPG**  
Host  
**Petroleum Exploration Society of New York**  
affiliated organizations of the  
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## EAST COAST

### OFFSHORE SYMPOSIUM

Challotte Haddon Hall Hotel

Atlantic City

New Jersey

April 23-25, 1973

**General Information:** The Eastern Section of AAPG and the Petroleum Exploration Society of New York present, "East Coast Offshore Symposium-Bathia Bay to the Bahamas", which will deal with the regional geology of the east coast of North America according to our present understanding.

Registration 12:00 noon to 6:00 pm on Monday, April 23rd, and 8:00 am to 4:00 pm on Tuesday, April 24th in the foyer of the Pennsylvania Room, Haddon Hall Hotel. All Symposium events will be in the Haddon Hall Hotel. Registration fee \$15.00 for each registrant.

**Welcome:** The welcome party will be a cash bar social hour held from 6:30 pm to 8:00 pm on Monday April 23 in the Vernon Room, Haddon Hall Hotel.

**Speakers Breakfast:** There will be an opportunity for speakers and session Chairman for the day to meet for a complimentary breakfast and briefings each morning from 7:15 to 8:45 am in the Derbyshire Room.

**Eastern Section Luncheon:** A Dutch Treat Eastern Section Luncheon (by invitation) for Officers and Delegates, will be in the Derbyshire Room from 12:15 pm to 1:30 pm on Tuesday, April 24, 1973.

**Informal Evening Technical Session:** In order to provide adequate discussion and presentations not included in the formal program, an informal evening session will be held from 7:30 pm to 9:30 pm on Tuesday, April 24 in the Pennsylvania Room.

Publication of AAPG expects to publish papers delivered at this meeting in a special volume.

#### East Coast Offshore Symposium Committee:

General Chairman

George C. Grow, Jr.

Transoceanic Pipe Line Corp., Newark, N. J.

Program Chairman

William T. Schreiber

Kobil Oil Corp., New York, N. Y.

Asst. Treasurer

Robert E. Geiger

Mobil Oil Corp., New York, N. Y.

Printing

Donald A. Parks

Shaw's & Co., New York, N. Y.

Publicity & Press Relations

Hugh Hay, Inc.

Belico Petroleum Corp., New York, N. Y.

Registration

John R. Connolly, Michael B. Clark

B. P. Alisita, New York, N. Y.

Technical Services

David A. Fontaine

Rutgers University (Newark), Newark, N. J.

#### MONDAY P.M., APRIL 23, 1973

##### Registration

Foyer, Pennsylvania Room

##### Welcoming Reception

Vernon Room

#### TUESDAY A.M., APRIL 24, 1973

##### Speakers Breakfast

Derbyshire Room

##### Registration

Foyer, Pennsylvania Room

##### Technical Session

Pennsylvania Room

##### Introductory Remarks:

George C. Grow, Jr., General Chairman, Symposium Committee

Gordon H. Wood, President, Eastern Section of AAPG

James E. Wilson, President, American Association of Petroleum Geologists

Chairman: J. E. Wilson, Shell Oil Company, Denver, Colorado.

Keynote Address: Canadian Offshore Mineral Resource Dr. D. G. Crosby, Director, Resource Management & Conservation Branch, Department of Energy, Mines & Resources, Ottawa, Ontario.

1. Structural Framework of the Continental Margin of Eastern North America:  
M. A. Mapaev, New York University, New York, New York

A reference surface is defined as the top of some layers of rock, continuation of the surface for a series of basins, depressions, and embayments, which have continental, marine, and other features distributed over the basin. The continental margin of the Atlantic Ocean is bounded by the continental shelf, the continental slope, the continental rise, and the abyssal plain. The continental shelf is about 5.6 km. wide. High sediments are bounded with relatively thin, shallow limestone facies in some areas along areas of the inner shelf. Lower carbonaceous carbonates in the Bahamas block area, and very possibly farther north, have vertical facies, and oblique, undulating crumpled bedded facies. The continental slope and the continental rise are characterized by the presence of large, irregular blocks of older rocks, and the abyssal plain is covered with a thin layer of clayey limestone facies. The continental margin of the continental shelf and the continental slope has relatively smooth topography. Few measurements are in the range of normal topography, including wave, tidal, and current measurements, and about 2% of the ocean bottom.

In a broad sense, the "Scandinavian arch" is a belt of high land which extends from the British Isles through Scandinavia, across the Baltic Sea, and along the southern coast of Russia. In a narrower sense, however, the term "Scandinavian arch" is applied to the high land which lies between the "Caledonian fold belt" to the west and the "Baltic fold belt" to the east. The latter is the continuation of the "secondary arch" belt which extends from the British Isles through Scandinavia, across the Baltic Sea, and along the southern coast of Russia.

TUESDAY, P.M., APRIL 24, 1973

**Chairman:** R. L. Fuchs, Geosystems Corporation, New York, N.Y.  
**2:00 p.m.** **Pennsylvania Room**

Technical Session

**Chairman:** R. L. Fuchs, Geosystems Corporation, New York, N.Y.  
**2:00 p.m.** **Pennsylvania Room**

L. Grand Banks Regional Geology

W. G. Aylton, D. E. Burnie, J. H. Smith, and H. R. Williamson, Offshore Exploration Staff, Amoco Canada; Petroleum Ltd., Calgary, Alberta; and D. B. Harrison, J. F. Scandola, D. C. Waudett, and R. A. F. Wilkison, Petro-Canada, Calgary.

22. *Malabar Bay:*

C. E. Kerin, and D. J. Ross, Atlantic Geoscience Centre, Bedford Institute, Dartmouth, Nova Scotia; M. Luck, Keenest, Keenest, Lantau, Calgary, Alberta, and M. J. Kerin, Department of Geology, Dalhousie University, Halifax, Nova Scotia.

Halifax has a cool oceanic climate. This has been shown by selected temperature studies. In the central part of the city, temperatures average 10 °C, ranging from 2 °C in late October to about 14 °C in July. The mean annual air temperature is 10.5 °C. A large amount of precipitation falls in the city, about 1,400 mm annually. The mean annual snowfall is 100 cm. The mean annual wind speed is 10 km/h. There is a marked seasonal variation in wind speeds, with a maximum in winter and a minimum in summer. The mean annual relative humidity is 75%. The mean annual solar radiation is 1,100 MJ/m<sup>2</sup>. The mean annual atmospheric pressure is 1013 hPa. The mean annual atmospheric temperature is 10.5 °C. The mean annual atmospheric humidity is 75%. The mean annual atmospheric pressure is 1013 hPa.

### **A. Ecology of Labrador Shearwater:** Nesting Association of Goodall, Gullion

**GAY, ALBERT** *Albertine Company of Canada*, &c. 00  
The area he made the steep and continental slope of eastern Canada a home in north latitude, 54° and 67°. Waterfalls range on the average between 100 feet and 200 feet. Some of the falls are as much as 1,000 feet in height.

spaces, policies and procedures for local foundations. The foundation for future local strategic work has been established.

### Palyнологical Analyses of Mesozoic—Cenozoic Sediments of the Grand Banks of Newfoundland:

W. W. Abbott, Geological Survey of Canada, Calgary, Alberta and G. L. Williams, Geological Survey of Canada, Dartmouth, Nova Scotia

Sediment Budgets on Lake Winnipesaukee 305

The Grand Banks of Newfoundland, situated in 30°S. on the continental shelf, are the site of shallow corals, which have been collected by Mr. J. W. Goodall. Palaeontological analyses of 100 samples from nine localities, mostly corals, were made by Dr. G. E. R. Williams, and the following species were recorded:

**Telemetry section.** These "telemeters" are designed on the spot, pulled out and/or modified here and elsewhere, associated with the development of his

Ecology and paleoecology can be reconstructed in part from the rock assemblage. All sediments were composed of loamy

one of the concholepas (Banks 10) and are of marine origin. The stratigraphic interval from Penry's Lagoon to the Adair includes two well-known intervals of the Shabotah series. These were not correlated in any of the Shabotah tests. The oldest bank (Cretaceous sediments of Lake Alib) is of continental origin. The Cretaceous transgression marked the onset of erosion in this position which was relatively continuous throughout the Lake O-



an early date at the port of Atlanta, on many of the early railroads, and in the state of Maine, where the first railroad was built in 1831. At the same time, the first steamship on the Tennessee River, a steamer named "The Atlantic," was built in Mobile, Alabama. In 1835, the first steamship on the Gulf of Mexico, built by George Steers, a man from New Bedford, Massachusetts, was built in Mobile. This ship, the "Alabama," was the first vessel to sail around the southern tip of Florida, and the first to cross the Atlantic Ocean. The "Alabama" was the first vessel to sail around the southern tip of Florida, and the first to cross the Atlantic Ocean.

### 3. Geology of the Georges Bank Basin

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**Technical Session** Pennsylvania Room  
 2:00 P.M.  
**Chairman:** Gordon H. Wood, United States Geological Survey, Washington, D.C.  
**Prominent Geological Report on the U.S. Northern Atlantic Continental Margin:**  
*J. P. Minelli, W. J. Ryan, E. A. Weed, E. I. Riddon, B. H. Allin, and F. C. Rhodesland, U.S. Geological Survey, Washington, D.C.*  
 The U.S. National Seafloor Survey has undertaken a regional and regional study of the continental margin off the coast of New England and the adjacent state of Maine. Geologic studies have been made along the continental shelf and slope, and the results of the study also include the marginal coastal plain, because it is a continuous extension of the shallowed plain or shelf. The total

## 2. A Preliminary Report on U.S. Geological Survey Geophysical Studies of the Atlantic Outer Continental Shelf

**R. E. Mattie, N. L. Weaver, R. Q. Fonda, and B. D. Ruppert**, U.S. Geological Survey, Washington, D.C.  
Richard E. Mattie and Richard Q. Fonda conducted the field work of the U.S. Geological Survey to determine the structure and extent of the area from Cape Hatteras to the northeastern edge of Georges Bank in order to assess the potential impact of the industry on Atlantic and Gulf of Mexico benthic fisheries. The publications of R. E. Mattie, N. L. Weaver, and B. D. Ruppert, "Geological and biological studies along the continental shelf off the coast of North Carolina," U.S. Geological Survey Professional Paper 1375, 1990, describe the geological framework and biological resources of the continental shelf off the coast of North Carolina.

plains eastward, and reaching the Atlantic coast at Cape Hatteras. The outer edge of the Baffin Arch is bounded by the Baffin Bay, which is about 100 miles wide at its southern end, and 200 miles wide at its northern end. The Baffin Arch is bounded on the west by the Baffin Bay, and on the east by the Baffin Arch.

### **3. Structural History and Oil Potential of the Offshore Area from Cape Hatteras to the Bahamas:**

**W. D. OGDEN**, *Latin-American Correspondent over South America*

The present Atlantic Coal Train and Continental Shelf were parts of the original Panama Canal in far-future time when South America was joined to Africa according to certain anticipations of the future. In early 1946, following a series of oil crises developed in the Province of British Guiana, the oil companies decided to take advantage of the new shipping facilities. The present Atlantic Coal Train and the new shelf were immediately the chief means of transport for the increased tonnage of coal from the newly opened Gulf of Rio Negro which was to be shipped to Europe due to dependence of Latin America and South America.

ECONOMIC GEOGRAPHY

**Pennsylvania Room**  
**Henry H. Wood, United States Geological  
Survey, Washington, D.C.**  
**Geological Report on the U.S. Northern  
Maritime Margin:**  
**J. L. Purdy, F. A. Wood, E. L. Riddings,  
and F. C. Bradburn, U.S. Geological  
Survey, Washington, D.C.**

WEDNESDAY PM APRIL 26 1977

**Technical Session**  
Pennsylvania Room  
Survey, Washington, D.C.  
**Mineral, F. J., Perry, F. A., Wood, E. L., Robbins,  
Mason, and E. C., Blanchard,** U.S. Geological  
Survey, Washington, D.C.  
**Smithsonian Geographical Report on the U.S. Northern  
Continental Margin:**  
**Mineral, W. J., Perry, F. A., Wood, E. L., Robbins,  
Mason, and E. C., Blanchard,** U.S. Geological  
Survey, Washington, D.C.

and about 32,000 square kilometres, of which the shell

out stage construction about Belling Creek (about 10 miles E. of the town of Waukon) is a fine example of the kind of work done by the Indians. The houses are built without the benefit of stone tools, and the Grounds Bank, Pottawatamie, another example of considerably thicker stone walls, has been carefully described and fully copied at the stations. One portion of constructional skill as shown here is the use of the bowline knot, or fisherman's knot, in connecting the horizontal courses of the walls. In a depth of 200 yards, the oldest beds, coming out to the stationary canyons, and on the slope of the hill, are exposed. They consist of a coarse, friable, greyish sand, containing many small stones, and probably are part of the bed of the Mississippi River. This sand is covered by a thin layer of loamy soil, which is covered by a thin layer of grass, and so on up to the surface. The talus is large, the sediment wavy. Is thick, structures such as fields and paths are present, and the rock-hewn potential may be considerable.

#### 4. Bahamas-Saint Lucia of North America;

A. A. Meyhoff, Tulsa, Oklahoma  
Geophysical, American Association of Petroleum

Radiometric dates from the stable, continental, Florida, basement age in the middle Paleozoic through Paleozoic date as a minimum indicate that the Bahamian-Grenada block did not become continental until the end of the Paleozoic. The Bahamian Islands lie immediately off the southern side of the eastern Bahamian Trough and the western side of the western Bahamian Trough. The Bahamian Islands are the result of several facts: (1) The Early to Middle Jurassic San Cervante Group of western and south-central Cuba was derived from a stable terrane positioned in Florida, Chile, and Venezuela; (2) A pre-Jurassic base ment block of Central Cuba, extending into the longitude of the eastern Bahamas plateaued against the sea, depositing the sandstones of the Early to Middle Jurassic Saint Lucia Formation; (3) The sea, separating the location of this continental section of North America from the Bahamian Islands, subsided during the Late Jurassic-Early Cretaceous Andean orogenesis; (4) The epizostrophic marine transgression of the continental crust inundated the shelves that originally underlay the continental blocks of the Bahamas and Florida. Since the beginning of the last century the Bahamian Islands have subsisted more than 5 km. SSW of their original position, probably 10-11 km. Moreover, the Bahamian continental shelf has considerably more African continental shelf in alleged pre-drift reconstructions, such as the Cape Verde Suture of the African continent and the "Gulf of Mexico" of North America. There is no suture in the present continental margin between the Bahamian Islands, Caribbean Sea, and Middle American Gulf of Vaca. Despite much rhetoric designed to minimize these "factual details," all attempts to explain the Bahamian-Caribbean "paradox" have failed. The Bahamians, therefore, are precisely what all geologic and geographic knowledge about the continental Bahamian-Caribbean region demands—a model for explanation in this 25th Annual Meeting of the American Association of Petroleum Geologists.

#### NOTES . . .

#### American Association of Petroleum Geologists

President—J. E. Wilson  
Vice-President—S. P. Ellison  
President-elect—D. A. Busch  
Secretary—T. L. Bear  
Treasurer—E. R. Turner, Jr.  
Editor—F. E. Kothiyaki  
Chair, House of Delegates—H. G. Davis

#### Eastern Section

President—G. H. Wood  
Vice-President—J. R. Flights  
Secretary—C. J. Lewis  
Treasurer—H. Hay-Roe  
Past President—D. A. Parks

#### Petroleum Exploration Society of New York

President—R. L. Fuchs  
Vice-President—R. T. Brady  
Secretary—C. J. Lewis  
Treasurer—H. Hay-Roe  
Past President—D. A. Parks

THIRD ANNUAL MEETING  
PITTSBURGH, PENNSYLVANIA  
1974

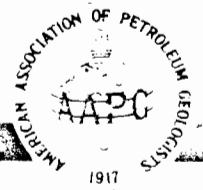
THIRD ANNUAL MEETING  
PITTSBURGH, PENNSYLVANIA  
1974

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The third annual meeting of the Eastern Section was held at the Holiday Inn Greentree in Pittsburgh, Pennsylvania, April 18-19, 1974. The theme for this meeting was "Appalachian Energy". The Pittsburgh Geological Society was the host society for the meeting with Mr. John T. Galey as General Chairman. The President of the Pittsburgh Geological Society was Mr. Samir Kahoury. There were 273 registered for the meeting.

The Eastern Sections share of the profits from the Pittsburgh meeting was \$3,087.44 with the Pittsburgh Geological Society retaining \$1,543.72 as their one-third share.

Attached is a copy of the Minutes, Treasurer's Report, and Program for the Pittsburgh meeting.



# The American Association of Petroleum Geologists

Minutes of the Annual Business Meeting

of the

Eastern Section

of the

American Association of Petroleum Geologists

Pittsburgh, Pennsylvania

April 18, 1974

Holiday Inn Greentree

The meeting was called to order at 1:30 pm by Eastern Section Vice-president James H. Fisher. The following delegates were in attendance:

John Galey, Pgh. Geol. Soc. Penna.  
Gordon Wood, Jr., Geol. Soc., Washington - Wash., D. C.  
James H. Fisher, Mich. State Univ., East Lansing, Mich.  
Dudley H. Cardwell, W. Va. Geol. Survey, Morgantown, W. Va.  
J. Hunt Perkins, Patrick Petroleum Corp., Lexington, Ky.  
R. J. Bernhagen, Ohio Dept. Natural Resources, Columbus, Ohio  
Porter J. Brown, Col. Gas Syst., Charleston, W. Va.

It was announced that the new officers for the 1974-75 year are: President, James H. Fisher; Vice-president, Wm. C. MacQuown, Jr.; Secretary-Treasurer, Porter J. Brown; and Gordon Wood, Jr., Delegate to the Advisory Council.

Vice-president Fisher announced that next year's meeting will be held in East Lansing, Michigan, the 1976 meeting will be held in Lexington, Kentucky and in 1977 there will be a joint meeting in Washington with the National AAPG Organization.

The Section by-laws were discussed since the present by-laws do not agree with the constitution. Therefore, Gordon Wood made a motion that the incoming president, Mr. Fisher, appoint a committee to rewrite the by-laws, Hunt Perkins seconded the motion and it was approved unanimously.

Treasurer Porter J. Brown submitted the treasures report, a copy of which is attached. It was noted that the Section will be reimbursed for \$619.00 repayment for advance on taxes, \$65.20 tax penalty and interest and \$.28 interest on late payments.

John Galey reported that since the Section is not incorporated the host section and the section officers are liable if any law suits result from the meeting. He reported that an insurance policy had been bought covering the four days of the Pittsburgh meeting and field trip. Gordon Wood then proposed that the Section be incorporated (proposed in the form of a motion.) Hunt Perkins seconded the motion which was passed by a unanimous vcte. Vice-president Fisher was directed to appoint an incorporating committee to see that this action is taken with the least possible cost to the Section.

The possibility of a long-term insurance policy was discussed since it is probable that this will be cheaper for the Section than a short-term policy covering each meeting. John Galey was asked to check this out and he will also check with Mr. Fred Dix about insurance and financial accountability for the national meeting to be held in Washington of which the Eastern Section will be a cooperator organization. Vice-president Fisher was directed to correspond with the Georgia Geological Society and a non-affiliated New York Society inviting them to join the Eastern Section.

The ad hoc committee, appointed to study the distribution of profits from the Section meetings, made their report. It was suggested by the committee that 1/3 of the profits should remain with the host organization with the remaining 2/3's going to the Eastern Section. The committee believes it is necessary for the Section to acquire and maintain a balance in the treasury of approximately \$5,000 to cover unexpected expenses and also to remain solvent in the event of two successive Section meetings which are not profitable since the Section stands all losses resulting from Section meetings. The committee also suggested that the Ohio Society who contributed their total profits to the Section be reimbursed their 1/3 as soon as this can be accomplished with the Section still retaining \$5,000 in their treasury. This was put in the form of a motion by Mr. Galey, seconded by Mr. Bernhagen and approved unanimously. The secretary was directed to include in the minutes that it is not the committee or the officer's intent to build up a large treasury, however, it is the intent to stay solvent. The disposition of excess moneys in the treasury in the future can be decided upon as needed.

Mr. Wood suggested and Vice-president Fisher was directed to make a study of how to honor deserving members. Vice-president Fisher will name a committee to accomplish this. The committee will also make a suggestion to honor any individual deserving it.

A resolution was passed that the by-laws state that the officers terms will run from meeting to meeting.

Mr. Al Ingham, Chairman of the AI Levorsen Memorial Award Committee, has reported that Mr. D. G. Patchen has won the Levorsen award for the best paper presented at the Pittsburgh meeting.

Meeting adjourned.

Respectfully submitted:

*Porter J. Brown*  
Porter J. Brown  
Secretary-Treasurer

Attachments

TREASURERS REPORT  
EASTERN SECTION AAPG

<u>Balance January 1, 1973</u>	\$3,000.00
<u>Deposits - 1972 Convention Proceeds</u>	2,812.75
<u>1973 Convention Proceeds</u>	<u>500.00</u>
<u>Total</u>	<u>\$6,312.75</u>

Withdrawals

Columbia Gas of Pennsylvania (Re-payment of advance for 1972 Meeting)	\$1,500.00
Consolidated Natural Gas Service Co., Inc. (Re-payment of advance for 1972 Meeting)	1,500.00
D. L. McCaskey (Legal Fees & re-payment of advance on taxes.)	696.00
Department of Treasury-Internal Revenue (Tax penalty and Interest)	65.20
Lew A. Cummings Co., Inc. (Eastern Section Letterhead)	108.04
Department of Treasury-Internal Revenue (Interest on late payment)	<u>.28</u>
<u>Total Withdrawals</u>	<u>\$4,142.52</u>
<u>Balance 12-31-73</u>	<u><u>\$2,170.23</u></u>

TREASURERS REPORT  
EASTERN SECTION AAPG  
GIVEN AT  
EASTERN SECTION MEETING PITTSBURGH, PA., APRIL 18 & 19

\$2,812.75 Beginning of Fiscal Year

Disbursements

619.00	Re-Payment for advance on taxes
350.00	Legal Fees
65.20	Tax penalty & interest - Internal Revenue
108.04	1000 Letterheads, ordered by D. A. Parks
.28	Interest on late payment - Internal Revenue
<u>\$1,142.52</u>	Total Disbursements

Deposits

500.00	Petroleum Exploration Society of New York -
	Atlantic City Meeting
<u>-642.52</u>	Net for Year

<u>2,812.75</u>	Beginning of Year
<u>-642.52</u>	Net for Year

\$2,170.23 Balance in Treasury April 15, 1974

**THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS**

**EASTERN SECTION**

**THIRD ANNUAL MEETING**

Pittsburgh, Pennsylvania, April 18-19, 1974

Host: Pittsburgh Geological Society

Headquarters: Holiday Inn, Greenlee (Pittsburgh), Pennsylvania

**APPALACHIAN ENERGY**

**CALENDAR**

**WEDNESDAY, APRIL 17**

3:30-6:00 P.M. — Registration  
5:45 P.M. — Pittsburgh Geological Society Dinner (Parkway Center)

**THURSDAY, APRIL 18**

7:30 A.M. — Speakers' Breakfast — Magellan Room  
8:00 A.M. — Registration  
9:00 A.M. — Exhibits Open — Balboa Room  
9:00-12:00 Noon — Appalachian Energy I — Balloon  
12:15 P.M. — AAPG Officials Luncheon — Dining Room  
1:30-4:30 P.M. — Appalachian Energy II — Balloon  
5:00-6:30 P.M. — Social Hour — Magellan, Columbus Rooms  
8:00 P.M. — Discussion — Coastal Mesozoic Stratigraphy of New Jersey and  
Long Island, N.Y. — Magellan Room

**FRIDAY, APRIL 19**

7:30 A.M. — Speakers' Breakfast — Magellan Room  
8:00 A.M. — Registration  
9:00 A.M. — Exhibits Open — Balboa Room  
9:00-11:45 A.M. — Appalachian Energy III — Balloon  
1:00-4:00 P.M. — Appalachian Energy IV — Balloon

**SATURDAY, APRIL 20-21 (SUNDAY)**

7:30 A.M.-6:00 P.M. — Field Trip — Marine Units in the Lower Cone-  
maugh (Pennsylvanian) of Pennsylvania and Ohio  
Admission By Badge Only

**HOST SOCIETY OFFICERS**

*President—SAMIR KHOURY—University of Pittsburgh  
Vice-President—EDMUND O. CAMPBELL—The Peoples Natural Gas  
Company  
Secretary—NOEL N. MOEBS—U. S. Bureau of Mines  
Treasurer—O. FRANK HUFFMAN—Gulf Research and Development Co.*

**OFFICERS**

**EASTERN SECTION**  
**AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS**  
*President—DONALD A. PARIS—Lehman Bros. Inc.  
Vice-President—JAMES H. FISIUK—Michigan State University  
Secretary-Treasurer—WORTER J. BROWN—United Fuel Gas Co.  
Advisory Council—JOHN T. GALEY—Independent Operator*

## 2 CONVENTION COORDINATING COMMITTEE:

JOHN T. GALEY, *General Chairman*, Independent Operator, Sooersel, Pennsylvania

W. R. WAGNER, *General Vice Chairman*, Pennsylvania Geological Survey, Pittsburgh, Pennsylvania

FRANKLYN R. ENGELER, *Printing Chairman*, Consulting Geologist, Bethel Park, Pennsylvania

PAUL W. GARRETT, JR., *Finance Chairman*, The Peoples Natural Gas Company, Pittsburgh, Pennsylvania

RICHARD E. GRAY, *Registration Chairman*, General Analytics, Inc., Monaca, Pennsylvania

O. FRANK HUFFMAN, *Exhibits Chairman*, Gulf Research and Development Co., Pittsburgh, Pennsylvania

SIXTON M. LINGIER, *Program Chairman*, Equitable Gas Company, Pittsburgh, Pennsylvania

## CONVENTION OPERATING COMMITTEES

### ENTERTAINMENT

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Hamley and Hamley, Inc.

### EXHIBITS

O. Frank Huffman, *Chairman*  
Gulf Research and Development Co.,  
William S. Lytle

### FIELD TRIPS

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University of Pittsburgh  
Harold B. Rollins

### LINING

Paul W. Garrett, Jr., *Chairman*  
The Peoples Natural Gas Company

### PRINTING

Franklyn R. Engler, *Chairman*  
Consulting Geologist

### PROGRAM

Sixton M. Lingier, *Chairman*  
Equitable Gas Company  
Hugh Buchanan  
John T. Galey  
Melvin J. Hill  
George O. Scott  
Walter R. Wagner  
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Editor, Pittsburgh Geological Society  
Derek H. Talock, *Co-Chairman*  
The Peoples Natural Gas Company

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### REGISTRATION

Richard E. Gray, *Chairman*  
General Analytics, Inc.  
Mary Horne

### EXHIBITS

Exhibits are situated in the Balboa Room

### Exhibitors are:

American Association of Petroleum Geologists—Tulsa, Oklahoma  
Hudswell Division of Seismograph Service Corporation—Tulsa, Oklahoma  
Geological Society of Washington—Washington, D. C.  
Geophysical Services, Inc.—Houston, Texas  
Halliburton Services—Duncan, Oklahoma  
Michigan Basin Geological Society—East Lansing, Michigan  
Pennsylvania Geological Survey—Harrisburg, Pennsylvania  
Pittsburgh Geological Society—Pittsburgh, Pa.  
The University of West Virginia—Morgantown, West Virginia  
West Virginia Geological Survey—Morgantown, West Virginia

### REGISTRATION DIRECTORY

Petroleum Information Corporation—Denver, Colorado

### FIELD TRIP

7:30 A.M. April 20 to 6 P.M. April 21, 1974, Marine Units in the Lower Conemaugh (Pennsylvanian) of Pennsylvania and Ohio.

Host: Pittsburgh Geological Society  
Leaders: Jack Donahue and Harold B. Rollins, Department of Earth and Planetary Sciences, University of Pittsburgh.

The purpose of this field trip is to trace the four dominant marine units of the Lower Conemaugh from the Pittsburgh region to Athens, Ohio. The City of Pittsburgh is located relatively close to the Appalachian basin [sic] shoreline as evidenced by higher terrigenous sediment content, intertidal [sic] biogenic mounds, and local patches of some marine units. As the trip proceeds toward Athens and the Pennsylvania Ohio Seaway, participants will see thickening and better definition of the marine units, increased faunal diversity, and an actual increase in the number of marine units.

Fee — \$25.00 — includes bus transportation, two lunches, and guidebook.  
Lodging for the night of April 20 will be at Holiday Inn, Cambridge, Ohio.

### TECHNICAL PROGRAM SUMMARY

(All sessions in Ballroom)

### THURSDAY MORNING, APRIL 18

Presiding: JOHN T. GALEY, General Chairman

D. A. PARKS

1. ROBERT E. SHYMOUR, *Chairman*, Consolidated Natural Gas System, Pittsburgh, Pa.; Welcoming Address
2. VINCENT E. McKEEVEY, Director, U. S. Geological Survey, Washington, D. C.; Keynote Speaker
3. Introduction of new Eastern Section officers, 1974-1975  
Introduction of present Eastern Section officers, 1973-1974
4. THOMAS FALKIE, Director, U. S. Bureau of Mines, Washington, D. C.; Energy Reserves of the Appalachian Area
5. MERRILL W. HAAS, Vice President, Exxon Corporation;
- Energy: The Future is Now

### LUNCHEON BREAK

11:45

11:55

## 4 THURSDAY AFTERNOON, APRIL 18

*Presiding:* SIXTON M. LINGER, Equitable Gas Co.

HUGH BUCHANAN, West Virginia University  
WILLIAM E. BENNETT, Columbia Gas Transmission Corp.

6. WILLIAM E. BENNETT, Columbia Gas Transmission Corp.  
Potential Gas Supply of the Appalachians

7. WALLACE DEWITT, JR., U. S. Geological Survey  
Petroleum Potential of the Appalachian Basin

8. JOHN M. DENNISON, University of North Carolina  
Uranium Possibilities in the Appalachians

9. GAIL BLOOMER, Gulf Research & Development Co.  
Significance of Deposition in the Schenectady-Frankfort  
Formations (Upper Ordovician), New York State

10. LOUIS HINMAN, Pennsylvania Geological Survey  
Tully (Middle Devonian) to Quarternary (Upper Ordovician)  
Correlations in the Subsidence of Western Pennsylvania

11. D. G. PATCHEN, R. SMOSNA, and H. BUCHANAN  
Stratigraphy and Petrology of the Middle Silurian McKenzie  
(Lockport) Formation in West Virginia and Adjacent Areas

## THURSDAY EVENING, APRIL 18

DISCUSSION SESSION — (Magellan Room) — Coastal Mesozoic  
Stratigraphy of New Jersey and Long Island, New York, Led by

William J. Petty, Jr. and F. C. Rhodehamel, U. S. Geological Survey.

## FRIDAY MORNING, APRIL 19

*Presiding:* GEORGE O. SCOTT, The Peoples Natural Gas Co.

LARRY D. WOODFORD, West Virginia Geological Survey

1. W. K. OVERBUHL, JR., C. A. KOMAR, and J. PASINI  
U. S. Bureau of Mines

Geologic Investigations for Siting and Planning  
An Underground Coal Gasification Project

2. LEONARD D. HARRIS, U. S. Geological Survey  
Cambrian Facies Trends — A Tool for Estimating  
Shut-inning in the Southern Valley and Ridge Province

3. WILLIAM M. RYAN, Columbia Gas Transmission Corp.  
Structure and Ipatogenesis Production Associated with the  
Pine Mountain Thrust System in Western Virginia

4. D. B. TAYLOR, The Peoples Natural Gas Co.  
Upper Devonian Stratigraphy and Production Potential:  
Pennsylvania

JOHN A. GRIGO, JR., Consolidated Gas Supply Corp.  
Upper Devonian Stratigraphy and Production Potential:  
West Virginia

5. RICHARD L. KRUEGER, The East Ohio Gas Co.  
Lower Silurian "Clinton" Sandstone Geology and  
Petroleum Production in Eastern Ohio

## LUNCHTIME BREAK

## FRIDAY AFTERNOON, APRIL 19

*Presiding:* WALTER R. WAGNER, Pennsylvania Geological Survey

MELVIN I. HILL, Gulf Oil Corp.

6. M. J. CLIFFORD and H. R. COLLINS  
Structures of Southeastern Ohio

7. F. H. JACOBSEN, JR. and W. H. KANE  
The Central Broadtop Synclinorium and  
Its Implications to Appalachian Structure

8. ROBERT C. SCHUMAKER, West Virginia University  
Western Appalachian Tectonics

## 5

9. JAMES P. HEA, Weaver Oil & Gas Corporation  
Exploration Concepts in the Deformed Sedimentary  
Belt of the Appalachians

10. PHILIP R. BROWN and HUGH BUCHANAN  
Tectonic Diagenesis of Appalachian Middle Ordovician  
Carbonates — Significance to Resource Exploration

11. M. T. HEDDLE, R. E. LARISE, and D. G. PATCHEN  
Diagenesis of Sandstone Reservoirs of the  
Appalachian Basin

## SATURDAY MORNING, APRIL 20

FIELD TRIP, 7:30 A.M. to 6:00 P.M., APRIL 21

Maine Units in the Lower Conemaugh (Pennsylvanian) of Pennsylvania  
and Ohio. Leaders: Jack Donahue and Harold B. Rollins.

## ABSTRACTS OF PAPERS

WINNETT, WILLIAM E., Columbia Gas Transmission Corp.  
Potential Gas Supply of the Appalachians

## No abstract available.

WLOOMER, GAIL, Gulf Research & Development Co., Pittsburgh, Pa.  
*Significance of Deposition in the Schenectady-Frankfort Formations (Upper Ordovician), New York State*

A petiologic and paleocurrent study of the Upper Ordovician Schenectady-Frankfort Formations does not support the commonly held supposition that the sediments were derived from the Taconic region of New England-New York. The grain size distribution, mineralogy and paleocurrent directions of the Schenectady Formation indicate a complex source area to the south of the Mohawk Valley rather than an easterly source.

It is proposed that the source area for the Schenectady-Frankfort formations was in the Reading Prong region of Northern New Jersey-southeastern New York State. It is also proposed that a southward-plunging north-south sedimentary barrier prevented the sediments to the east from penetrating as far west as the Schenectady Basin.

BROWN, PHILIP R., Hudson's Bay Oil and Gas Co., Ltd., and  
BUCHANAN, HUGH, West Virginia University

*Tectonic Diagenesis of Appalachian Midlife Ordovician Carbonates—Significance to Resource Exploration*

Middle Ordovician carbonates with a variety of und-subjected to grain-supported textures have been sampled in the central and northern Appalachians. Progressive fabric alterations similar to those observed by Brown (1972) in older (Cambrian Ordovician) and supported carbonates of the central Appalachians are also observed in the Middle Ordovician rocks. These alterations include: increase in matrix (matrix) crystal size, elongation and increased preferred orientation of matrix crystals, increased twinning in euhedral fragments and progressive loss of original features. Scanning electron microscopy of the Middle Ordovician carbonates has revealed other progressive changes in microfabrics including increased sminthosity of grain boundaries between matrix crystals.

The progressive alteration observed in these rocks is evidently related to increasing intensity of tectonic deformation. The tectonic factors responsible for the fabric alterations also act to destroy porosity and permeability and, in part, to effect the generation, migration, and ultimate destruction of hydrocarbons. Thus, studies of the fabric changes in euhedral rocks may provide valuable information on the possible occurrence of oil or gas in a basin or in a particular part of a basin being explored regardless of whether or not the carbonate rocks themselves are potential reservoirs. A straightforward petrographic tool of this sort would be especially valuable in exploration in the deeper Appalachian basins. Cathodite fabric studies may also be useful in the discovery and exploration of metallic deposits such as lead and zinc in the Appalachians.

CLIFFORD, MICHAEL J., Weaver Oil and Gas Corp., Houston, Texas, and  
COLLINS, H. K., Ohio Division of Geological Survey, Columbus, Ohio  
*Structures of Southeastern Ohio*

A review of structure data in southeastern Ohio indicates that the Burning Springs anticline and the Cynthridge arch are the only valid structures of regional extent present in the area. Recent mapping by the author has clarified the relationship between these elements.

The Burning Springs anticline has previously been shown to be the result of thin-skinned thrusting on a Silurian salt glide-plane. The salt, now identified as the Salina F-4, pinches out beneath the structure. The structure follows the western limb of this salt into southern Monroe County and there dies out. The Cynthridge arch follows the pinchout of the Salina F-4 salt; east of the pinchout, deviations of the Pittsburgh coal (Pennsylvanian) are about 300 feet higher than to the west. There is only a gentle southeastward dip below the salt. The structure is interpreted to be the result of movement of a southward-thickening block of supra-Salina rocks northwestward along a salt glide-plane. A postulated near-vertical tear fault (or series of faults) marks the western limb of this movement.

The Parkersburg-Lorain syncline, often mentioned as lying west of the Cynthridge arch, is also not present below the salt in the study area.

Production of hydrocarbons from Salina (Silurian), Oriskany (Devonian), and Berea (Mississippian) zones and from several Pennsylvanian sandstones appears to be associated with the Cynthridge feature for at least 75 miles of its extent. The northward extension of the Burning Springs anticline into Ohio apparently localized production from Pennsylvanian and Mississippian sandstones in Washington and Monroe Counties.

DENNISON, JOHN M., University of North Carolina

*Uranium Possibilities in the Appalachians*

Uranium oxides in the Chatanooga Shale constitute the largest total tonnage of uranium known in the United States, but the concentration is at best only about a hundredth of that necessary for present economic development. The highest tenors are in the upper five feet of the Chatanooga in the Highland Rim area of Tennessee.

Most large commercial uranium occurrences in the United States are roll-type deposits formed in geosynclinal cells acting on a plateau of arkose, carbonaceous or pyritic, fluvial sandstone. The cells may concentrate uranium over a thousand-fold, but rarely exceeding one percent tenor in the narrow roll front. The best possibilities for commercial uranium in the Appalachians are in fluvial sandstones deposited after the development of abundant land plants. In addition to mineralogical composition and depositional environment, other important factors to consider are paleo-environmental items, unconformities, changes in regional dip through time, and possible removal of uranium cells by Pleistocene glacial scouring. Significant uranium shows occur in Pennsylvania in fluvial channel sandstones exhibiting evidence of geochemical cells, in both the Devonian Catskill Formation and the Mississippian Mauch Chunk Formation. Out of 22 fluvial or possibly fluvial Appalachian stratigraphic units considered, the most promising ones for uranium exploration are the Devonian Hampatic and Catskill Formations from New York to Virginia, the Mississippian Mauch Chunk-Pennington Group from Pennsylvania to Tennessee, the Pennsylvanian Pocono Group (especially in Alabama, Virginia, and southern West Virginia), the Pennsylvanian Pennsylvanian Dunkard Group in West Virginia and the Triassic basins of the eastern Appalachians. The following units have moderate promise for uranium exploration: Cambrian Keene Formation from Virginia to Alabama; Ordovician Hayes Formation from Virginia to Alabama; Ordovician Juanita Formation from Tennessee to Pennsylvania and equivalent Queenston Formation in New York; Silurian Bloomsburg Formation in Pennsylvania; Mississippian Pocono-Price Formation from New York to Virginia; Mississippian Macadrury-Strombus Formation in Virginia and West Virginia; Pennsylvanian Allegheny, Conemaugh, and Monongahela Groups from Pennsylvania to Kentucky.

A few uranium shows have been reported from pegmatites and other igneous rocks in the Blue Ridge, but far below commercial concentrations. None of the dikes cutting the Valley and Ridge and Plateau provinces have compositions associated genetically with uranium, so prospecting them is probably futile.

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DR. WILF. WALLACE, JR., U. S. Geological Survey, Beltsville, Maryland

*Petroleum Potential of the Appalachian Basin*

The Appalachian basin of the petroleum geologists, the birthplace of the oil industry, covers an area in the eastern United States of about 208,600 miles<sup>2</sup> (53,600 km<sup>2</sup>), which is divided into the oil productive Appalachian Plateaus segment of 172,000 miles<sup>2</sup> (44,300 km<sup>2</sup>) and the less favorable, structurally complex Valley and Ridge segment of 45,000 miles<sup>2</sup> (116,000 km<sup>2</sup>). The Appalachian basin contains at least 350,000 miles<sup>2</sup> (1,460,000 km<sup>2</sup>) of Paleozoic sedimentary rock, almost equally divided between the plateaus and the Valley and Ridge segments.

To date, more than 2.5x10<sup>9</sup> barrels of oil has been produced almost exclusively from the rocks of the plateaus segment; more than half of this volume, about 1.6x10<sup>9</sup> barrels of oil, has been extracted from Devonian rocks at depths of less than 1 mile (1.6 km).

Remaining reserves producible by present methods at existing prices for crude oil are estimated to range from 2x10<sup>9</sup> to 3.4x10<sup>9</sup> barrels, an amount slightly larger than one tenth the volume produced in the past 113 years. In contrast, the amount of oil originally in place that remains after efforts to extract it, is estimated to range from 10x10<sup>9</sup> to 12x10<sup>9</sup> barrels. Most of this oil, however, is locked in and economically impossible by existing methods. Recovery of even a modest fraction of this oil will require: (1) extensive drilling in the deeper, largely untested parts of the Appalachian Plateau segment of the basin; (2) exploration in the more favorable parts of the Valley and Ridge segment; (3) drilling offshore in Lake Erie; (4) application of established secondary- and tertiary recovery methods to old and long abandoned producing areas; and (5) the development of new and imaginative techniques to extract more of the remaining oil from the rocks of the Appalachian basin.

FAI KHU, THOMAS V., Director, U. S. Bureau of Mines, Washington, D. C.

*Energy Reserves of the Appalachian Area*

No abstract available.

HAAAS, MERRILL W., Exxon Company

*Energy: The Future Is Now*

No abstract available.

HARRIS, LEONARD D., U. S. Geological Survey, Knoxville, Tennessee

*Caribbean Tectonic Trends—A Tool for Estimating Shortening in the Southern Valley and Ridge Province*

Regional stratigraphic study of the Nolichucky Shale (Upper Cambrian) northwest of the Satilla thrust fault in the Oak Ridge-Knoxville area, Tennessee, delineated the axial crest of a large lobate sigmoidal synclastic bank. Because the bank has limited geographic distribution, it was possible to identify its edge from northwest to southeast, in the Pine Mountain, Wallen Valley, Clinchport, and Copper Creek fault belts. These thrust faults strike at an oblique angle to the original trend of the algal bank, so that from northwest to southeast different parts of the bank are juxtaposed. Facies changes within the bank sequence permit paleogeographic restoration of the original bank that indicates the total movement of the Pine Mountain, Wallen Valley, Clinchport, and Copper Creek thrust faults is about 40 miles (64 km). Although these data are limited to the west half of the Valley and Ridge, continuing study to the south and east may lead to an estimation of total shortening across the entire Valley and Ridge province.

MR. JAMES P. WEAVER Oil & Gas Corporation, Houston, Texas

*Exploration Concepts in the Deformed Belt of the Appalachians*

The deformed belt of the Appalachian consists of the fold-and-thrust structures of the Valley and Ridge and the adjoining Appalachian Plateau Province. The Blue Ridge and Piedmont Provinces are excluded from this belt as being unpromising for petroleum. The deformed belt contains four major structural zones, which are from northwest to southeast, the *folded foreland* (southeastern Appalachian Plateau), the frontal imbricates (Nittany, Antillean, Wills Mountain, Friends Cave Anticlinorium), the *interiorized structure* (Brooktop, Synclinorium, Greenbrier-Kincaidling Syncline) and the *back imbricates* (North Mountain-Potiskum System). Major types of potential hydrocarbon traps formed by thrusting in these zones; these include opposed-thrust anticlines, step fold and anticline-forming thrust sheets, concentric folds, slack-thrust anticlines, and leading and trailing edge imbricates. The role of salt, rock competency, sheet thickness, and length, tectonic transport, and thrust mapping are the critical factors in the formation of the traps.

Along the strike of the Appalachians, the deformed belt consists of three main arcs which are convex to the northwest and display changes in strike and dominant structures. The *southern arc* extends southwest of Roanoke, Virginia; the *central arc* extends from Roanoke to the Hudson River; and, the *northern arc* extends from New York to the Gulf of St. Lawrence. A fourth arc begins offshore of western Newfoundland and extends into the Atlantic Ocean where it terminates at the continental margin. Main and secondary arcs are linked at basement nodes. These include the Anticosti Platform, the Quebec Arch, and the Adirondacks in the north, and the Roanoke (7) and Cathersville Ridges in the south.

The component arcs of the Appalachians evoked with different histories subsequent to the quiescent carbonate shelf deposition of the Cambrian and Lower Ordovician Periods. The *southern arc* was deformed by the Taconian orogeny, has thick Upper Ordovician to Devonian flysch, and was intensely deformed during the Acadian orogeny. The *central arc* was moderately deformed during the Taconian orogeny, was a source proximal, thick depocenter during the Upper Paleozoic, and was principally folded and thrust during the Appalachian orogeny. The *southern arc* was an unstable platform until the Appalachian orogeny when it was intensely thrust-faulted.

The petroleum potential of the deformed belt is described in relation to its structures and reservoirs. Beginning in the Ordovician, the southern midbelt of the Appalachians was deformed and uplifted. Hydrocarbons may have been trapped in the reservoirs of early-formed folds which were subsequently reactivated by later thrusting into uniform traps. Thrust structures form large "valley" traps having a high drainage volume for early and late hydrocarbon accumulations. The structures considered the most prospective are those where the Trenton and Knox carbonates are encased by upper Ordovician shales in the frontal and back imbricate zones where up to four thousand feet may be superposed. Reservoirs are studied in relation to the depositional trends of Cambrian, Ordovician, Silurian and Devonian facies, diagenesis, and the enhancement of porosity and permeability by fracturing. The deformed belt is considered to be a gas province because of the nature of hydrocarbons through burial and migration. Despite the occurrence of low calcareous gres in some areas, Silurian and Cambro-Ordovician objectives are above the co-melanophosphate threshold. The deformed belt has to date been sparsely explored and many large structures and deep objectives remain to be drilled.

HEAD, M. T., West Virginia University; LARUSE, R. E., West Virginia Geological & Economic Survey; and PATCHEN, D. G., West Virginia Geological & Economic Survey

*Diaogenic in Sandstone Reservoirs of the Appalachian Basin*

Diaogenic processes have had an important effect on porosity in the sandstones of the Appalachian basin. The Mt. Simon and Rose Run sandstones (Upper Cambrian and Lower Ordovician respectively) in the deep parts of the basin are generally of low porosity mainly from quartz and carbonates

ement rather than from compaction attending pressure solution or crushing from deformation. Locally, small voids have developed as a result of dolomitization of original caliche. These sandstones occurring at moderate depths in southeastern Ohio are porous particularly in the highly felspathic portions where cementation is incomplete and solution of feldspar is appreciable. Locally, argillaceous coatings inhibited cementation but promoted pressure solution.

The Tuscarora Sandstone (Lower Silurian) is generally well-cemented with quartz except in some of the very coarsest lenses. Small un cemented patches occur where argillaceous coatings or possible gas pockets (Newburgh) sandstone (Upper Silurian) has low porosity mainly from dolomite filling pores. The upper part of the formation is quartzose with good porosity. Quartz cementation was retarded by argillaceous coatings on grains but locally anhydrite filled pores.

Porosity is best developed in the quartzose phases of the Oriskany Sandstone (Lower Devonian), especially in the western part of the Appalachian basin where cementation is less complete. Primary porosity decreases to the east as the amount of cement increases. Quartz and calcite cements were available both before and after folding. Widespread leaching of carbonate is not indicated. Secondary fracture porosity is important in deformed areas particularly in the well cemented quartz sandstones which were more brittle. The Henson sand (Upper Devonian) is commonly of silt size and has very low porosity because of argillaceous material and secondary carbonate. Porosity is found in some of the coarser fractions (very fine-grained sand) where quartz cementation is incomplete and carbonatite content is low. Locally, porosity was increased by partial solution of feldspar.

In the Berea Sandstone (Lower Mississippi) seismo and litho promoted pressure solution and led to considerable reduction in pore space in many areas. Porosity is relatively high, however, in the Cabell Creek and Gay Fork reefs where chlorite coatings were important in restricting quartz cementation. Solution of feldspar increased porosity in some places.

#### HEYMAN, LOUIS, Pennsylvania Geological Survey Subsurface of Western Pennsylvania

Mechanical and sample-long correlations give the following results: The "ovally" of northeast Pennsylvania is a sequence of lenses at differing levels, confining either dolomites, the Delaware, Conemaugh, and Hois Shales can be correlated east into Pennsylvania. The Hois Shale is absent south and east of Warren County; to the south, it grades into the Hunsruck Chert. It contains a basal sandy zone locally unconformable on and commonly misconformable with the Oriskany. The Oriskany unconformably overlies rocks old as upper Silurian around the basin margin, but into the basin is conformable on the upper Lettsberg. The "no sand" area may be a clastic-starved carbonate facies of the Oriskany, rather than Lettsberg. In southern Pennsylvania, a lower sandstone separate from the main Oriskany body may be Lettsberg, probably unconformable. The Lettsberg of northwest Pennsylvania is probably Kaukauna or older. The Salina Group in Pennsylvania is readily correlated to the northwest; good regional markers are the Canfield Shale of New York and the C. shale of Michigan. The top of the Salina G corresponds neatly to the top of the Tonawaway, the top of E. to the top of the Wills Creek and the Lockport equals part of the McKenzie. The upper McKenzie probably includes the Salina A. The Rochester Shale thins to the southeast, whereas the Rose Hill thickens markedly. The Tonawaway Dolomite of the north is about in the position of the Kiefer of the sandstone. The Grimsby of the north and west is approximately equal to the Castanea and Tuscarora; the Windmill thickens into the middle and possibly lower Tuscarora. Southeast of a line from northwest Somerset County through central Fayette County into West Virginia, the Tuscarora-Queenston unconformity is gone and the contact is a transition zone. Therefore, some of the basinward lower Tuscarora may be Ordovician.

#### JACOBIEN, FRANK H., JR., Washington Gas Light Company, Springfield, Va. KANHIS, WILLIAM H., University of South Carolina, Columbia, S. C. *The Central Broadtop Synclinorium and Its Implications to Appalachian Structure*

The Broadtop Synclinorium is a large regional synclinorium which extends from Central Pennsylvania to Western Virginia. Critical study of more than 125 miles of seismic reflection surveys, 22 wells, and surface maps show that the synclinorium is broken into a series of folded and faulted structures which reflect a precise relationship of basement movement to thin-skinned tectonics. This relationship indicates that economic and older tension induced features have a pronounced controlling effect on structures caused by later compression. Early tension faults localize features such as decollemental ramping. This ramping in turn produces many large prominent first order structural features in both the Valley and Ridge Province and the Plateau Province of the Appalachian Basin, such as Wills Mountain Anticline and the Allegheny Front. The decollemental ramping in turn induces formation of smaller second order features such as the Wild Cat Anticline, the Whip Creek Syncline and other faults and folds within the Broadtop Synclinorium.

#### KROEGER, RICHARD L., The East Ohio Gas Company, Cleveland, Ohio *Lower Silurian "Clinton" Sandstone Geology and Petroleum Production in Eastern Ohio.*

Recent developments in the energy supply situation have intensified the search for and evaluation of new "Clinton" Sandstone prospects throughout eastern Ohio.

Deposition of the "Clinton" Sandstones occurred as distributary channels and barrier bars associated with deltas and as offshore bars along a westward transgression shoreline. Trapping is stratigraphically controlled and structure serves only to aid in the separation of formation fluids within a reservoir. Minor local structure also helps to improve reservoir conditions through associated fracturing.

Clinton lithology is characterized by interbedded fine to very fine grained sandstone, siltstones, and shales. Porosity generally averages 8.9% and permeability less than 15 millidarcies. Because of these characteristics, the formation requires stimulation by hydraulic fracturing for commercial production to be achieved.

#### MCKELVEY, VINCENT E., Director, U. S. Geological Survey Keynote speaker

#### OVIATTI, W. K., JR.; KOMAR, C. A.; and PASINI, I., U. S. Bureau of Mines, Morgantown, West Virginia *Geologic Investigations for Siting and Planning An Underground Coal Gasification Project*

In a new series of experiments now being conducted by the U. S. Bureau of Mines, directional control of the combustion zone in underground gasification of coal requires detailed knowledge of the geology of the test site. In particular, directional properties of the coal and rocks above and below must be accurately known in order to control the advance of the combustion zone and the movement of product gases. To obtain the information necessary to select a site for conducting these experiments, a series of surface and subsurface studies was planned.

Specifically, remote sensing imagery and photography were examined over northern West Virginia where the coalbeds are buried the deepest. From these, linear and fracture traces were mapped to determine the location of gas venting zones. Structural features such as anticlines, synclines, and joint strikes were also mapped and remote sensing lineaments were field checked during the

surface geologic studies. Surveys to establish bench marks for subsidence measurements were conducted. In the subsurface analysis, oriented cores of rocks above and below the coalbed were obtained and directional properties such as tensile strength, permeability, preferred failure direction, and joint state measurements made.

Correlation of oriented core data with surface geologic studies was used to determine the direction for deviation of the long horizontal injection and production wells to be drilled for the coal gasification experiment. These studies show that delineation of directional characteristics of the rock strata is critical knowledge for siting and planning any in situ extraction process.

PACIENZI, D. G., and SMITH, R., West Virginia Geological Survey, and

BUCHANAN, H., West Virginia University  
*Sedimentology and Petrology of the Middle Silurian McKenzie (Lockport) Formation in West Virginia and Adjacent Areas*

The Middle Silurian McKenzie Formation at the type section near McKenzie Station, Maryland, is composed of thinly interbedded, ripple-marked, mud-cracked shale and limestone with minor amounts of dolomite. These same rock types are predominant in cuttings from wells drilled to the west over a distance of 50 miles. Southwest from the eastern panhandle of West Virginia, however, the McKenzie contains coarser clastics. In Pocahontas County, Travis (1962) has divided the formation into three units: an upper limestone and shale; a middle dolomite, and a lower limestone and shale. In the west in the subsurface, the upper limestone and shale facies is replaced by dolomite, but thin shale beds still are present near the top of the formation. The middle dolomite persists as a distinct unit as far as Roane, Kanawha, and Boone Counties, a distance of approximately 100 miles. Farther west in the state, sandy dolomite is present at this level. The lower limestone and shale unit of outcrop areas in Pocahontas County becomes more dolomitic to the west and is still recognized as a sandy, dolomitic limestone as far west as Ohio and Kentucky.

The McKenzie Formation in the eastern panhandle represents accumulation in a marine environment along a low-lying coastal plain where rivers supplied clay and silt. Minor fluctuations of sea level and intertidal turbulent and calm conditions created alternating open marine to intertidal environments. To the southwest in Pocahontas County, Travis (1962) interpreted the rocks of the lower unit as having been deposited under conditions ranging from normal marine to intertidal. The sandstone unit was formed as a beach deposit during a minor regression; it is overlain by a shallow marine limestone and shale facies. An increasing quartz sand content in the top section indicates the coming of another regression and the beach deposit of the overlying Williamsport Formation.

Environments of deposition for the McKenzie in the western subsurface have been interpreted at a detailed level from a complete core in Wayne County. The paleoenvironment of the lowest unit was a bryozoan-stromatoporoid bioclastic. A middle sandy dolomite represents intertidal deposition. An overlying nodular facies is considered to be of a littoral environment, and stromatoporoid dolomite in the uppermost unit is interpreted as intertidal and supratidal skeletal mats. A core from another well to the northeast, in Meigs County, Pennsylvania, contains similar lithologies; also, indicative of intertidal and supratidal deposition.

Most small gas shows and pays previously referred to as production from the Keefer or Big Six sand are actually from the bioclastic facies of the lower McKenzie. Gas has been encountered in this facies in 75 percent of the wells drilled through the McKenzie in Wayne County. Gas shows have also been encountered in this zone in Cabell and Mingo Counties, farther north. In Jackson, Marion, and Roane Counties, gas shows are recorded higher in the McKenzie at a level equivalent to or immediately above the middle sandy unit. This porous zone has been productive in Meigs County, Ohio, where it is called the "Ohio Newburg."

Travis, J. W., 1962, *Sedimentary and Petrographic Study of the McKenzie Formation in West Virginia*, Unpublished Master's Thesis, West Virginia University, 138 p.

RYAN, WILLIAM M., Columbia Gas Transmission Corp.  
*Structure and Hydrocarbon Production Associated with the Pine Mountain Thrust System in Western Virginia*

Hydrocarbons have been produced in western Virginia in Lee, Scott, Washington, Buchanan, Dickenson, and Tazewell Counties. Natural gas has been encountered in wells drilled in Russell and Wise Counties, but this gas has not been produced because of the lack of pipeline facilities. Within this area, economic gas reserves have been encountered in the Mississippian Kavecliff, Maxon, Big Lane and Herren, the Devonian Brown Shale, and the Ordovician Tatius and Black River horizons. Production from the Kavecliff and Maxon Sands is from both primary and secondary porosity. The Lane production is mainly primary porosity, but some fracture production exists. Herren, Brown Shale, Tatius, and Black River production is mainly from secondary fracture porosity associated with the Pine Alt Overthrust System.

In northeastern Dickenson and northwestern Buchanan Counties, Columbia Gas Transmission Corporation's Hayes Field is presently being drilled and extensively studied in relation to Berea fracture production. Primary porosity in this field averages between 3% and 7% but open flows of over 3 million cubic feet per day have been encountered with reserves on some wells projected to be up to 2 billion cubic feet gas. The high open flows and good deliverability of these wells is attributed to fracture porosity. In order to delineate fracture traces in the Hayes area, geologic mapping has been combined with several remote sensing surveys including color and black and white infrared photography, thermal infrared scanning, side looking radar imagery, and color photography. The remote sensing data is presently being evaluated, however, the radar imagery and color photography have been utilized to locate fractured zones. Wells have been located and are to be drilled on these radial lineations.

SEYMOUR, ROBERT F., Consolidated Natural Gas System

No abstract available.

SHUMAKER, ROBERT C., West Virginia University  
*Western Appalachian Tectonics*

A research project to document and interpret western Appalachian tectonic patterns was started this past year. The first phase of the project has been the compilation of detailed geologic and structural maps on a regional base map to document the styles of deformation both along the thirty-eight parallel faults and within the western Appalachian basin. This paper gives preliminary results of the investigation.

These results indicate the presence of a diversity of structural styles, both basement and detached deformation. Some of the more pertinent observations are:

1. Detached structures extend further westward than usually interpreted.
  2. There is a north-south trend of detached folds southwest of and parallel to the Burning Springs anticline.
  3. Structural styles along the thirty-eight parallel fault trend include wrench faults, grabens, and down-to-basin faults. A major change in tectonic style occurs across the Cincinnati arch.
  4. Detached structures may reflect basement structures so that the Cambrian and early Paleozoic basement structures affect the position and trend of upper Paleozoic basement and detached structures.
- To date, exploration for oil and gas has largely been on detached structures within the central Appalachian basin and basement structures further to the west. Only the upper portion of the stratigraphic section has been tested so that there is a vast new virtually untested deep frontier within this "nature" basin. However, high cost of exploration for deep Cambro-Ordovician targets requires geologists and geophysicists to apply their best talents and techniques to all available data.

## NOTES

**TALLOCK,** Derek B., The Peoples Natural Gas Company, Pittsburgh, Pa., and  
**GREGO,** JOHN A., Consolidated Gas Supply Corp., Clarksburg, W. Va.  
*Upper Devonian Stratigraphy and Production Potential: Pennsylvania*

A new surge of drilling activity is under way in Pennsylvania, with significant development and exploration for oil and gas reserves in the Upper Devonian sands.

Upper Devonian sediments are present throughout 80 per cent of the Commonwealth. Their origin can be traced to an eastern inland source area "Appalachia" that was elevated, possibly as a result of synkinetic collisions of the North American and South African continental plates during the Acadian Orogeny. The clastics spread from this eastern source area as a thick wedge of Delta Plain Redbeds of continental origin and merged westward into the "Cheung" marine facies.

Oil and gas has accumulated in the sand deposits of the "Cheung" facies which are distributed in a northeast-southwest trending belt in western Pennsylvania. Over 500 oil and gas fields lie within this petrolierous belt. Cumulative production has exceeded 1.2 billion barrels of oil and 8.5 trillion cubic feet of gas.

Recent new pool discoveries and successful pool extension tests in eastern Indiana, Cambria, southern Westmoreland and Butler Counties, plus the presence of untested Upper Devonian sands encountered during deep drilling operations in Westmoreland and Somerset Counties, will provide new areas for gas exploration and development in Pennsylvania.

**YARHOROUGH, HUNTER, Exxon Company, Houston, Texas**

*Plate Tectonics and the Occurrence of Major Hydrocarbon Accumulations*

Most of the major hydrocarbon accumulations occur in basins formed during the Mesozoic and the Cenozoic. Many of these basins, their contained sediments, and their structural and stratigraphically trapped oil and gas fields appear to be genetically related to the hypotheses of Plate Tectonics.

Of particular interest are those basins that formed at plate boundaries. Three fundamental methods of basin development according to type of plate margin deformation are reviewed: tensional, compressional, and shear-zone. Basin types, structural styles, and sedimentary histories are reviewed for different plate margins.

Significant intracratonic basins have developed as a result of shear zones "cracking" the cratons. Furthermore, impositional intracratonic "strand-sid" basins and their associated uplifts have resulted from viscosity inhomogeneities within the asthenosphere.

Many major worldwide eustatic changes in sea level appear to be due to the episodic nature of sea floor spreading. Accordingly, much of the paleogeographic history of our continents appears to be related to the hypotheses of Plate Tectonics.

FOURTH ANNUAL MEETING  
EAST LANSING, MICHIGAN  
1975

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The fourth annual meeting of the Eastern Section was held at Kellogg Center, Michigan State University, East Lansing, Michigan, October 5-7, 1975. The theme for this meeting was titled "Reefs and Evaporites". The Michigan Basin Geological Society was the host society for the meeting. Mr. James H. Fisher was the General Chairman, Mr. Wayne E. Moore was President of the host society. There were 311 registered for the meeting.

Attached is a copy of the Program, Minutes and Treasurer's Report for the Michigan meeting.



# The American Association of Petroleum Geologists

EASTERN SECTION

Minutes of the Annual Business Meeting

of the

Eastern Section

of the

American Association of Petroleum Geologists

East Lansing, Michigan

October 5-8, 1975

Kellogg Center, Michigan State University

The meeting was called to order at 1:30 p.m. by Eastern Section President James H. Fisher. The following delegates were in attendance:

James H. Fisher	- President - Eastern Section
Porter J. Brown	- Secretary-Treasurer - Eastern Section
John H. Buehner	- Illinois Geological Society
Arthur VanTyne	- New York State Geological Association
Wallace Dewitt	- Geological Society of Washington
Ralph Miller	- Geological Society of Washington
Vincent Nelson	- Geological Society of Kentucky
Gordon H. Wood, Jr.	- Geological Society of Washington
Robert L. Bates	- Ohio Geological Society
R. H. Alexander	- Ohio Geological Society
John Galey	- Pittsburgh Geological Society

It was announced that the officers for the 1975-76 year are: President, William C. MacQuown, Jr.; Vice-president, Ralph L. Miller; Secretary-Treasurer, Porter J. Brown. A tabulation of the officers from 1972-76 is attached.

Secretary-Treasurer Porter J. Brown submitted the secretary-treasurers report. It was noted that the section as of October 1, 1975 owns a \$5,000.00 Treasury note, had advanced \$900.00 to the Michigan Geological Society toward expenses for the East Lansing meeting and had \$218.13 in the bank. Outstanding debts are \$937.58 to the Ohio Geological Society.

President Fisher reported that an insurance policy to cover the three day meeting was purchased, costing 20¢/person and suggested that similar policies be purchased for future meetings.

The possibility of the Eastern Section sponsoring student speakers was discussed. Porter Brown made a motion that the incoming president, Mr. MacQuown, appoint an ad hoc committee to study the feasibility, desirability, and possible methods to be used in choosing the sponsored speakers. Arthur VanTyne seconded the motion and it was approved unanimously.

President Fisher suggested that in all future years the Eastern Section secretary contact the sponsoring society of the upcoming meeting, informing them of the 1/3-2/3 split of any possible profits from the meeting and requiring them to furnish a complete financial statement after the meeting to the Eastern Section treasurer.

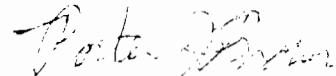
The Section constitution and by-laws were discussed and President Fisher suggested that the officers term of office, as stated in the by-laws, be changed to run from meeting to meeting with the current president conducting the first portion of the meeting discussing old business and incoming president conducting the last portion of the meeting concerning new business. Gordon Wood moved that President MacQuown appoint an ad hoc committee to study the constitution and by-laws and recommended amendments where necessary, and report their recommendations at the next annual meeting. Bill Perry seconded the motion and it was approved unanimously.

President Fisher announced that next year's meeting will be held October 6-8 in Lexington, Kentucky. The 1977 meeting will be a joint meeting in Washington, June 13-16 with the National A.A.P.G. organization. Mr. Porter Brown was directed to contact the Appalachian Geological Society regarding their sponsoring a Section meeting either in 1978 or 1979.

Charlotte Schrieber won the Levorsen Memorial Award for the best paper presented at the Michigan meeting.

Meeting adjourned.

Respectfully submitted,



Porter J. Brown  
Secretary-Treasurer

Attachments

TREASURER'S REPORT  
EASTERN SECTION A.A.P.G.  
1974

<u>BALANCE</u>	January 1, 1974	\$ 2,170.23
<u>DEPOSITS</u>	1974 Convention Proceeds	3,134.24
	Tax Refund Including \$51.12 Interest	735.60
	Booth Rental Pittsburgh Meeting	<u>50.00</u>
	Total Deposits	\$ 3,919.84
	TOTAL	\$ 6,090.07
<u>WITHDRAWALS</u>	\$5000 8% Treasury Note	\$ 5,134.81
	Rental - Safety Deposit Box	<u>9.39</u>
	TOTAL	\$ 5,144.20
	Balance in Bank . . . 12/31/74 . . . . .	\$ 945.87

Porter J. Brown  
Treasurer

TREASURER'S REPORT  
 EASTERN SECTION A.A.P.G.  
12/31/74 THROUGH 10/1/75

<u>BALANCE</u>	December 31, 1974	\$ 945.87
<u>DEPOSITS</u>	Interest from Treasury Note	<u>400.00</u>
	Total	\$ 1,345.87
<u>WITHDRAWALS</u>	Lawyer - Additional Work Tax Refund	\$ 150.00
	Advance for Eastern Section 1975 Meeting	900.00
	Letterheads and Stationary	74.68
	Service Charge on Bank Account	<u>3.06</u>
	Total	\$ 1,127.74
	Balance in Bank . . . 10/1/75 . . . . .	\$ 218.13

Note: The Pittsburgh Geological Society's 1/3 of Pittsburgh Meeting profit was \$1,543.72 paid 9/16/74.

The profits from the Ohio Meeting was \$2,812.75, 1/2 of which is \$937.58. This will be paid when the money is available.

Porter J. Brown  
 Treasurer



AMERICAN ASSOCIATION  
OF PETROLEUM GEOLOGISTS  
EASTERN SECTION  
FOURTH ANNUAL CONVENTION

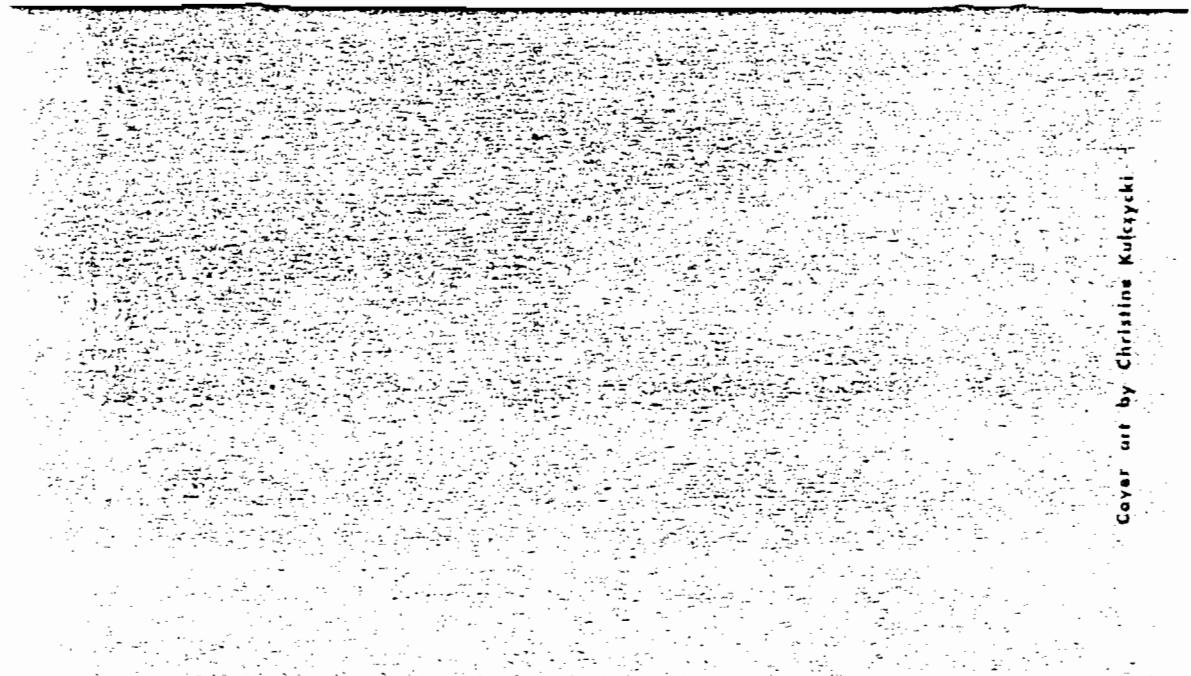
OCTOBER 5-7, 1975  
KELLOGG CENTER  
EAST LANSING, MICHIGAN

*Reefs  
and  
Evaporites*

MICHIGAN BASIN  
GEOLOGICAL SOCIETY



Cover art by Christine Kulczycki



## Welcome

### WELCOME TO MICHIGAN

On behalf of the Eastern Section of the American Association of Petroleum Geologists and the Michigan Basin Geological Society, your co-hosts at this Fourth Annual Convention, we extend to you a hearty welcome to the campus of Michigan State University.

As our energy crisis becomes more acute and petroleum exploration increasingly difficult, it is indeed appropriate to sponsor a meeting devoted to the exchange of technical information on reef exploration. The participation in this meeting of representatives from all over the United States and Canada is an indication of the dedication of industry, government, and universities alike to the solution of our energy problems.

We hope that you will find the technical sessions informative, the surroundings pleasant, and the arrangements convenient.

**James H. Fisher**  
President  
Eastern Section AAPG  
  
**Wayne E. Moore**  
President  
Michigan Basin  
Geological Society

## Officers

### EASTERN SECTION - AAPG

**James H. Fisher** - President  
**William C. McQuown, Jr.** - Vice Pres.  
**Porter J. Brown** - Secy. - Treas.  
**Gordon H. Wood, Jr.** - Advisory Council

### MICHIGAN BASIN GEOLOGICAL SOCIETY

**Wayne E. Moore** - President  
**Michael W. Barratt** - Vice President  
**Michael A. Feldman** - Secretary  
**Richard T. Albrecht** - Treasurer  
**William B. Fleck**, - Business Manager

## *Convention Committee*

### *Sponsor*

#### **GENERAL CHAIRMAN** James H. Fisher, Michigan State University

#### **CONVENTION FACILITIES**

W.T. Sandefur, Michigan State University

#### **EXHIBITS**

Curtis L. Lunday, Mich. Consol. Gas Co.

#### **ENTERTAINMENT**

O. Lee Shayton, Getty Oil Co.

#### **FINANCE**

Aureal T. Cross, Michigan State University

#### **FIELD TRIP CO-OR.**

Paul A. Catacosinos, Delta College

#### **HONORS AND AWARDS**

Chilton E. Prouty, Michigan State University

#### **LADIES PROGRAM**

Doreen Caubrey, Michigan State University

Claire Sibley, Michigan State University

#### **PAINTING**

Earl Schmidt, Kafka and Schmidt

#### **TECHNICAL PROGRAM**

Louis L. Briggs, University of Michigan  
William F. Mantek, Consumers Power Co.

#### **COCKTAIL PARTY**

CEDCO Drilling Co.  
Core Laboratories, Inc.  
Don Yarie Drilling Co.  
Dowell  
Eastman Whistock, Inc.  
Halliburton Services  
Janest Bigard Drilling Co.  
Lease Management, Inc.  
Magruder, Dresser Oilfield Prod. Div.  
Midway Supply Co.  
Mika, Meyers, Reckott and Jones - Attorneys  
North American Drilling Co.  
Nelson Trucking Co.  
Petroleum Information Corp.  
Petrotech, Inc.  
Schlumberger Well Services  
Seismograph Service Corp.  
Tooke Engineering

#### **COCKTAIL PARTY REFRESHMENTS**

Tooke Engineering

#### **WELCOME FOLDERS**

Miller Brothers

#### **COFFEE BAR**

Schlumberger Well Services

**DISCUSSION SESSION REFRESHMENTS**  
Michigan Basin Geological Society

## *Technical Exhibitors*

### AMERICAN ASSN. PETROLEUM GEOLOGISTS

Tulsa, Oklahoma

MI. PLEASANT, Michigan

### CORE LABORATORIES, INC.

MI. PLEASANT, Michigan

### DRESSER - ATLAS

Houston, Texas

### MERRITT ENTERPRISES

East Lansing, Michigan

### SCHLUMBERGER WELL SERVICES

MI. PLEASANT, Michigan

### SEISMOGRAPH SERVICE CORP.

Alma, Michigan

### TRAILBLAZER GEOLOGICAL ASSOC.

Denver, Colorado

## *Calendar of Events*

### SUNDAY, OCTOBER 5 -

1:00 - 5:00 REGISTRATION - Lobby  
5:30 - 7:00 Cocktail Party - Big Ten Room

### MONDAY, OCTOBER 6 -

7:30 - 8:30 Speakers Breakfast Red Cedar Room A  
8:00 - 9:30 Technical Exhibits - Lincoln Room A and B  
8:00 - 9:30 Educational Exhibits - Room 106  
8:50 - 9:00 WELCOME Auditorium

9:00 - 10:30 Ladies Entertainment - Room 106  
9:00 - 12:00 Technical Program - Auditorium

12:00 - 1:30 Luncheon AAPG Big Ten Room  
1:30 - 4:30 Technical Program - Auditorium

4:30 - 6:00 Discussion - REFRESHMENTS SERVED  
in Contenued Room

6:30 - 8:30 BANQUET - Big Ten Room

Presentation to John T. Gidley.  
Presentation of Leinenen Award to Douglas G. Patchen.  
"Records and Exporters" by Laurence L. Shors

### TUESDAY, OCTOBER 7 -

8:00 - 4:00 Technical Exhibits - Lincoln Room A and B  
8:00 - 4:00 Educational Exhibits - Room 106  
9:00 - 12:00 Technical Program - Auditorium  
12:00 - 1:30 Luncheon Big Ten Room  
12:15 - 1:30 AAPG Luncheon - Red Cedar Room A

Society Presidents  
Society Delegates  
Eastern Section Committees  
Eastern Section Officers

Note: A business meeting of the Eastern Section  
will follow this luncheon

1:30 - 3:30 Technical Program - Auditorium

## *Educational Exhibitors*

### MICHIGAN BASIN GEOLOGICAL SURVEY

### WEST VIRGINIA GEOLOGICAL SURVEY

## Technical Program

### MONDAY MORNING — AUDITORIUM

Presiding — *P. William Cambray*

Presiding — *Wayne E. Moore*

\*denotes speaker

- 2:30 JOHN B. DROSSTE and ROBERT H. SHAVER\*: Cationation of Salina Evaporite Cycles of the Michigan Basin and Reef-bearing Blocks of the Wabash Platform.
- 3:00 B. CHARLOTTE SCHIFFMAYER\*, HARMONDO CATALANNO and EDWARD SCARREIBER: An Evaporitic Lithofacies Continuum — Continental to Subaqueous Deposits.
- 3:30 ROY D. KIRK\* and GERALD M. FRIEDMAN: Sedimentology and Diagenesis of the Lower Salina Group (Upper Silurian) Evaporites in the Michigan Basin.
- 4:00 PETER SONNENFELD\*, P. P. HODGE, J. A. BOON and A. TUTZEK: Rose Metal Concentration in a Density-Stratified Evaporite Unit.
- 4:30 DISCUSSION — CENTENNIAL ROOM
- TUESDAY MORNING — AUDITORIUM**
- Presiding — *Roy D. Nami*  
*Dan Gill*
- 9:00 ROBERT J. VINOOPAL\* and ALAN H. COOGAN: Effect of Shape Sorting on Porosity of Carbonate Sands and Gravels.
- 9:30 F. JEFFREY LUGCA: Sulfur Domination of Niagaran Reefs in Northern Limn of Michigan Basin.
- 10:00 MICHAEL L. TURFSH: Evaporative Solution Phenomena in the Salina Group (Late Silurian) in New York State.
- 10:30 MICHAEL W. HARRATT\*: Salt Gaffapace Phenomenon Features in Michigan.
- 11:00 EDWARD L. THEMBA\* and G. FAURE: Isotope Composition of Stratiform Evaporites from the Oceans Series of New Mexico and the Cayugan Series of Ohio.
- 11:30 C.N. McCOLLAUGH, JR.: Origins of Pale Filling Salt in the Niagaran Reefs of Northern Michigan.
- MONDAY AFTERNOON — AUDITORIUM**
- Presiding — *W. Thomas Straw*  
*John M. Hu*
- 1:30 R. DAVID MATTHEWS: Evaporite Cycles in the Devonian at Midland, Mich.
- 2:00 RON BUDDE\* and LOUIS L. BRIGGS: The Depositional Environment of the Buff Formation in Southeast Michigan.

**TUESDAY AFTERNOON - AUDITORIUM**

*Presiding - Charles L. Smith  
Girard D. Ellis*

- 1:30** R.A. SAMESNA\*, S.M. WATSHAFER, D.G. PATCICHEN, and  
W.A. PERRY:  
Relationships Between Pandoway Limestone Environments  
of Deposition and the Distribution of Salina Evaporites in  
West Virginia.

- 2:00** MANN C. DONALDSON\*, MELTON T. HEMD, JOHN J.  
RENTON, and STEVEN M. WARSHAFER:  
Depositional Environment of Rome Trough Rocks, Mingo  
County Well, West Virginia.

- 2:30** A. JANSSONS:  
Distribution of Potassium (?) - bearing salt in the Subsurface  
Schorian Rocks of Northeast Ohio.

- 3:00** ROBERT C. SHUMAKER:  
Relationships of Paleozoic Thalassinoides and Ongcav in  
the Mid-Continental Region.

**ABSTRACTS OF PAPERS**

**BARRATT, MICHAEL**, Michigan Gas Utilities

*Salt Collapse Phenomenon Features in Michigan*

No abstract available.

**BEINKAFNER, KATHIE J.**, New York Geological Survey  
*Statistical Probability of Finding Gas-Bearing  
Reefs in the Onondaga Formation Edgecliff  
Member in N.Y. State*

A finite number of Edgecliff reefs has been mapped along the arcuate Onondaga outcrop band extending east from Buffalo to Albany and turning south toward the intersection of New York, New Jersey and Pennsylvania. Twenty-one of the reefs are clustered in the Albany area and two at Williamson near Buffalo. The first discovered subsurface gas-bearing reef was the Hackford Field in Jasper Town, Steuben County, drilled in 1967. The Adrian, Thomas Corners, and Stone Hill Fields have been found farther north in the same county. Plotting the reefs in these three areas does not clearly define a pattern of shallow water reef growth; hence, finding reefs is more difficult than drilling along a trend. Where and how many are the unknowns. A statistical estimation of how many reefs exist, may influence future drilling fervor.

The area of reefs in outcrop ( $RO$ ) and the area of the Edgecliff outcrop ( $EO$ ) is measured; whereas the area of the subcrop ( $ES$ ) is calculated. With a comparison of the ratios of reef to rock for outcrop and subcrop, the area of reef subcrop ( $RS$ ) is estimated by  $RS = (RO \times ES)/EO$ . Probability of gas-bearing based on drilled samples and average reef area is taken into consideration to determine how many reefs may yet be undiscovered in the subsurface.

**BUDROS, RON**, Continental Oil Co., Houston, Tex.  
and BRIGGS, LOUIS I., University of Michigan

*The Depositional Environment of the Ruff Formation  
in Southeast Michigan*

The Ruff formation, which has been proposed as the formal name for the informal A-1 Carbonate Unit (Budros, 1974), occurs in the basal portion

of the Salina Group and lies between A-1 Evaporite below and the A-2 Evaporite above in the Michigan basin.

It is basically a brown to dark gray-brown, fetid, unfossiliferous carbonate mudstone which can be limestone, dolomitic limestone or dolomite. Lithofacies based upon associations of subordinate lithologic constituents within the carbonaceous mudstone. The lithofacies are: A. Microlaminated mudstone lithofacies; B. Leached mudstone lithofacies; C. Pelletal wackestone/packstone lithofacies; D. Thinly laminated mudstone lithofacies; E. Nodular anhydrite lithofacies.

The Ruff Formation is interpreted as being deposited primarily in the shallow subtidal to infratidal zones of a quiet, protected, hypersaline, reducing environment with limited deposition on ephemeral tidal to supratidal flats.

In Southeast Michigan, the basal portion of the Ruff Formation was intertidal flat algal-laminated mudstone which transgressed over the A-1 Evaporite, its supratidal facies equivalent. The remaining Ruff Formation was primarily subtidal to infratidal microlaminated mudstone with intratidal to intertidal pelletal wackestone/packstone occurring near the Niagara reef peripheries. This was interrupted by the development of ephemeral tidal flats at the reef peripheries in which nodular anhydrite was deposited. The uppermost portion of the Ruff Formation was the subtidal facies equivalent of the lowermost A-2 Evaporite which was essentially a prograding supratidal flat.

The Ruff formation along the northern shelf region, which was described by Ihl (1973), has similar lithofacies but the distribution of the lithofacies and their relation to the Niagara pinnacle reefs are different. This is apparently a result of differential tectonics within the Michigan Basin. The lithologies seen in the A-1 Evaporite also illustrate this situation. These differences within the Ruff Formation may shed some light on the recent reef-evaporite discussion by Gill, and Mesolella and others (1975).

DORALDSON, ALAN C.; HEALD, MILTON T.; REHDER, JOHN J.; and WARSCHAUER, STEVEN M., West Virginia University

*Depositional Environment of Rome Trough Rocks, Mingo County Well, West Virginia*

In 1972, Columbia Gas Transmission Corporation completed a deep test in the Rome Trough located

In Mingo County, West Virginia. Although the well penetrated the precambrian crystallines at 19,527 feet and the anticipated expanded Rome sequence from 10,840 to 19,527 feet, it failed to yield commercial gas or appreciable Cambrian sandstone. Instead, thick shale and interbedded carbonate and shale sequences were encountered.

At depth 17,906 to 17,915 feet, fossils in shale include alyptoptomataids (Ithyolithes), inarticulate brachiopods (Lingulids), and trilobites (*Alokistiscarella*) which indicate a shallow marine depositional environment and a Middle-Upper Cambrian age.

Interval 16,201 to 16,260 feet is a carbonate sequence which lithologically is similar to the Elbrook and Bone-Maynesboro carbonates of the Shenandoah Valley. Rocks consist of 1 to 4-inch beds of argillaceous finely crystalline dolomite, finely crystalline dolomite to calcitic finely crystalline dolomite, dolomitic calcilutite, and calcareous dolomite, dolomitic calcilutite, and calcareous dolomite which occur in cycles. Algal mats and stromatolites suggest a tidal-flat depositional environment. Coarser grained limestone represent tidal-channel deposits. Organic matter is associated with the clays of the argillaceous dolomites although interstitial and vugular accumulations of organic matter occur in the "cleaner" dolomitized algal limestones.

No porosity was observed in thin section analysis as pores, vugs, and fractures presently are filled with secondary carbonate or secondary quartz. Diagenetic changes occurred in several stages. Lack of abundant pressure solution effects suggests extreme loading and tectonic stresses were not significant. Organic content is sufficient to produce a petroleum-gas prospect but reservoir conditions in this carbonate sequence appear "tight". Equivalent detrital sandstone facies apparently occur west of the Mingo County well.

DROSTE, JOHN B., Indiana University, and SHAVER, ROBERT H., Indiana University and Indiana Geological Survey

*Culation of Salina Evaporite Cycles of the Michigan Basin and Reef-Bearing Rocks of the Wabash Platform*

A large part of the 500-foot post-tectonic sequence in northeasternmost Indiana and its down-dip salt-bearing equivalent facies of the Silurian reef-bearing rocks of the Wabash Platform. These platform rocks are thicker than

400 feet in places along the Fort Wayne Bank, in the structural low across the Kankakee Arch, and along the Terre Haute Bank flanking the proto-Illinois Basin, where some reefs may have grown uninterrupted into Early Devonian time. Salina and Salina-equivalent rocks of Indiana lack salts and anhydrites, but they reflect basinal evaporite cyclicity as far south was Indianapolis. Apparently no major unconformity intervenes internally, and in the up-dip area carbonates probably replace salts laterally.

A typical salinity-influenced carbonate cycle in Indiana consists of dark-colored partly laminated micrites (related to above-normal salinity) overlain by lighter colored coarser grained material (more normal salinity). Cycles are obscured in places by reefs, reef desilts, and dolites and thus by patchy distribution of given lithologies. Terrigenous sediments from southerly sources also complicate interpretation.

Our suggested collation of platform rocks with Michigan Basin Salina units is: (1) upper, brown Salamonie--part of A unit; (2) Walron through middle Louisville--upper part of A unit and B evaporite; (3) upper Louisville and Wabash (Mississinewa and Linton Creek members)--C shale possibly through f evaporites and into G dolomite; (4) Kokomo (Salina formation)--F evaporites; and (5) Kenneth (Salina)--part of F or G. Possibly three major reef-start times were coordinated with periods of more normal salinity during late Salamonie, late Louisville and Mississinewa, and Kenneth deposition. Some first generation reefs aborted during a period of above-normal salinity, but many others grew through all the interreef cyclicity. The platform units indicating greatest above-normal salinity are: part of the upper, brown Salamonie, the micritic part of the Walron-Louisville section, and the Kokomo. These Salina-like carbonate tongues extend well into central Indiana and form transgressive-regressive facies within named units.

We do not know precisely where the D-salt event of the basin fits in the platform record, but the 300-foot reef section in the Wabash Formation alone and the multiple-cycled Kokomo and closely associated rocks (suggesting F-unit cycles) indicate a relatively thick and complete platform buildup that continued beyond C-unit deposition. These interpretations, calling for continuous and even Late Silurian deposition on the platform, do not favor some current ideas on thick salina evaporites, hundreds of feet of drawdown and refluxing, and near-dessication of the Michigan Basin.

HITCHAM, WILLIAM J., Tenneco Oil, Oklahoma City, Oklahoma and FISHER, JAMES H., Michigan State University

#### The Salina Group of the Southern Michigan Basin

The Salina sequence is well defined in the central part of the Michigan Basin where evaporites are present. South of the evaporite zone in Indiana and Ohio these units are not readily delineated.

Data obtained from gamma-ray logs was utilized in the construction of Isopach maps for each unit of the Salina with the exception of F and G which were grouped. The outline of the massive Niagara reef of southern Michigan was superimposed on each map. The A-1 evaporite changes from salt to anhydrite north of the massive reef and does not cross the massive reef. The A-1 carbonate thickens in the pass areas of the massive reef but is still confined to the Michigan area. A-2 evaporite is similar in pattern to A-1 evaporite. The first major transgression across the massive reef into Ohio and Indiana occurs in A-2 carbonatic time. The B- and C-units wedge out in the vicinity of the Fort Wayne Bank. The D-Unit shows a major regression into the deeper Michigan basin which is continued in the E-, F-, and G-units.

Based on the above maps, three depositional models are proposed:

- (1) The Fort Wayne Bank forms first. A relative drop in sea level creates the southern massive reef of Michigan. A re-advance of the sea during A-2 carbonate and B-Unit time creates formations that lap up on the margin of the Fort Wayne Bank. Regression begins in B-Unit time.
- (2) The southern massive reef of Michigan forms first. A relative rise in sea level creates the Fort Wayne Bank which continues to grow through C-Unit time. This means that the Michigan Basin evaporites would be deep water deposits.
- (3) The massive reef of southern Michigan forms first. A further rise of sea level in Niagara time creates an embryonic Fort Wayne Bank. A relative drop in sea level during A-1 evaporite through A-2 evaporite time exposes the Fort Wayne Bank and the Michigan massive reef to erosion while shallow water deposition is occurring in the Michigan Basin.

re-advance of the sea in A-2 carbonate through C-unit time creates further growth in the Port Wayne and Michigan massive reefs. Regression occurs in B-unit time.

FRIEDMUTH, GERALD M., Rensselaer Polytechnic Institute

*Can Reefs and Evaporites Form in Stratigraphic Contact During One Depositional Cycle?*

*Answer from a Quaternary Example*

In modern depositional environments reefs and evaporites are mutually exclusive. This antipathetic relationship stands to reason. Reef-building critters do not survive under the hypersaline conditions which precipitate evaporite minerals. They prefer not to be pickled in brine. Yet in the rock record reefs and evaporites occur together.

Emergent Pleistocene sea-marginal reefs and neighboring hypersaline pools of the Red Sea shoreline may explain this contradiction. In these pools gypsum precipitates as a meshwork between algal mats and forms laminae comparable to the laminated gypsum of the rock record. Halite likewise precipitates. These modern evaporites bury emergent reefs. Thus if extrapolated to the rock record: (1) critters built reefs under normal marine conditions, (2) the sea receded or the reefs emerged, and (3) in a tropical-arid setting sea-marginal or continental evaporites migrated across the subaerially exposed reefs. Two cycles of deposition followed in sequence; live reef-building critters were not exposed to brine. An interval of emergence separated reef construction and evaporite precipitation.

JANSSENS, A., Ohio Geological Survey  
*Distribution of Potassium(?)-bearing Salt in the Subsurface Silurian Rocks of Northeast Ohio*

The areal and stratigraphic distributions of highly radioactive gamma ray responses of Silurian probably potassium-bearing salt beds of northeast Ohio have been examined. In all cases the gamma ray through these beds goes off scale, and in five of the wells the caliper log shows hole enlargement indicative of salt beds. These beds, first mentioned by Clifford (1973), are found in Asitalula (Salina D unit), Holmes (E and F), Lake (F<sub>2</sub>), Mahoning (F<sub>2</sub>, F<sub>3</sub>, F<sub>4</sub>), Medina (F<sub>1</sub>), Portage

(F<sub>2</sub>, F<sub>3</sub>, F<sub>4</sub>), and Wayne (E and F) Counties. Maximum thickness found is 48 feet. Except in the F<sub>2</sub>, the beds follow the updip salt limits closely. In Wayne County, where 17 logged wells have penetrated potassium(?) bearing salt, subsea depths to the salt range from 1100 to 1500 feet. In view of these shallow depths and the demand for potassium, it is recommended that core be taken to determine the composition of the salt.

KAHLE, CHARLES F., Bowling Green State Univ.

*Silurian History of the Michigan Basin as Recorded in Rocks Near Toledo, Ohio*

About 400 ft. of Silurian rocks are exposed in quarries in this region along the southeastern margin of the Michigan basin. The generalized vertical sequence of Silurian rocks is partly brecciated, massive, mainly stromatoporoid-coral-hyozonit-echinodermal "reefy" dolomite (Guelph? Formation) overlain by non-fossiliferous, bedded dolomite containing algal stromatolites and molds of evaporite minerals (Greenfield? Formation?). This sequence correlates, respectively, with reef rock in pinnacle reefs and the A-1 carbonate associated with such reefs in the Michigan basin, except in terms of thickness.

In the Toledo region, calcareous crusts occur at different levels below the top of the Guelph? and indicate that this unit was exposed subaerially during its formation, at least intermittently, as a result of fluctuations in sea-level. Assuming that such sea-level changes were due to evaporative drawdown and that the Guelph? is entirely Niagaraan, then episodes of evaporative Cayigan evaporite deposition in the Michigan basin. Evidence of subaerial exposure occurs at the top of all Guelph? rocks exposed in the Toledo region and, at Maumee, manifested by extensively developed vadose pisolithes. Such evidence supports the idea (Gill and others, 1975) that a widespread subaerial unconformity was present in the Michigan basin region during or at the end of the Niagaraan.

Limpid dolomite crystals, common in the Greenfield? record subaerial exposure and freshwater flushing of this unit that resulted from tidal fluctuations in a tidal flat environment and may have also resulted from evaporative drawdown in the Michigan basin.

LUCIA, F. JERRY, Shell Oil Company, Houston, Tex.

*Saltina Dolomitization of Niagaran Reefs in  
Northern Rim of Michigan Basin*

Over 200 Niagaran reefs have been discovered by drilling the northern rim of the Michigan Basin. These reefs are located on a gentle ramp which extends from the Niagaran shelf margin out into the basin. The lithology of the reefs changes from dolomite to limestone in a basinward direction. The control for this pattern appears to be the depositional and diagenetic history of the Salina A-1 Carbonate formation.

The regional pattern of dolomitization in the A-1 Carbonate is similar to the pattern of reef dolomitization. The A-1 Carbonate was deposited in two stages: 1) over the reefs during a high stand of sea level and 2) interreef during a receding sea level. Tidal flats developed over the reefs during stage 1, dolomitizing the reef tops. During Stage 2, tidal flat sediment accumulated at the shelf margin and prograded seaward. In addition, the receding sea level exposed an increasing area of sediment to tidal flat conditions. The interreef A-1 Carbonate and the Niagaran reefs engulfed in this tidal flat were dolomitized.

MATTHEWS, R. DAVID, Dow Chemical Company,  
Midland, Michigan  
*Evaporite Cycles in the Devonian at Midland,  
Michigan*

A study of individual salt beds of Devonian age at Midland, Michigan was based on core descriptions from closely-spaced wells and from other subsurface data. This evaporite section is of little economic interest to the petroleum industry and few accurate subsurface data have been available to previous workers. Early in the study many evaporite cycles were defined and numbered informally for identification. Several cores exhibited uninterrupted cyclic deposition with time in a purely autochthonous system in which the depositional environments changed gradually as the parent brines vacillated through a variety of salinity conditions from highly saline to nearly normal sea water. Occasionally, the smooth vertical flow of evaporite lithofacies in the cores was found to be broken, but on a rather minor basis considering both map position

and depositional time.

Although the informal stratigraphy developed was intended to be local in application, it has been possible to correlate some of the cycles from Ludington on the west edge of the salt to Saginaw County at the southeast edge of the Detroit River salts. Tentative correlations of some of the sulfate facies have been extended into Ontario. It is concluded that (1) the cycles can be correlated, (2) the correlation by cycles is a valuable adjunct to lithologic correlation and in many cases it is superior, (3) the peaks and lows of the cycles record time lines, (4) time lines cross lithologic boundaries repeatedly, (5) with each new cycle, available space in the depositional basin was filled with the evaporite lithofacies appropriate to the local salinity gradient and to the map position of those gradients as the influence of the brine body changed with the cycle, and (6) a predominately halite facies can change laterally into a sulfate facies having little or no salt and these minerals can be deposited synchronously and in nearly equal thicknesses over distances as great as 38 miles.

MCCINTOCK, PETER L., Seismograph Service Corp., Alma, Michigan

*Seismic Data Processing Techniques Used For  
Northern Michigan Reefs*

Improvements in data processing techniques, including powerful new software and greater personal involvement, have manifested in specialized techniques that yield greater confidence in identifying northern Michigan reefs. These include true relative amplitude processing, deconvolution, automatic statics combined with manual statics, etc. Examples are shown from several areas to demonstrate data problems and the processing used to yield improved data quality and therefore improved interpretations.

MCCOLLOUGH, C. N. JR., Shell Oil Company, Houston, Texas

*Origins of Pale Filling Salt in the Niagaran  
Reefs of Northern Michigan*

The bromide content of halite is directly related to the bromide concentration of the brine

from which the halite precipitated. Measurements of the bromide content of the Silurian Salina A-1 and A-2 salts show that the A-1 seas were about twice as rich in bromide as the A-2 seas (120 ppm. vs. 60 ppm.). Comparison of these values with those from halite in the pores of the reefs indicate that a major part of the salt plugging of reef porosity was from direct precipitation from water like that of A-1 salt seas. A portion of the pore filling salt in the reefs is indicated to have been precipitated from A-2 sea water or to have undergone solution and re-precipitation. Plugging salt in the A-1 Carbonate appears to have been derived from A-2 sea water.

The mechanism and distribution of salt plugging are not yet understood. The occurrence of A-1 type halite in the upper part of several reefs suggests that the reefs were fully grown and had been exposed to leaching prior to A-1 salt time.

MC SULLA, KIRKETT J., Weaver Oil and Gas Corp., Houston, Texas

*Paleogeographic Aspects of Silurian Deposition, Michigan and Appalachian Basins*

An intense search by the petroleum industry for hydrocarbon-bearing reefs in the Michigan basins has provided the stimulus for gathering paleogeographic information concerning the depositional setting of Silurian carbonates and evaporites in that area. This information has been useful in delineating major reef trends in the Michigan Basin and also has served as a "model" for a better understanding of closely related Silurian strata in the Appalachian Basin. In the Michigan Basin, dolomitized Middle Silurian (Niagaran) carbonates several hundred feet thick surround the basin and grade inward into less than 100 feet of limestone. The transition from thick, basin-margin dolomites to thinner, basin-interior limestones is marked by the occurrence of pinnacle reefs which extend in a nearly continuous belt or "fairway" around the basin. It is now generally recognized that the thick, basin-margin carbonates were generated by a massive, prograding barrier reef complex and that the relatively thin basin-interior limestones represent deposition in somewhat deeper water. Extensive reef topography which developed largely during the Middle Silurian was filled progressively by Upper Silurian (Salina) halite units. The

oldest halite units to be deposited in the Michigan Basin (A-1 and A-2 evaporites) pinch out basinward of the barrier-reef complex. However, thick halite beds deposited during the younger B Evaporite phase extend from the basin-interior outward across the barrier reef complex in several areas.

In the Appalachian Basin, evidence is available which suggests the existence of another distinct Middle Silurian depositional basin in Ohio. As in Michigan, several hundred feet of dolomitized Niagaran reef carbonates are present at the margins of the basin. The massive reef dolomites grade basinward into thinner, more argillaceous dolomites and limestones. The basin is further defined by a sheet of A-1 anhydrite which covers much of the basin-interior. Pinnacle reefs are common within the basin. Several factors suggest, however, that this basin may have been somewhat more shallow than the Michigan Basin.

The prograding basin-margin carbonates in Ohio are approximately one-half the thickness of those in Michigan. The pinnacle reefs occur throughout the basin rather than being limited to the basin margins as in Michigan. Also, whereas several hundred feet of basin-filling halite are associated with the A-1 and A-2 evaporite phases in Michigan, no A-1 or A-2 halite has been noted in Ohio.

East of the depositional basin in Ohio, it appears that the general environment of deposition during the Middle Silurian became progressively more shallow. The Lockport dolomite of the western Appalachian Basin probably represents deposition on an extensive, relatively shallow-water shelf. The dolomites of the Lockport grade southeastward into interbedded limestones and shales of the McKenzie Formation in the eastern Appalachian Basin. Although the environment of deposition of the McKenzie is not well understood, much of this formation may represent mud flat deposition along the margins of "Appalachia".

NURIA, ROY D., Schlumberger-Doll Research Center, Ridgefield, Connecticut, and FRIEDMAN, GERALD M., Rensselaer Polytechnic Institute

*Sedimentology and Diagenesis of the Lower Salina Group (Upper Silurian) Evaporites in the Michigan Basin*

Sedimentological analysis of the lower Salina Group and the distribution of its evaporite and carbonate lithofacies suggest that the Michigan Basin was periodically desiccated during the early

**Cayugan.** The deposition of the Salina Group began with sea-level lowering at the end of the Niagara. The pinnacles and marginal platform were subaerially exposed during the first major Cayugan sea-level lowering as evidenced by erosional features; weathering surfaces (siliceous crusts, clay stains), and diagenetic features of vadose origin directly below the Salina Group. In the basin-center area, Cayugan sedimentation began with the subaqueous interstitial precipitation of lenticular gypsum crystals. Sulfate-reducing bacteria may have restricted or prevented the accumulation of gypsum at the sediment-water interface. The lenticular gypsum crystals have been replaced by finely crystalline anhydrite. Anhydrite laminae formed by coalescence in zones where gypsum crystals were abundant. This inter-laminated limestone and anhydrite, the basal lithofacies of the Salina Group, is transitional with the Middle Silurian limestones and in the basin-center area, is interbedded with the A-1 salt. On the northeastern interimmacle area, the carbonates and evaporites coeval to the limestone-anhydrite laminae are shallower-water deposits that have undergone extensive halite replacement. These rocks include nonplanar and planar stromatolites, flat-pebble halite concretions, and vertically orientated, prismatic gypsum crystals replaced by halite. These crystal forms are suggestive of precipitation at the sediment-water interface. Marine-playa stages, or periodic desiccations, are marked by sylvinitic and calcium-borate precipitation, erosional solution surfaces, gypsum and halite sands, and halite crystals having chevron-shaped zones of brine inclusions.

After the deposition of the basinal, subtidal A-1 carbonate the Cayugan sea again contracted to the basin-center area. Evidence for this sea-level lowering is found at the top of the A-1 carbonate basinward of the pinnacles and includes erosional surfaces, channels, lily-type stromatolites, nodular anhydrite, and disrupted crusts. Within the carbonates above and below the A-1 salt in the center of the basin, sedimentological features such as ooids, peloids, planar and nonplanar stromatolites, and nodular anhydrite, indicate shallow-water deposition. Extensive replacement by halite has masked or obliterated many sedimentological features but has preserved algal growth forums within stromatolitic zones.

SCHREIBER, B., CHARLOTTE, Queens College (City University of New York); CATALDO, RAIMONDO, Universita di Palermo, Palermo, Italia; and SCHREIBER, EDWARD, Queens College (City University of New York)

#### An Evaporitic *Lithofacies Continuum - Continental to Subaqueous Deposits*

Evaporitic deposits have been typified as either supratidal or as subaqueous, and these two realms curiously never seem to meet. In the Messinian deposits of Sicily, however, we find that depositional continuity is complete. This region exhibits the results of the synchronous formation of subtidal sulfate deposits landward of the basin margins, supratidal sulfate, carbonate and salt deposits on the landward edges, intertidal and subtidal sulfate, carbonate and salt deposits seaward of the margins, and basinal sulfates, carbonate-rich shales and salts out in the deeper waters. Clastic debris, reworked from adjacent continental areas and from shallow water are among the sediments commonly observed. These clastic components also include some of the carbonate and sulfate formed in the shallower-water environments of the sea. It must be noted that a fauna of skeletal material, other than algal debris and the shells of a few varieties of specialized gastropods was produced within the hypersaline sea. The only exceptions to this were in marginal lagoons or in isolated arms of the sea, into which considerable fresh water flowed. A complication in this tidy model is the fact that a large hypersaline basin is in a delicate balance between evaporation and influx. A small variation in this balance will result not only in a marked salinity change but also may produce a significant change in sea-level (i.e. draw-down). Indeed the shoreline of a hypersaline basin may migrate from time to time, probably pausing successively at certain elevations, the configurations of which represent more or less stable points in the water budget. The result of this sea-level and salinity fluctuation pattern is reflected in marked vertical changes in deposition at any given site.

SHUMAKER, ROBERT C., West Virginia University Relationships of Paleozoic Taphrogeny and Orogeny in the Mid-Continent Region

This paper reports the results of a tectonic compilation which suggests that there is a relationship between Lower Cambrian block faulting and the subsequent development of the middle and upper Paleozoic basins of the continental interior. Evidence relating the early tectonic history of the Appalachian orogenic belt is found within the craton.

SNOOKSMA, R. A.; MARSHAUER, S. M.; PATCHEN, D. G., West Virginia Geological Survey; and PERRY, W. J., U. S. Geological Survey, Reston, Va.

*Relationships Between Tonoloway Limestone Environments of Deposition and the Distribution of Silicic Evaporites in West Virginia*

In the outcrop areas were deposited on intertidal flats. The middle member was deposited in environments where water depths fluctuated from intertidal to shallow subtidal to deeper subtidal. A parallel sequence of environments is represented under the eastern plateau where salinities apparently increased toward the depo-center of the basin. In general, a widespread transgression was responsible for the more normal marine conditions in the middle member.

SONNENFELD, P.; HILLE, P. P.; DOON, J. A.; and TUREK, A., University of Windsor, Windsor, Ontario  
*Base Metal Concentration in a Density-Stratified Evaporite Pan*

The Upper Silurian Tonoloway Limestone at Pinto, Maryland, is divided into 3 informal members on the basis of field, paleontologic, and petrographic studies. The lower member is characterized by thin bedding, stromatolites, gypsum pseudomorphs, intraclasts, and mud cracks. The rocks are typically laminated dolomite and pehnicrite. In the field and in thin section, this member is similar to the upper one. The faunal diversity is extremely low in both. The middle member, composed of dolomite sparite and bivalcrite, is more fossiliferous than either of the other members and shows an extreme variability in the development of communities. This member can be traced along the Silurian outcrop belt from Pinto, Maryland, to Pendleton County, West Virginia. Under the eastern Plateau in West Virginia, silty, argillaceous beds in the Keyser Formation above the Tonoloway and in the upper Wills Creek Formation below provide useful correlation zones. There dolomite and anhydrite occur in the upper and lower parts of the Tonoloway whereas the middle member is chiefly limestone. Farther west, the subsurface equivalent of the Tonoloway of the eastern outcrop is the Salina Formation which consists of light- to dark-gray dolomite and anhydrite with minor green and gray shale. Several salt beds are usually developed. Most of these are equivalent to the F evaporite of Ohio, but in Marshall County, West Virginia, salts as low as the D evaporite are also well developed. Total salt thickness exceeds 250 feet in several wells; however, excessive thicknesses may be due to tectonic thickening within anticlines. The upper and lower members of the Tonoloway

The sediments and waters of a density and temperature stratified pond located on Los Roques Archipelago, Venezuela, have been analyzed for their base metal content of Mn, Fe, Cu, Pb, and Zn. The pond has an indirect connection to the open sea, and also receives run-off from the near-volcanic hills, as a result, the surface layer of water is enriched in the base metals as compared to sea water. Evaporation concentrates all metals until the concentration of gypsum precipitation is reached.

Upon precipitation, gypsum removes from 7 to 15 percent of the metals from solution, and contains 22.9, 12.1, and 58.4 ppm, on the average, of Zn, Cu, and Pb, respectively. The metal is also in part abstracted by the slowly settling particulate matter which collects at the bottom of the deep part of the pond. The metal concentration of the bottom brine layers is approximately twice that of the surface layer.

It is suggested that upon conversion of gypsum to anhydrite under lithostatic pressure of burial the gypsum can serve as a source of metal-rich solutions.

TREFSH, MICHAEL I., Texaco Inc., Houston, Texas  
*Enigmatic Solution Phenomena in the Salina Group (late Silurian) in New York State*

Due to its highly soluble nature halite with-in the Salina Group (late Silurian) of New York State has been subjected to three major episodes of solution. Solution-collapse breccias super-jacent to many halite beds and solution channels

are early solution phenomena as indicated by stratigraphic and petrographic relationships.

Second generation salt beds may have resulted as follows: 1) release of water via gypsum dehydration to anhydrite during moderate burial, 2) solution of salt interbedded with or disseminated in the sulfate-bearing rocks, 3) upward migration of NaCl-saturated solutions into penecontemporaneous collapse zones that formed during dehydration of gypsum and salt solution, and 4) precipitation of second-generation salt in the collapse zones as a result of a brine-mixing process or by cooling as the saturated solutions moved upward. Second-generation halite is distinguished by inclusions of breciated fragments of overlying lithologies and lower water-insoluble residue content.

The third period of solution resulted from ground water action near the outcrop belt late in the geologic history of the salt. The breccias on outcrop and those above salt as observed in cores are very similar to water-insoluble residues of Salina Group salt beds. Dissolution of the subsurface salt beds would result in a breccia of approximately the same thickness as breccias observed in outcrop. In cores the top of the highest observed salt coincides with the lowermost extent of gypsum and indicates maximum penetration of ground waters during the third period of solution. The gypsum formed as a result of the hydration of anhydrite by ground water while overlying sediments were being eroded.

TREMBIA, EDWARD L., Grand Valley State College, Allendale, Michigan, and FAULK, G., Ohio State University  
*Isotopic Composition of Strontium in Evaporites From the Ochoco Series of New Mexico and the Cayuan Series of Ohio*

Sr<sup>87</sup>/Sr<sup>86</sup> ratios of the water-soluble phases of evaporites from the Ochoco Series of New Mexico and the Cayuan Series of Ohio were measured in an attempt to determine their initial Sr<sup>87</sup>/Sr<sup>86</sup> ratios. Twenty-seven samples of primarily halite with negligible amounts of rubidium from a 100 foot section of the Salado formation (Ochoan) of New Mexico had a mean Sr<sup>87</sup>/Sr<sup>86</sup> ratio of 0.7077±0.0001 (one standard deviation). This value is similar to the Sr<sup>87</sup>/Sr<sup>86</sup> ratio of 0.7073 reported for aragonitic marine fossils of similar ages. Samples of primarily sylvinitite from the first and

third potassium ore zones within the section had radiogenically enriched Sr<sup>87</sup>/Sr<sup>86</sup> ratios as high as 0.7723.

On the other hand, four samples of primarily halite from the F unit (Cayuan) of Ohio had a mean Sr<sup>87</sup>/Sr<sup>86</sup> ratio of 0.709310.0001. This value is statistically greater than the Sr<sup>87</sup>/Sr<sup>86</sup> ratio of 0.70785 for Late Silurian seawater determined by interpolation of Sr<sup>87</sup>/Sr<sup>86</sup> ratios reported for aragonitic marine fossils of Late Ordovician (0.7079) and Middle Devonian (0.7078) ages. Possible explanations for this lack of agreement include the following: (1) Strontium in the F unit may have been isotopically re-equilibrated following deposition. (2) The Sr<sup>87</sup>/Sr<sup>86</sup> ratio of Late Silurian Seawater was about 0.7093. (3) Strontium in the waters of the Ohio Basin may not have been of the same isotopic composition as strontium in seawater of the same age. Analyses of samples from above and below the potash-fum ore zones in the section of the Salado formation studied suggest that the isotopic re-equilibration of strontium is less likely than one of the other two possibilities.

VINOPAL, ROBERT J. and COOGAN, ALAN H., Kent State University

#### *Effect of Shape Starting on Porosity of Carbonate Sands and Gravels*

An overall average porosity value for carbonate sands composed of varied-shaped particles has remained undetermined owing to the unpredictable effect of different fossil particle shapes on porosity. In this study porosity was measured for 250 single, dual and multi-component packs of varied-shaped, particulate sands and gravels of natural and artificial origin. Single-shape component packs, where the shapes approximately correspond to Zing shapes as well as less regular shapes, have repeatedly determinable average porosities for moderately well-sized sediments as follows: 1) discs = 35%, 2) spheres = 43%, and 3) rods = 46%. Packs of irregularly contorted rods and coral sticks (Porites) average 59% porosity and a long stick sand (Goniolithon) average 62% porosity. Porosities of single-shape packs of various pelletalized shells range from 65% (*Transarella*) to 85% (*Anomia*). Dual-shape, two component packs (e.g. discs + rods) have porosities proportional to the percent of the dominant component of the mix, making the

porosity of two component mixtures essentially predictable.

Packing of three or more varied-shaped particles (e.g. spheres + blades + rods) tends to block and cancel the interference effects of radical shape which in single-shape component packs increases porosity. Consequently, carbonate sands and gravels of grains with high shape variability tend to cluster about the center of the shape-influenced porosity range of 35% to 48%, or at about an estimated value of 60% porosity. The measured value for an artificially prepared multi-component mixture is 67% porosity. The value for a carbonate beach gravel is 65% porosity. Thus, lacking any other information on grain type or shape, a value of 65% may be presumed for the average interparticle porosity of a carbonate sand or gravel of moderate size sorting before it is cemented, compacted or leached.

### Notes

EASTERN-AAPG

1976

LEXINGTON, KY.

FIFTH ANNUAL MEETING

LEXINGTON, KENTUCKY

1976

FIFTH ANNUAL MEETING  
LEXINGTON, KENTUCKY  
1976

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The fifth annual meeting of the Eastern Section was held at the Phoenix Hotel, Lexington, Kentucky, October 6-9, 1976. The theme of the meeting was "Basin-Arch Relationships". The Geological Society of Kentucky was the host society for the meeting and Mr. Vincnet E. Nelson was General Chairman. Mr. Basel Doerhoefer, III was President of the host society. There were 244 registered for the meeting.

The net profit from the meeting was \$3,698.84, \$2,465.89 of which was given to the Eastern Section with the Kentucky Geological Society retaining \$1,232.95 as their third.

Attached is a copy of the Program, Minutes, and Treasurer's Report.



# The American Association of Petroleum Geologists

EASTERN SECTION

Minutes of the Annual Business Meeting  
of the  
Eastern Section  
of the  
American Association of Petroleum Geologists  
Lexington, Kentucky  
October 6-9, 1976  
Headquarters - Phoenix Hotel

The meeting was called to order at 1:15 p.m. by Eastern Section President William C. MacQuown, Jr.

The following were in attendance:

William M. MacQuown, Jr.	- President, Eastern Section
Ralph L. Miller	- Vice President, Eastern Section
Porter J. Brown	- Secretary-Treasurer, Eastern Section
Gordon H. Wood, Jr.	- Advisor to Eastern Section
Larry D. Woodfork	- Delegate, Appalachian Geological Society
George Grow	- American Association of Petroleum Geologists Foundation
John M. Cochrane	- Delegate, Ohio Geological Society
John Galey	- Delegate, Pittsburgh Geological Society
John W. James	- Chairman, House of Delegates
Howard Schwabl	- Delegate, Indiana-Kentucky Geological Society
Margaret H. Hawn	- Alternate, Illinois Geological Society
Vincent E. Nelson	- Delegate, Kentucky Geological Society
John Avila	- Alternate Delegate, Appalachian Geological Society
Ronald W. Manus	- Delegate, Northern Ohio Geological Society

A request by the Northern Ohio Geological Society to become an affiliated member of the Eastern Section was discussed. A motion was made by John Galey that they became an affiliated society, seconded by John Cochrane, unanimously approved.

The Section considered a request by the Northern Ohio Geological Society to hold the 1978 Section meeting in Cleveland, Ohio. Mr. Manus discussed the available facilities and personnel. A motion was made by Porter Brown that the 1978 meeting be held in Cleveland, Ohio, sponsored by the Northern Ohio Geological Society, seconded by John Galey, unanimously approved.

A request by the Appalachian Geological Society to hold the 1979 meeting in West Virginia was discussed. Upon motion duly made by Larry Woodfork and seconded by John Avila, it was unanimously approved.

A motion was made by John Galey that the Secretary and Treasurer duties be separated so that an additional member will be familiar with the Section operations and be available for other offices thus assuring better continuity. Motion seconded by John Avila, unanimously approved.

A report by the nominating committee consisting of John Galey, Vincent Nelson, and Gordon Wood and chaired by Gordon Wood was then given. The following offices were nominated for Years 1976-77:

President	- Ralph Miller
Vice President	- James A. Noel
Secretary	- Vincent Nelson
Treasurer	- Larry Woodfork
Advisor Elect	- Porter J. Brown

Howard Schwabl moved the nominations be closed, John Cochrane seconded the motion and President MacQuown proclaimed those nominated elected unanimously. (The advisor serves for a three year term. Gordon Wood will remain advisor until the election at the Washington meeting.)

The nominating committee strongly urged future nominating committees and delegates to consider the following members as future officers for the terms shown. These members have agreed to accept the office, if elected, unless their job or other situations change which would not allow them to do so. The reason for this recommendation is so experienced officers will be in charge of the section in future years and a strong active section will be maintained. It is hoped that future nominating committees will follow their example.

Years 1977-78

President	-	James A. Noel
Vice President	-	Vincent Nelson
Secretary	-	Ronald Manus
Treasury	-	Larry Woodfork
Advisor	-	Porter Brown

Years 1978-79

President	-	Vincent Nelson
Vice President	-	Larry Woodfork
Secretary	-	Ronald Manus
Treasury	-	Howard Schwalb
Advisor	-	Porter Brown

Years 1979-80

President	-	Larry Woodfork
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Mr. Ralph Miller explained that when the section meeting is held in conjunction with the national meeting, the national organization gives the section \$2,000 to partially reimburse them for the work involved. It has been the custom of the sections (with the exception of one) to then give the \$2,000 to the society who actually performs the work. A motion was made by John Galey that the \$2,000 be given to the Geological Society of Washington and that the treasurer indorse the check directly to the Geological Society of Washington so it will not show on the section books. The motion was seconded by Vincent Nelson and unanimously approved.

The Secretary-Treasurer submitted the secretary and treasurers report. As of September 1, 1976, the section had total assets of \$7,480.20 with no liabilities. A motion was made by John Galey that the Secretary-Treasury report be accepted as read, seconded by John Cochrane and unanimously approved.

Secretary-Treasurer Brown pointed out that the \$5,000 Treasury Note would expire early in 1977 and that the \$5,000 should be reinvested. Mr. Brown then made a motion that the treasurer research and recommend future investments. His recommendations would have to be approved by the executive committee prior to making any investments. The motion was seconded by John Galey and unanimously approved.

Mr. George Grow explained the function and needs of The American Association of Petroleum Geologists Foundation and requested a contribution from the Eastern Section. President MacQuown passed the responsibility for this recommendation to President Elect Miller to be discussed at the 1977 meeting.

President Elect Miller stated that he would appoint an ad hoc committee to study the Constitution and By-laws and recommend amendments, where necessary.

Mr. Ralph Miller moved that the secretary write letters to the president of the Geological Society of Kentucky, Mr. William MacQuown and Mr. Vincent Nelson congratulating and thanking them for an excellent meeting. Motion was seconded by John Galey and unanimously approved.

TREASURER'S REPORT  
 EASTERN SECTION A.A.P.G.  
12/31/74 THROUGH 12/31/75

<u>BALANCE</u>	December 31, 1974	\$ 945.87
	Interest from Treasury Note	<u>400.00</u>
	Total	\$ 1,345.87
<u>WITHDRAWALS</u>	Lawyers - Additional Work Tax Refund	\$ 150.00
	Advance from Eastern Section 1975 Meeting	900.00
	Letterheads and Stationery	74.68
	Service Charge on Bank Account	4.95
	A.A.P.G. Memoir No. 6 - John Galey	75.00
	Plaque and Engraving	<u>31.24</u>
	Total	\$ 1,235.87
	Balance in Bank . . . 12/31/75 . . . . .	\$ 110.00
	Section Assets as of 12/31/75	
	Cash	\$ 110.00
	Treasury Note	5,000.00
	Advance	<u>900.00</u>
	Total	\$ 6,010.00
	Section Liabilities as of 12/31/75	
	Ohio Geological Society one-third profits from meeting	\$ <u>937.58</u>
	Total	\$ 937.58

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Porter J. Brown  
 Treasurer

**TREASURER'S REPORT**  
**EASTERN SECTION A.A.P.G.**  
12/31/75 THROUGH 9/1/75

<u>BALANCE</u>	December 31, 1975	\$ 110.00
<u>DEPOSITS</u>	Repayment of Advance	900.00
	Two-thirds profit from Michigan Meeting	2,015.28
	Interest from Treasury Note	<u>400.00</u>
	Total	\$ 3,425.28
<u>WITHDRAWALS</u>	Rental - Safety Deposit Box	\$ 7.50
	Ohio Geological Society - One-third meeting profits	937.58
	Advance - 1976 Annual Meeting	<u>1,000.00</u>
	Total	\$ 1,945.08
	Balance in Bank . . . 9/1/76. . . .	\$ 1,480.20

Section Assets as of 9/1/76

Cash	\$ 1,480.20
Treasury Note	5,000.00
Advance	<u>1,000.00</u>
Total Assets	\$ 7,480.20

Section Liabilities as of 9/1/76 0.00

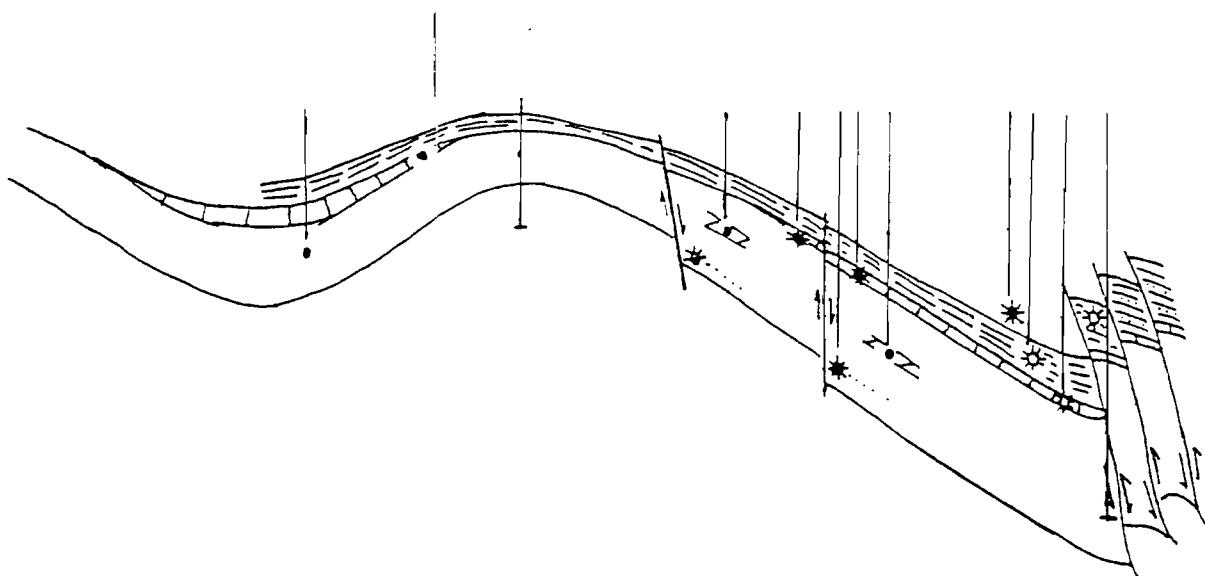
Note: Bank Account has been moved from Mellon Bank in Pittsburgh, Pennsylvania to Charleston National Bank, Charleston, West Virginia.

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Porter J. Brown  
Treasurer

E. SEC. A.A.P.G.

FIFTH ANNUAL CONVENTION



BASIN-ARCH RELATIONSHIPS

IN EAST-CENTRAL UNITED STATES

LEXINGTON, KY. OCTOBER 6-9, 1976  
Headquarters Phoenix Hotel

FIFTH ANNUAL CONVENTION  
EASTERN SECTION  
AMER. ASSOC. PETR. GEOLOGISTS

October 6-9, 1976  
Phoenix Hotel  
Lexington, Ky.

BASIN-ARCH RELATIONSHIPS  
IN EAST-CENTRAL UNITED STATES

GEOLOGICAL SOCIETY OF KENTUCKY  
Host Society

## WELCOME

### WELCOME TO "BLUE GRASS" COUNTRY

On behalf of the Eastern Section of the American Association of Petroleum Geologists and the Geological Society of Kentucky, your co-hosts of this Fifth Annual Convention, we extend to you a hearty welcome to Lexington and the beautiful Blue Grass Country.

The theme of our meeting, "Basin-Arch Relationships in the East-Central United States," will be evident during technical sessions and field trips to be held appropriately enough on the Cincinnati Arch, in the heartland of the area of interest.

The increasing difficulty of petroleum exploration during the continuing energy crisis, requires a new and more sophisticated look at the basic structure and stratigraphy of the East-Central United States to determine the future oil and gas potential of the area.

We hope that you will find the meeting stimulating and rewarding and your visit in Lexington memorable.

WILLIAM C. MACQUOWN President Eastern Section AAPG	BASIL DOERHOEFER, III President, Geological Society of Kentucky
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VINCENT E. NELSON General Chairman Fifth Annual Convention Eastern Section, AAPG
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### EASTERN SECTION -- A.A.P.G

William C. MacQuown--President  
Ralph L. Miller--Vice President  
Porter J. Brown--Sec'y.-Treasurer

### GEOLOGICAL SOCIETY OF KENTUCKY

Basil Doerhoefer, III--President  
James K. Vincent--Vice President, W. KY  
Zelek L. Lipchinsky--Vice President, E. KY  
Beecher J. Hines--Secretary  
Peter W. Whaley--Treasurer

## CONVENTION COMMITTEES

### GENERAL CHAIRMAN

Vincent E. Nelson

### CONVENTION FACILITIES

Louis R. Ponsetto, Phil N. Miles  
Co-Chairmen

### RECEPTION FACILITIES

Jon E. Huffman, George W. Elsworth  
Co-Chairmen

### EXHIBITS

Howard R. Schwab Chairman

### FIELD TRIPS

Donald C. Haney Chairman

### FINANCE

Thomas G. Roberts

### HONORS AND AWARDS

Gordon W. Weir Chairman

### LADIES' PROGRAM

Phyllis Nelson Chairwoman

### PRINTING

Edward N. Wilson

### PUBLICITY

Lois J. Campbell

### REGISTRATION

Donald W. Hutcheson Chairman

### TECHNICAL PROGRAM

J. Hunt Perkins, Wm. C. MacQuown  
Co-Chairmen

### TECHNICAL SERVICES

R. E. Sergeant Chairman

## SPONSORS

### CO-HOSTS FOR WEDNESDAY EVENING RECEPTION

Halliburton Services

Quaker State Oil Refining Corp., Oil City, Pa.

Kendall Drilling Co., Inc.

Geomap Company

Peppard-Souders & Associates

Columbia Gas Transmission Corporation

Warren Drilling Co., Inc.

Birmie Oil Tool Works

Atlas Oil Company, Frankfort, Ky.

John O. Schofield

Henry R. Fullop

W. H. Greer Supply Co., Inc.

Tenexco Inc.--Richard S. Incandela, Pres.

Petroleum Information Corp.

Schlumberger Well Services

Birdwell Division of SSC

East Ohio Gas Co.

Texas Pacific Oil Co., Inc.

Basin Survey, Inc.

Ray Resources

### COFFEE BAR THURSDAY & FRIDAY

Schlumberger Well Services

5

## CALENDAR OF EVENTS

### EXHIBITORS

#### TECHNICAL

Birdwell Division of SSC  
Francis Paul Geoscience Literature  
Schlumberger Well Services  
Trollinger Geological Associates, Inc.

#### STATE GEOLOGICAL SURVEYS OF:

Indiana  
Kentucky  
West Virginia

#### EDUCATIONAL EXHIBITORS

Dept. of Geology  
Eastern Kentucky University  
Dept. of Geology  
University of Kentucky  
Dept. of Physical Sciences  
Morehead State University

#### AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

#### WEDNESDAY, OCTOBER 6

8:00 Pre-meeting field trip leaves Phoenix  
1:00- 5:30 Registration--Mezzanine  
2:00- 4:30 Ladies' Hospitality--Breckenridge Room  
5:30- 7:00 RECEPTION--Crystal Ballroom

#### THURSDAY, OCTOBER 7

7:30- 8:30 Speakers' Breakfast--Stephen Foster Room  
8:00- 5:00 Technical and Educational Exhibits  
Convention Hall  
8:30- 9:30 Ladies Hospitality--Breckenridge Room  
Trip leaves 10:00am from Lobby  
8:50 WELCOME  
9:15-11:45 Technical Program--Crystal Ballroom  
12:00 President Moody's Luncheon--Lafayette Room  
1:30- 4:30 Technical Program--Crystal Ballroom  
4:30- 6:00 Discussions--Crystal Ballroom  
6:30- 8:30 BANQUET--Convention Hall  
Presentation of Lavoress Award to Charlotte B.  
Schreiber  
"Perspectives on Energy Problems"--John B. Moody

#### FRIDAY, OCTOBER 8

7:30- 8:30 Speakers' Breakfast--Stephen Foster Room  
8:00- 5:00 Technical and Educational Exhibits  
Convention Hall  
9:00-12:00 Technical Program--Crystal Ballroom  
10:00 Ladies' Shakertown Trip leaves from Lobby  
1:30- 4:30 Technical Program--Crystal Ballroom  
4:30- 5:00 EASTERN KENTUCKY SYMPOSIUM  
5:00 Adjourn

#### SATURDAY, OCTOBER 9

8:00 Post-meeting field trip leaves Phoenix

## TECHNICAL PROGRAM

(All Sessions in Crystal Ballroom)

### THURSDAY MORNING

- 8:50 WELCOME: William C. MacQuown, presiding.  
Remarks: Damon Harrison, Commissioner, Kentucky Dept. of Energy  
William C. MacQuown, Pres. E Sec AAG  
Vincent E. Nelson, Gen. Chmn.
- 9:10 PAPERS: John Avila, Albert Bryant, presiding (Asterisk \* denotes speaker)
- 9:15 L. L. Sloss: Basin Evaluation in the East-Central United States
- 9:45 Albert J. Rudman\*, Judson Mead, Robert F. Blakely, Joseph F. Whaley: Precambrian Geophysical Provinces in Indiana
- 10:15 Coffee Break
- 10:45 G. R. Keller\*, M. L. Ammerman, A. E. Bland, R. E. Soderberg: A Geophysical and Tectonic Study of the Moorman Syncline and the Roma Trough and their Relation to the Cincinnati Arch
- 11:15 John M. Dennison\*, Garland R. Dever, Jr.: Energy Resource Implications of the 38th Parallel Lineament across the Appalachian Basin

### THURSDAY AFTERNOON

- 1:30 PAPERS: George R. Thomas, Brandon D. Nuttall, presiding
- 1:30 Leroy E. Becker, John B. Droste\*: General Sedimentological History of Late Silurian and Early Devonian Events in Southwestern Indiana
- 2:00 Carl B. Rexroad: Lithofacies Relationships in Alexandrian and Early Niagaran Rocks (Silurian) in Indiana and Parts of Illinois, Kentucky, and Ohio
- 2:30 Arlie Janssens\*, T. H. Dehling, R. R. Ott: The Relationship between Salina (Upper Silurian) Oil Production and Shallow Structure in East-Central Ohio
- 3:00 Tea Time
- 3:30 O. G. Patchen\*, R. A. Smosna: Evolution of Basin-Shelf Relationships during Silurian Time in West Virginia

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- 4:00 Ralph L. Miller\*, William Back, Ruth G. Dickey: The Wildcat Valley Sandstone in Southwest Virginia—a Possible Reservoir Sandstone

4:30 Adjourn

### FRIDAY MORNING

- 9:00 PAPERS: Porter J. Brown, Howard R. Schwab presiding
- 9:00 William C. MacQuown, Jr.\*, Jon E. Huffman\*: Structural and Stratigraphic Aspects of Fort Payne (Lower Mississippian) Petroleum Production from Waulsortian-type Carbonate Lenses and Mounds in North-Central Tennessee
- 9:30 Richard Q. Lewis, Sr.\*, Paul Edwin Potter: Some Observations Related to the Age and Tectonics of the Cincinnati Arch in South-Central Kentucky
- 10:00 Coffee Break
- 10:30 Robert H. Osborne\*, Peter E. Borella: Late Middle and Early Late Ordovician History of the Cincinnati Arch Province, Central Kentucky to Central Tennessee
- 11:00 R. C. Quick\*, E. F. Pawlowics, W. J. Hinze: The Bowling Green Fault—a Case of Resurgent Tectonics?
- 11:30 Eugene K. Rader\*, William J. Perry, Jr.: Stratigraphy as a Key to the Arch-related Origin of the Little North Mountain Structural Front, Virginia and West Virginia

### FRIDAY AFTERNOON

- 1:30 PAPERS: Gene Haney, Joseph B. Cathey, Jr. presiding
- 1:30 Donald C. Haney: Structural Control on Paleozoic Sedimentation in Eastern Kentucky
- 2:00 Frank R. Ettensohn: Stratigraphic, Paleoenvironmental, and Structurally-related Aspects of Middle and Upper Mississippian Rocks (Newman and Pennington Formations), East-Central Kentucky
- 2:30 George W. Ellsworth: Chesterian Shoreline Sequences in Eastern Kentucky
- 3:00 Tea Time

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3:30 Michael R. Short: Early Pennsylvanian Depositional Systems in Northeastern Kentucky--Their Relation to Local Structure  
4:00 J. C. Horne\*, B. P. Bognaz, J. C. Ferm, C. L. Cantrell: Carboniferous Sedimentary Response to Contemporaneous Tectonism in Eastern Kentucky  
4:30 EASTERN KENTUCKY SYMPOSIUM  
5:00 Adjourn

#### FIELD TRIPS

PRE-MEETING FIELD TRIP, OCTOBER 6, 8:00 AM  
SELECTED STRUCTURAL FEATURES AND ASSOCIATED COALSTONE OCCURRENCES IN THE VICINITY OF THE KENTUCKY RIVER FAULT SYSTEM:  
Leaders: Douglas F. B. Black, Donald C. Haney  
  
POST-MEETING FIELD TRIP, OCTOBER 9, 1976  
STRATIGRAPHIC EVIDENCE FOR LATE PALEOZOIC TECTONISM IN NORTHEASTERN KENTUCKY  
Leaders: Garland R. Dever, Jr., Norman Hester, Harry Hoge

#### EASTERN SECTION AAPG 5th ANNUAL MEETING

Lexington, Kentucky  
October 6-9, 1976

#### BASIN AND ARCH RELATIONS IN EAST-CENTRAL UNITED STATES

##### Abstracts of Papers

BECKER, LEROY E., Indiana Geol. Survey, Bloomington, Ind., and JOHN B. DROSTE, Dept. Geology, Indiana Univ., Bloomington, Ind.

General Sedimentologic History of Late Silurian and Early Devonian Events in Southwestern Indiana

Evidence from geophysical logs and petrographic study of subsurface samples permits speculation about the sequence of sedimentologic events in Late Silurian and Early Devonian time in southwestern Indiana. The textures of the fine-grained carbonate and terrigenous quartz content of the Moccasin Springs Formation and Bailey Limestone are very similar. Medium to coarse-grained bioclastic carbonate rocks are present in the uppermost beds of the Bailey and in the Backbone Limestone. Grassy Knob rocks below the Backbone and Clear Creek rocks above the Backbone are carbonate rocks that characteristically are speckled (dolomitic rhombs and chitinozoans), impure, fine to medium grained, and cherty. Much of the chert clearly shows the relict, speckled texture of the carbonate rocks.

Moccasin Springs and most Bailey rocks were deposited in deeper water as basin facies of shallow-water Wabash platform rocks. Fossils indicate that upper Moccasin Springs and most of the Bailey may be Late Silurian in age; uppermost Bailey is Early Devonian (Gedinnian) in age. Uppermost Bailey and Backbone rocks were deposited on shallow-water shelves that prograded basinward. Grassy Knob and Clear Creek rocks were laid in deeper water basin environments as facies of these shelves.

The following sequence is postulated: (1) the Moccasin Springs and much of the Bailey are basin facies of shallow-water carbonate banks on the margin of the Wabash platform; (2) with lowering of sea level the banks emerged and shallow-water-shelf deposition moved basinward; (3) transgression (Grassy Knob) produced deeper water sedimentation; (4) regression (Backbone) reestablished shelf sedimentation; (5) transgression (Clear Creek) moved the locus of shelf sedimentation eastward onto the platform. This interpretation suggests that undiscovered "pinnacle reefs surrounded by Bailey rocks may lie along the basin margin of the Terre Haute bank in southwestern Indiana.

DENNISON, JOHN M., Dept. Geology, Univ. North Carolina, Chapel Hill, N.C., and GARLAND R. DEVER, JR., Kentucky Geol. Survey, Lexington, Ky.

**Energy Resource Implications of 38th Parallel Lineament across Appalachian Basin**

The 38th parallel lineament (fracture zone) across Kentucky, West Virginia, and Virginia, initially indicated by an alignment of igneous intrusions and structural features, is marked by distinct variations in sedimentary rock units, which are indicative of tectonic activity along the lineament. These factors have implications in the search for geothermal, oil, gas, coal, and uranium resources in the region.

Pulses of igneous activity have occurred along the trend of the fracture zone in late Precambrian, Devonian, Permian, Triassic, Jurassic, and Eocene times. Thermal-spring activity near the Eocene intrusions (western Virginia and eastern West Virginia) may be related to residual heat from a deep pluton still cooling, warranting exploration for geothermal resources.

Sedimentary rocks ranging in age from Cambrian to Pennsylvanian vary in distribution and thickness along the trend of the lineament. Early Paleozoic movement on the basement fault forming the northern boundary of the Rome trough in Kentucky resulted in depositional and erosional thinning of Cambrian and Lower Ordovician units northward across the fault. The Rome trough probably formed as a result of tectonic patterns accompanying the opening of the proto-Atlantic Ocean in late Precambrian time.

Mississippian tectonic activity is suggested by several patterns. In east-central West Virginia, the lineament is marked by an east-west belt where the Pocono Formation is absent, and by the northward disappearance of the MacCrady red beds and the Hillsdale (= St. Louis of Kentucky) and Denmar members of the Greenbrier Limestone. Uplift along an east-west axis in Mississippian time is proposed. Restriction of reported evaporites south of this axis suggests that it was positive during MacCrady deposition. The Gay-Fink and Cabin Creek channel deposits in the Berea Sandstone generally parallel the lineament and may represent westward drainage channeled along the sides of the uplift. Recurrent basement-fault movement in northeastern Kentucky is indicated by erosional removal of the St. Louis and Ste. Genevieve members of the Newman Limestone and upper members of the Borden Formation in areas on the northern (upthrown) block.

Commercial coal in the Pottsville Group (Pennsylvanian) of West Virginia and Kentucky is concentrated in the area south of the lineament. In West Virginia, the New River and Kanawha Formations (Lower and Middle Pennsylvanian) are thick south of the lineament; on the north, they are thinner with a pronounced unconformity beneath the Pennsylvanian. The lower tongue of the Breathitt Formation (Lower Pennsylvanian) thins northward across the basement fault in northeastern Kentucky.

Uranium possibilities in the Hampshire Formation (Upper Devonian) may be enhanced by the unconformity at the top of the formation in the West Virginia area

of no Pocono, where Mississippian geochemical cells could have concentrated uranium in the Hampshire. Uranium geochemical cell concentrations in the Pocono could occur along the flanks of the Mississippian uplift.

ELLSWORTH, GEORGE, Eastern Kentucky Univ., Richmond, Ky.

**Chesterian Shoreline Sequences in Eastern Kentucky**

Stratigraphic and lithologic studies of Chesterian strata in eastern Kentucky record a change from a carbonate shoreline and shelf deposits to a loocore shoreline and deltaic deposits. The changing shoreline types reflect a response to increased land-derived clastic sediment along a tectonically active hinge-line and the inability of marine processes to redistribute it.

Successive shoreline sequences show a transition from marine deposits essentially free from land-derived detritus to deltaic deposits dominated by land-derived detritus. Each successive shoreline sequence reflects a higher clastic influx than the preceding sequence.

The following sequences, with shoreline types in parentheses, are listed in stratigraphic order: (1) Breathitt-Lee (deltaic); (2) upper Pennington (linear clastic); (3) Glen Dean-lower Pennington (mixed clastic-carbonate); (4) Haney-Hardinsburg (mixed clastic-carbonate); (5) Reelsville-Beech Creek (carbonate).

The nature of the unconformity between the depositional sequences is related to the type of shoreline depositional system involved. Diagenetic alterations (subaerial crusts, caliche, brecciation, etc.) and localized or small-scale erosion resulted from the exposure of carbonate shoreline deposits underlying the Haney-Hardinsburg sequence. Moderate planar truncation is recorded for the unconformity between the mixed clastic-carbonate and linear clastic shoreline sequences. Large-scale erosion and deep incision generally are associated with the deltaic shoreline deposits of the Breathitt and Lee Formations.

The character of the unconformity below these deltaic deposits is a function of shoreline type along a tectonically active hinge-line and may represent no greater hiatus than exhibited below the underlying Chesterian shoreline sequences.

ETTENSOHN, FRANK R., Dept. Geology, Univ. Kentucky, Lexington, Ky.

**Stratigraphic, Paleoenvironmental, and Structurally Related Aspects of Middle and Upper Mississippian Rocks (Newman and Pennington Formations), Eastern Central Kentucky**

New exposures of upper Valmeyeran and Chesterian rocks in east-central Kentucky reveal complex lithologies, biofacies, and sedimentary features deposited in subterrestrial to open-marine environments during transgressive and progradational events. These complexities were compounded by synsedimentary tectonic activity on the north-south Waverly arch and an east-west basement-fault zone.

Analysis of regional stratigraphy and tectonics indicates that the Newman and Pennington Formations represent five separate transgressions and a progradational event. The lower Newman Formation represents three westerly transgressions onto the cratonic shelf

from the Appalachian basin; each was ended by uplift on the Waverly arch. The upper Newman Formation and parts of the lower Pennington Formation represent a westerly Mississippian transgression onto the cratonic shelf followed by a westerly clastic progradation. The progradation was interrupted by a brief marine incursion. Upper Newman Formation carbonate rocks were deposited on a low-angle, southeasterly dipping ramp formed on exposed lower Newman Formation carbonate strata. This surface was low in relief, pitted with microkarst, and covered with a thin residual soil.

Depositional environments in the late Newman Formation transgressive phase apparently are related to the interaction of wave base and gently dipping bottom. Each upper Newman member represents a more or less distinct depositional environment. As these environments migrated westward with transgression and progradation, their lithologic members developed a sheet-like geometry with widespread distribution. Transgressive-phase members represent in ascending order terrigenous-carbonate intertidal mud-flat (Cave Branch), lagoonal (Armstrong Hill), carbonate sandbelt (Beech Creek), shallow open-marine (Haney), and deeper open-marine (lower Hardsburg) environments. Progradational-phase members represent in ascending order shallow open-marine (upper Hardsburg), carbonate sandbelt (lower Glen Dean), shallow, back-sandbelt marine (upper Glen Dean), lagoonal (Rowan Member, Pennington Formation), and clastic tidal channel-tidal flat (Carter Caves Sandstone Member, Pennington Formation) environments. Probable subsidence and a brief transgression (Licking River Limestone Member, Pennington Formation) interrupted the progradational event throughout the region. The overlying sandy shales, predominantly red and green in color (Bernard Member, Pennington Formation), represent renewed progradation with deposition in lagoonal and tidal mud-flat environments. The uppermost Pennington Member is largely absent in northern parts of the outcrop belt because of structural influence. The disconformably overlying Pennsylvanian clastic rocks represent a later, unrelated progradation in the region.

Many aspects of Newman and Pennington stratigraphy, such as depositional and erosional thinning, internal disconformities, disjunct-unit distribution, and different facies on opposite sides of structural features, are related to synsedimentary tectonic activity along the Waverly arch and a basement-fault zone. Although the Mississippian-Pennsylvanian boundary appears to be everywhere disconformable in the area, progressively more of the Mississippian section is absent as the structural features are approached. The most complete sections are south and east of these structures.

HANEY, DONALD C., Dept. Geology, Eastern Kentucky Univ., Richmond, Ky.

#### Structural Control on Paleozoic Sedimentation in Eastern Kentucky

Two major east-northeast structural features in eastern Kentucky which affected sedimentation during the Paleozoic include the Irvine-Paint Creek fault and a basement platform or high often referred to as the "Woodward fault zone." The Woodward zone, which

may be an eastward extension of the Kentucky River fault, appears to have been very active during the early Paleozoic as evidenced by exaggerated thicknesses of Cambrian formations on the downthrown southeastern block. The Woodward zone marks the northwestern boundary of the Rome trough of eastern Kentucky and western West Virginia. Early Paleozoic units in the trough, including the Cambrian Rome and Conasauga Formations, show the effects of tectonic activity and attained thicknesses far greater than that in outcrops farther east. North of the Woodward zone these formations are relatively thin and in places the Rome Formation is absent.

Further evidence of minor activity is recognized in Middle Ordovician rocks in eastern Kentucky in the vicinity of the Kentucky River fault. Activity along this fault during the Silurian and Devonian was probably intermittent and relatively minor; however, depositional trends in Upper Mississippian and Pennsylvanian rocks suggest significant tectonism during late Paleozoic. Features such as paleokarst, suberial crusts, absence of stratigraphic units, and chert breccias in the Mississippian Newman Formation suggest intermittent subaerial exposure along the Woodward zone and Irvine-Paint Creek fault during the Late Mississippian. Also, variations in the thicknesses and distribution of Lower Pennsylvanian clastic rocks indicate that tectonic activity continued into the Pennsylvanian.

Tectonism which initiated the Rome trough during the late Precambrian or Early Cambrian time continued intermittently throughout the Paleozoic and significantly affected depositional environments in rocks as young as Pennsylvanian in age.

HORNE, J. C., B. P. BAGANZ, J. C. FERM, and C. L. CANTRELL, Dept. Geology, Univ. South Carolina, Columbia, S.C.

#### Carboniferous Sedimentary Responses to Contemporary Tectonism in Eastern Kentucky

Most oil and gas exploration has centered around the search for reservoirs in areas of structural highs. If these features were contemporaneous with sedimentation, as in the late Paleozoic of eastern Kentucky, then there is a profound effect on the distribution of source and reservoir rocks. Detailed analyses of the lateral and vertical distribution of Carboniferous sedimentary rocks on a local as well as regional scale around known structural features has delineated the sedimentary responses to contemporaneous tectonics.

Locally, the siliciclastic responses over structural highs are reflected by thinning of sequences, merging of coals, increased amounts of rooting, pinch-outs of marine zones, and localization and deflection of channels along the flanks of active structures. In addition, these highs are mirrored in the carbonate rocks by the localization of high energy ooid shoals and beach deposits, the greater frequency and thickness of exposure surfaces, and tidal-flat and storm deposits.

Regionally, major structures such as the Paint Creek-Irvine and Woodward-Blaine fault systems were active during the Carboniferous and provided a mechanism for basinal subsidence. This resulted in the stacking of sedimentary facies and an increased thickness of sedi-

mimentary packets on the more rapidly subsiding basinal parts of these major flexures.

JANSSENS, A., Ohio Geol. Survey, and T. H. DEYLING and R. R. OTT, East Ohio Gas Co.  
Relation Between Salina (Upper Silurian) Oil Production and Shallow Structure in East-Central Ohio

Among the approximately 1,000 wells that have been drilled in Guernsey and Noble Counties as a result of a "Clinton" sandstone (lower Silurian) discovery in Guernsey County in 1969 are at least six that produce oil and minor amounts of gas from the Salina F Unit (upper Silurian). These Salina wells lie along a trend coincident with the western (updip) limit of the Salina E salt. Core examination reveals that the F-unit reservoirs have fracture porosity; primary porosity is absent in the host rock, which consists of dolomite mudstone interbedded with anhydrite.

Thickness of the interval between the base of the G anhydrite and the top of the E unit increases by as much as 70 ft (21 m) along the trend and results in structurally high Onondaga Limestone (Middle Devonian) sections in many wells. In other wells this structural effect is attenuated by normal faulting within the E unit above the salt.

The producing trend coincides also with the trend of the Cambridge arch, which extends southward into east-central Washington County and can be mapped on Berea Sandstone (Mississippian) and younger beds.

These observations lead to our interpretation that, at the time of valley and ridge folding to the east, the rocks in east-central Ohio above the E salt were thrust westward for a distance of probably less than 1 mi (0.6 km). The Devonian and younger beds above the Onondaga Limestone (Middle Devonian) were subjected to parallel folding. Acting as competent beds, the Berea Sandstone and younger Mississippian and Pennsylvanian clastic rocks (thickness about 1,500 ft or 457 m) were folded into the Cambridge arch, which can be mapped as far south as east-central Washington County. The arch dies out in the incompetent Devonian shale (thickness about 2,200 ft or 670 m) underlying the Berea Sandstone.

Thrusting above the Salina F. salt gave rise to the Burning Springs anticline in West Virginia. We postulate a tear fault in east-central Washington County where the trends of the Cambridge arch and the Burning Springs anticline intersect.

Along the trend in Noble County, structure mapping below the salt reveals only regional dip.

KELLER, G. R., Dept. Geol. Sci., Univ. Texas at El Paso, El Paso, Tex., and R. K. SODERBERG, M. L. AMMERMANN, and A. E. BLAND, Dept. Geology, Univ. Kentucky, Lexington, Ky.

Geophysical and Tectonic Study of Moorman Syncline and Rome Trough and Their Relation to Cincinnati Arch

Recently, more than 6,000 gravity readings have been made in Kentucky and a program of aeromagnetic surveying has been initiated. The initial goal of these studies has been to study the interrelations and tectonic history of the fault systems, basins, troughs, and arches in

Kentucky and adjacent areas. The tectonic history appears to be quite complex and apparently includes several episodes of rifting. A north-south trending Keweenawan (~ 1.0 to 1.3 b.y.) rift zone passes through central Kentucky and Tennessee and may extend into the Great Lakes region. This feature is marked by a large (> 80 mgal) positive gravity anomaly, a complex zone of positive magnetic anomalies, and volcanic basement lithologies. It is offset at several locations along its trend which is subparallel with the Cincinnati and Waverly arches. The Rome trough is a major graben-like basin which extends northeastward from the Cincinnati arch. This trough does not appear to cross the Cincinnati arch. In eastern Kentucky, the trough is bounded on the north by the Kentucky River fault zone and on the south by the Pike and Perry County uplifts. The Moorman syncline in western Kentucky is a graben-like feature which also does not extend across the Cincinnati arch. The northern boundary of this feature is the Rough Creek fault zone and the southern boundary is the Green River fault zone. Both the Rome trough and Moorman syncline were formed in the early Paleozoic and the tectonic forces which produced subsequent movement along associated fault zones probably were different from those initiating the trough and syncline.

LEWIS, RICHARD Q., SR., U.S. Geol. Survey, Somerset, Ky., and PAUL EDWIN POTTER, Dept. Geology, Univ. Cincinnati, Cincinnati, Ohio

Age and Tectonics of Cincinnati Arch in South-Central Kentucky

Three major features about the basin-arch relations of the Cincinnati arch in south-central Kentucky have been determined by combining information from 1:24,000 scale geological maps and subsurface data.

1. The arch, a broad regional structurally positive feature, was active during Late Devonian to Mississippian, and probably into Pennsylvanian time. The oldest beds exposed at the disconformable base of the Chattanooga Shale and Boyle Limestone of Devonian and Early Mississippian age belong to the Ashlock Formation of Late Ordovician age; the youngest beds belong to the Braddock Dolomite of Early Silurian age. The Chattanooga Shale thins from more than 400 to less than 20 ft (122 to 6 m) in thickness over the arch and is locally absent near Marrowbone in Cumberland County. Mississippian formations reflect similar but more subdued thinning across the arch.

2. Locally superimposed on the arch are many small curving anticlines and synclines that have typical lengths of 3 to 8 mi (1.8 to 4.8 km) and closures of 20 to 50 ft (6 to 9 m).

3. At the surface on the arch there are some scattered normal faults, a few of which reflect reactivation of Cambrian growth faults.

Although vertical movements of the basement underlying the Cincinnati arch appear to be the dominant factor in its structural style, detailed explanations of the structural features, especially of the small folds, are lacking.

MILLER, RALPH L., WILLIAM BACK, and RUTH G. DEIKE, U.S. Geol. Survey, Reston, Va.

#### Wildcat Valley Sandstone in Southwest Virginia—Possible Reservoir Sandstone

In southeast Virginia, the Wildcat Valley Sandstone of Early Devonian age is present in several fault belts of the Valley and Ridge province and underlies the Cumberland Plateau in Wise, Dickenson, and Buchanan Counties. In the southeastern part of its depositional basin, it is predominantly a medium- and coarse-grained marine sandstone about 15 m thick. Northward beneath the plateau, it thickens and becomes predominantly limestone.

At the surface, carbonate cement that originally was present largely has been removed, and the sandstone is extremely porous and permeable, in some places even unconsolidated. Some or most of this solution could have taken place in the long interval of Middle Devonian time after cessation of Wildcat Valley sedimentation and before invasion of the Late Devonian seas in which the overlying Chattanooga (black) Shale was deposited.

In the Cumberland Plateau, deep cable-tool wells have penetrated the Wildcat Valley Sandstone well below the zone of recent weathering. Laboratory analysis of cuttings from several of these wells indicates that much of the carbonate rock in the Wildcat Valley Sandstone is impregnated in carbon 13, and hence resembles a freshwater carbonate more than a marine carbonate. Removal of original marine carbonate cement and replacement with freshwater carbonate is indicated. Thus, in this region, pore spaces that formed as a result of subsurface weathering in Middle Devonian time seem largely to have been refilled by freshwater carbonate. In the Valley and Ridge province, however, where the formation is almost entirely sandstone, porosity that formed in Middle Devonian time may have been retained. Hence, the formation could be an excellent reservoir for migrating hydrocarbons.

Three formations contain probable source beds for the generation of gas, of which the black shale of the Chattanooga is thickest and most promising. Both fault and anticlinal traps, or combinations of the two, may be present. Drilling will be needed, however, to determine whether gas has entered and been trapped in the Wildcat Valley Sandstone in the Valley and Ridge province.

OSBORNE, ROBERT H., Dept. Geol. Sci., Univ. Southern California, Los Angeles, Calif., and PETER E. BORELLA, Dept. Geology, Riverside City College, Riverside, Calif.

Late Middle and Early Late Ordovician History of Cincinnati Arch Province, Central Kentucky to Central Tennessee

Megascopic and microscopic examination of late Middle and early Late Ordovician strata from Lexington, Kentucky, to Nashville, Tennessee, showed six major limestone classes. Sediments comprising classes 1 through 4 were deposited in "open" epicontinental marine environments, whereas classes 5 and 6 reflect more "restricted" environments. The recognition of limestone classes and subclasses permitted the construction of relative mechanical-energy and relative-depth indices which were used to infer the paleobathymetry of this

area during a time-stratigraphic interval. The base of this interval is defined by a traceable bentonite bed commonly present near the base of the Brannon Member of the Lexington Limestone. The top is defined by a major change in the relative abundance of deep- and shallow-water platform conodont elements.

Relative mechanical-energy and depth contours intersect the present Cincinnati arch axis at high angles, which suggest that a continuous arch was not present during the time interval examined. Shoal environments existed in the Lexington, Kentucky, area and north-northeast of the present Nashville dome. The Lexington shoal was surrounded by deeper water environments on the north, east, and south, which suggests that the Lexington dome or perhaps a precursor to the dome was present during the late Middle Ordovician. Paleobathymetric contours roughly parallel east- and south-trending normal faults which are present in the Lexington area. This suggests that these faults were active during late Middle Ordovician time, and were partly responsible for creating the bathymetric relief necessary for high-energy carbonate sediments to accumulate.

Deeper water environments were in the north, west, and east of the southern shoal area, and a more restricted environment was present in the south. This southern shoal corresponds geographically to the position of the Nashville dome during the Middle Ordovician. The presence of restricted marine facies south of this shoal reflects a north-trending facies. The deeper water environments west of the shoal reflect the presence of the Reelfoot rift. The deeper water environments north of this shoal reflect the presence of the Rome trough.

The late Middle and early Late Ordovician strata in this area generally reflect a transgressive episode. These results are consistent with an oscillatory and submergent model for cratonal sedimentation.

PATCHEN, D. G., and R. A. SMOSNA, West Virginia Geol. Survey, Morgantown, W. Va.

Evolution of Basin-Shelf Relations during Silurian Time in West Virginia

Thickness and lithofacies maps of nine mappable Silurian units illustrate that during Middle Silurian time a broad shelf emerged from southeast to northwest across southern West Virginia, creating an adjacent basin on the north. This shelf thus separated the northern basin from the rest of the Appalachian basin on the southwest in Kentucky, Tennessee, and Alabama. The Lower Silurian Tuscarora Sandstone was deposited throughout an extensive, unbroken area from Tennessee to Pennsylvania under fluvial to shallow-marine conditions—onshore-offshore complex from east to west. Likewise, the Rose Hill Shale was laid down in this same linear region, although ferruginous sandstones in the lower part were restricted areally along the eastern margin. The Rose Hill isopach map indicates the beginnings of differential subsidence with a major thickening of the formation in central West Virginia. The broad shelf and adjacent basin began to develop with sedimentation of the overlying Keefer Sandstone. Two major sources supplied sediment: coarser clastic rocks from the southeast onto the shelf and finer clastic material from the

northeast into the basin. During deposition of the Middle Silurian McKenzie Formation and Upper Silurian Williamsport Sandstone, the same basin-shelf relations continued though the basin center did migrate northwest. A clean Williamsport Sandstone accumulated on the southern shelf while immature sandstones, siltstones, and shales formed in the northern basin and on mud flats associated with the Bloomsburg delta. The Wills Creek Shale represents uninterrupted deposition of fine clastic materials in the basin and on mud flats on the northeast. Restriction of the sea in Upper Silurian time is shown by the basin-centered Salina evaporites (halite and anhydrite) and the surrounding-shelf carbonates (Tonoloway Limestone). Shelf development on three sides of this basin essentially separated it from a Salina basin in Ohio as well as from the southern Appalachian basin. The depocenter for the lower Salina salts had shifted to the northwestern part of West Virginia but later drifted to the north-central area for deposition of upper evaporites. The basin-shelf configuration probably existed until latest Early Devonian time. Higher energy environments were associated with the shelf areas during both sandstone and carbonate deposition, whereas shale and limestone accumulated in the adjoining basin under lower energy conditions. Known hydrocarbon reservoirs in the Keefer, McKenzie, Williamsport, and Salina/Tonoloway are on the respective shelves. Future exploration for gas should be concentrated in those areas where the shelf extended during different periods of Middle and Late Silurian time.

QUICK, R. C., E. F. PAWLOWICZ, Dept. Geology, Bowling Green State Univ., Bowling Green, Ohio, and W. J. HINZE, Dept. Geosci., Purdue Univ., West Lafayette, Ind.

#### Bowling Green Fault—Case of Resurgent Tectonics?

The Bowling Green fault lies along the west flank of the Findlay arch and is a part of the Lucas-Monroe monocline. Detailed gravity and magnetic studies in Wood and Lucas Counties of northwestern Ohio indicate that the trend of the fault parallels the west flank of a strong north-south-trending gravity and magnetic high, interpreted to represent an abrupt change in the character and structure of the basement rocks. This geophysically defined boundary in the basement can be traced northward across parts of southeastern Michigan and Lake Huron to the vicinity of exposures of the Grenville front in Ontario, and southward across Ohio. The correlation of this boundary with some Paleozoic structures that flank the Michigan basin is strong evidence that the boundary had been a zone of basement weakness which was reactivated during the formation of the Michigan basin. The association of petroleum accumulations with geophysical trends, such as the Albion-Pulaski-Scripio trend and the Lucas-Monroe monocline, illustrates the economic potential of detailed gravity and magnetism data in structural and tectonic interpretations.

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#### Stratigraphy as Key to Arch-Related Origin of Little North Mountain Structural Front, Virginia and West Virginia

The Little North Mountain structural front along the western margin of Shenandoah Valley separates the eastern and western Valley and Ridge structural belts in Virginia and West Virginia. Here Cambrian and Ordovician carbonate rocks of the North Mountain thrust sheet lie in fault contact on younger rocks on the west. Stratigraphic units ranging in age from Late Ordovician to Middle Devonian are exposed in a line of ridges and hills collectively termed Little North Mountain, just west of or in the fault zone.

Upper Ordovician to Middle Silurian rocks provide most of the data for the following interpretation. A normal stratigraphic sequence west of Little North Mountain (Judy Gap area, West Virginia) is Ordovician Reedsville Shale, Oswego Sandstone, Juniata Formation (red beds), and Silurian Tuscarora Sandstone, Rose Hill Formation, and Keefer Sandstone. In Massanutten synclinorium on the east, the sequence is Ordovician Martinsburg Formation (chiefly turbidites) overlain by Silurian Massanutten Sandstone. Five segments of Little North Mountain show four distinctly different stratigraphic sequences. The Gerrardstown, West Virginia, segment has a sequence very similar to that of the western Valley and Ridge. The Saumsville and Freemason Mountain, Virginia, segments contain an Oswego section with a tongue of Juniata red beds. In Rockingham County, Virginia, the Brocks Gap segment has a 400 to 600 ft (122 to 183 m) thick sandstone between the Martinsburg and Rose Hill Formations, and Juniata red beds are absent. Conformable Martinsburg and Tuscarora are present in the Buffalo Gap segment, Augusta County, Virginia. Only the Buffalo Gap and Gerrardstown segments are rooted; the intervening segments are tectonic slices transported differentially westward so that all are roughly in line, forming the discontinuous segments of Little North Mountain. As stratigraphic sequences of the segments are compared with each other and with those east and west of the front, the relative westward transport of each and the configuration of a Late Ordovician through Early Devonian axis of thinning may be established. The Brocks Gap segment has been transported farthest west from an initial position on or east of the axis, and the Gerrardstown and Buffalo Gap segments the least. The Brocks Gap segment requires approximately 5 mi (8 km) of transport over the Devonian black shales in the North Mountain fault system. This indicates the presence of Silurian and Lower Devonian sandstones which have associated probable fracture porosity and possible natural gas under part of the North Mountain thrust sheet in the western Shenandoah Valley.

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Lithofacies Relations in Alexandrian and Early Niagaran Rocks (Silurian) in Indiana and Parts of Illinois, Kentucky, and Ohio

Early Silurian depositional patterns indicate a structural setting different from that of the Ordovician Pen-

od and not yet defining patterns recognized later in the Silurian Period. The oldest Silurian rocks have a limited distribution. Shale and argillaceous carbonate rocks (Wilhelmi) in northern Indiana and adjacent Illinois contain much reworked Ordovician material and in Indiana pinch out southward. Their distribution appears to be related to subsidence in the Michigan basin. Contemporary impure carbonate rocks (Belfast) in central Kentucky and more argillaceous sedimentary rocks in Ohio suggest a depositional encroachment from the Appalachian basin.

The Brassfield-Sexton Creek complex represents deposition in extensive seas lacking strong tectonic control. In Indiana distribution of impure cherty carbonate rock corresponds closely to the present Illinois basin, but these deposits are continuous north into the present Michigan basin. Two north-south-trending linear positive in eastern Indiana bound this facies on the east. East of the northern positive the lithology changes to relatively pure platform carbonate rocks, whereas a distinct facies is present on the Ripley Island positive on the south and gives way east and south mainly to a cherty carbonate rock. Intercalations of shale in the No. land Formation above this cherty carbonate rock reflect a southeastern or eastern clastic source.

After cessation of deposition in much of the area dominantly carbonate deposition resumed except that a tongue of shale (Ezell-Osgood) from the east spread into central Kentucky and southeastern Indiana where there is a facies change north and west into carbonate materials. The carbonate rocks (Salamone-St. Clair) that are contemporaneous with and directly overlying this shale represent an extensive thin blanket deposit lacking terrigenous material but thickening northward.

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#### Precambrian Geophysical Provinces in Indiana

Regional statewide gravity and magnetic surveys in Indiana reveal large areas of high and low intensities. The source of these variations is lithologic changes within the Precambrian basement. A generalized map of basement provinces, constructed from both gravity and magnetic data, identified regions of basement lithologies as either dense or magnetic-rich rocks or combinations thereof.

Analyses of intense magnetic anomalies reveal the basement surface to range from 2,000 to 11,000 ft (610 to 3,353 m) below sea level. Many of the anomalies appear to be concentrated along the Cincinnati arch. Detailed studies of two regions suggest that the sources

may be basaltic pipe-like intrusions into a granitic country rock. Lava-flow structures may be associated with the individual pipes.

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#### Early Pennsylvanian Depositional Systems in Northeastern Kentucky—Their Relation to Local Structure

The Early Pennsylvanian in northeast Kentucky was marked by the initiation of the massive clastic deposition which dominates the Pennsylvanian and Permian of the Appalachian basin. Investigation of these sedimentary rocks has led to a new insight as to their occurrence and origin.

Five distinct facies, defined on the basis of composition, grain size, sedimentary structures, biota, and trace fossils, have been identified. The facies are represented as: (1) black, silty shale with abundant organic matter; (2) fine-grained, trough cross-bedded, quartzose sandstone; (3) horizontally laminated, bioturbated, silty sandstone; (4) fine-grained, horizontally thin-bedded sandstones with trace fossils common; and (5) coarse-grained, planar, and trough cross-bedded, quartzose sandstone.

The facies are in a generally coarsening upward sequence which directly overlies Mississippian carbonate rocks of the Newman Formation or siltstones and shales of the Borden Formation. The orientation of the facies and the relation of paleocurrent data to that of adjacent Lower Pennsylvanian sedimentary rocks indicate structural control from a topographic high on the west. In addition, the nature of the basal contact suggests that this structure may have been active in Middle or Late Mississippian time.

The systems appear to be related to the Lower Pennsylvanian conglomerates and sandstones of southeastern Ohio and are separate from the massive Lee Formation sandstones and conglomerates farther south and east.

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**Basin Evaluation in the East-Central United States**

Abstract not available.

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**Structural and Stratigraphic Aspects of Fort Payne (Lower Mississippian) Petroleum Production from Waulsortian-type Carbonate Lenses and Mounds in North-Central Tennessee**

Following the discovery of oil production in Lower Mississippian (Fort Payne) carbonates in Scott County, Tennessee in 1969, an active drilling campaign has led to the discovery of several significant oil fields. These fields are aligned in parallel trends extending northeast through Scott and Morgan counties and roughly parallel to and east of the Cincinnati Arch. The Oneida West Field, the discovery pool, had produced over 1,100,000 barrels by the end of 1975. The Indian Creek Field, discovered in December 1973, has also produced in excess of 1,000,000 barrels by the end of 1975. The crude production in Tennessee in 1975, mostly from Fort Payne fields, was 682,457 barrels. Favorable reservoir conditions occur in a carbonate facies up to 80 feet in thickness, and at an average depth of 1,300 feet. Open flow potentials range up to 1,700 BOPD with reservoir pressures up to 900 PSI.

The geometry and microfacies of Fort Payne mounds are similar to those typical of Waulsortian mud mounds and lenses of Lower Carboniferous age in western Europe and western North America. Whereas most Waulsortian mounds have been observed in surface exposures, the Tennessee mounds are documented by subsurface cores, samples, and mechanical log information. Structural and isopachous maps in addition to cross sections illustrate mound geometry, facies associations, and possible relationship of mound development to pre-existing structure on the underlying Chattanooga Shale.

The bryozoan-crinoidal wackestone facies of the Tennessee mounds is highly fractured and brecciated. Most porosity occurs as vugs commonly in stromatactoid structures partially filled with sparry calcite and internal sediment. Interconnected fracture and vug porosity accounts for reservoir permeability. The origin of porosity and permeability in the mound is uncertain. Decay of organic material to form stromatactoid vugs, transportation of internal sediment, de-watering and slumping of the mud build-up may have led to fracturing of partly cemented calcitic mudstone. Evidence of sparse evaporites and pseudomorphs of evaporites in the mound and particularly in adjacent dolomitic facies may indicate shallow water sedimentation in tropical or subtropical latitudes. If so, the mounds may have been

subaerially exposed periodically. Fresh, meteoric waters may have favored solution of carbonates and particularly evaporites. Evacuation of evaporites or solution of carbonates could account for the development of micro-fractures and angular solution or collapse breccia prominent in the producing facies.

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**Perspectives on Energy Problems: Ecology, Energy, United States and World Hydrocarbons**

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