

BULLETIN



HOUSTON GEOLOGICAL SOCIETY

Houston, Texas

Volume 9, No. 6

February, 1967

Houston Geological Society

1966-1967

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| Alternate | <i>Harold E. Voigt</i> | CA 4-5111 |



THIS MONTH

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| Editor..... | Fred M. Schall, Texas Gas Exploration Corporation..... | CA 2-9481 |
| Associate Editors | | |
| Committee Reports..... | McInnis S. Newby, North Central Oil.. | CA 4-5251 |
| News of Members..... | Eddie Heider, Schlumberger Well Surveying Corporation..... | CA 5-1607 |
| In Memoriam..... | Donald F. Gahagan, Tenneco Oil Company..... | CA 9-2711 |
| News of Societies..... | Fred M. Schall, Texas Gas Exploration Corporation..... | CA 2-9481 |
| Geo Science Notes..... | Walter Sadlick, Dept. of Geology University of Houston..... | CA 5-4451 |
| On the Distaff Side..... | Mrs. Clark (Virginia) Edgecomb..... | MO 5-6333 |

MEETING NOTICE

SIXTH MEETING - FEBRUARY 13, 1967

As usual the meeting will be held on the 10th floor of the Houston Club Building. The social hour starts at 5:15 P.M., dinner at 6:00 P.M. and the meeting will begin at 7:00 P.M.

Our guest speaker for the evening is Mr. MICHEL T. HALBOUTY, a member of our Houston Geological Society and President of AAPG. His talk is entitled "Creativity-The Basic Need in Future Exploration". Several points Mr. Halbouty will discuss are named below:

1. Anticipated future drilling activities in the coming years.
2. The type of ideas needed to locate the less obvious areas of accumulation.
3. How our future needs of petroleum will be met.
4. The type men needed to direct these new exploration programs.

Mr. Halbouty has traveled over 200,000 miles since being elected President of AAPG and has had an excellent opportunity to see and discuss first-hand what the future holds for us geologists. This paper is a realistic discussion of the coming years of petroleum exploration and it sets forth the position the geologists should and need to play in the years ahead.

Please make your reservations early and remember that you can call Cardinal Printing & Letter Service as late as Monday, February 13, to add your reservation - CA 3-9309.

CONTINUING EDUCATION PROGRAM

"Economics for Oil and Gas Explorationists" will be the subject of the next lecture series, presented by Mr. George C. Hardin, Jr., Kerr-McGee's Vice President for North American Oil and Gas Exploration. His lectures are scheduled for Wednesday, February 15, and Wednesday and Thursday, March 15 and 16, from 4 to 6 and 7 to 9 p.m., in the auditorium in the basement of the Humble Building. A catered "box supper" will be provided each evening in the adjoining cafeteria.

The entire cost, including the "box suppers," will be an appropriately economical \$10 per person. However, pre-registration is necessary for properly planning the meals. Pre-registration can be accomplished now by sending a check to the Houston Geological Society, 234 Esperson Building, with the names, affiliation and address of the people you wish to send; or you might suggest now to your people that they pre-register individually in the same manner.

THE PRESIDENT'S CORNER

In the AAPG's semi-centennial year we have the hardest working executive committee in the association's history. Two members of our Society are on the Executive Committee - Mike Halbouty, President, and Merrill Haas, Chairman of the Business Committee. These men have, at great personal sacrifice of time and money, been "telling the geologist's story" all over this continent. At last count, I am told Mike and Merrill had travelled over 237, 000 miles.

We are most fortunate in having men of this caliber who are willing to knock on industry's door and tell of our problems -- and we do have problems. Over the recent years geologists have had "feast or famine"; and at a period when our nation is at an all time economic high, geologists are having difficulty feeling secure in their job. We spend considerable effort in predicting long range energy needs, but I sometimes feel this is not properly coordinated with how we will meet these needs.

Immediately after any short term economic "pinch" geologists are usually the first to go and, after a few more ups and downs, I predict we will find we have insufficient geologists available or being trained in our schools to meet routine requirements much less an emergency. I'm concerned about this because those who have to do with predicting our future energy requirements tell us that we are not "keeping up" in replacing produced reserves plus future needs.

I am aware that I have oversimplified a complicated problem, but the basic idea, I believe, is correct. I am glad that Mike and Merrill who are acutely aware of this problem are at the "harness" of the AAPG this year. We need them!

I urge you to hear President Halbouty at our February 13 meeting for your edification as well as an encouragement to those who have worked so hard for us.

... Jesse L. George, Jr.

Directory

HOUSTON GEOLOGICAL SOCIETY GEOPHYSICAL SOCIETY OF HOUSTON

The new HGS-GSH Directory is moving ahead. New members will soon be notified as to time and place for directory pictures.

Old members who wish a new picture call Mrs. Hughes at Rembrandt Studios, Inc., 1205 Main Street, JA 8-4617. by February 15 for an appointment. Cost to old members will be \$2.75.

IS YOUR INFORMATION UP TO DATE ????

It has been sometime since information slips for the new directory were circulated to the membership. The Directory Committee feels that it is very possible that some members have changed offices, phone numbers, positions, etc., and would like the up-to-date information in the directory. Members who have information changes can use the form provided for this purpose. Please mail the completed form to Mrs. Howe, Cardinal Printing & Letter Service, 234 Esperson Building, Houston, Texas 77002.

..... detach

Name:

Local Society memberships:

Company affiliation:

Title:

Office address and Office phone:

Home address and Home phone:

Universities, colleges attended:

Wife's Name:

— Items From The Editor's Desk

The Houston Geological Society's recent publication on Deltas was dedicated to the late Dr. Harold N. Fisk whose work on the Mississippi river led to an appreciation of the importance of Deltas in our geologic thinking.

Ben Carsey candidate for President of AAPG is shown presenting Mrs. Fisk



Mr. Ben Carsey and
Mrs. Fisk

and Martha Lou Shirley with their copies of the delta volume in the dedication ceremony coincident with the December 1966 meeting of the HGS.

Martha Lou Shirley was the Chairman of the Committee responsible for the publication of the Delta volume. She deserves a lot of credit for this outstanding work.

To date over 1000 copies have been sold.

In another part of this bulletin you will find an announcement regarding the Technical section of the Houston Public Library which should be of interest to our members.

... Fred M. Schall



Mr. Ben Carsey and
Martha Lou Shirley

NEWS OF MEMBERS

Thomas J. McBryde, District Geologist for Atlantic Richfield, was transferred to Long Beach, California, as Offshore District Geologist.

O. N. Hopkins, Jr., Geologist for Texaco, Inc., in Bellaire, was transferred to Trinidad with Texaco.

Jim F. Patterson has rejoined the geologist consulting forces since Weco's operations have been taken over by Camerina Petroleum Corporation. Jim opened his office at 557 Main Building, Houston, Texas -- phone number CA 7-8361. He invites you to stop by and visit him.

Leighton F. Young resigned from Austral Oil Company to open an office as a petroleum geologist at 1408 C&I Life Bldg., Houston, Texas -- phone number CA 7-1031. Leighton will be glad to have you drop by.

E. Ralph Daniel has resigned from the Bank of the Southwest to join Curtis Hankamer, effective February 1, 1967. They will be located on the 7th floor of the Houston Bank & Trust Co. Bldg., effective March 1, 1967.

The Society wishes you much success in your new duties.

William C. Cooley, a Consulting Geologist, has moved his office to 204 McLendon Bldg., 500 Lovett Blvd., Houston, Texas - phone JA 9-7130.

The Texas Gulf Coast Division of Schlumberger Well Service has moved their offices from 906 to 1512 Bank of the Southwest Bldg. The following are affected by this move: Duane Babcock, Guy Sullaway, Ken Howell and E. H. Heider.

During 1966, E. H. Rainwater, Tenneco Oil Company, presented lectures in India, England, Brazil, Nigeria, and Alaska on various aspects of Petroleum Geology.

Joseph D. Watzlavick has resigned his position as Director and Officer of the Watzlavick Oil Co., Inc. and has divested himself of all his interest therein. The name of the corporation is to be changed.

ANNUAL BREAKFAST DANCE
of
THE HOUSTON GEOLOGICAL SOCIETY

Will be held at the beautiful Petroleum Club of Houston overlooking the metropolis of Houston.

Time - Friday, February 17, 1967

The price of \$15.50 per couple includes cocktails all evening beginning at 8:00. Dancing from 9:00 to 12:00, Buffet Breakfast at 11:30.

Purchase your tickets early, ticket sales will be limited to 150 couples. No table reservations will be made. Table arrangements will be available for 4, 5, and 6 couple groups, on a first come basis. So get up a party and take your wife out for Valentine.

Tickets may be purchased from the following:

Mr. Tom Purcell
George Mitchell & Associates
Houston Club Building -- CA 5-0161

Mr. Roger W. Hall
Pan American Petroleum Corp.
500 Jefferson Bldg. --CA 7-4371

Mr. Jack Stipes
Somac Offshore
2421 Humble Bldg. -- CA 5-0814

Mr. Bill Howell
Continental Oil Company, CATC
Capital National Bank Building
CA 5-1511 - Ext. 640

Mr. A. H. Wadsworth, Jr.
1626 Bank of the Southwest Building
CA 7-8151

Mr. Pete W. Cawthon, Jr.
First City National Bank of Houston
First City National Bank Building
CA 5-1271

LIBRARY COMMITTEE

In July 1965, the Houston Geological Society published the "Index to Geological Serials in the Houston Public Library." This catalogue indicates that our library has an excellent collection of geoscience data. We are not able to boast of having the best public geoscience library, even though we can boast of having the largest Geological Society in the world. Helping our library to achieve the status of a world renowned geoscience research library is certainly a worthwhile goal for our society.

The library committee needs the aid of volunteers who will help determine the deficiencies in our present collection. We need individuals who will re-search a subject or area in the "Index to Geological Serials in the Houston Public Library", and make recommendations for the acquisition of worthwhile supplemental books and serials. People with special interests (geophysics, paleontology, oceanography, Texas, Wyoming, California, Europe.....) can facilitate this appraisal. Once we have determined the shortcomings, we can establish a program to help obtain and maintain the collection.

Volunteers are also needed to survey new publications. Working through this committee, you can aid the library in choosing publications which will have the most value to members of the society and the general public.

If you can find a few minutes to aid us in the library evaluation, we will welcome your assistance. Call Barkley Souders, CA-8-7147.

BUREAU OF ECONOMIC GEOLOGY
The University of Texas
University Station, Box X
Austin 78712
Peter T. Flawn, Director

PUBLICATION ANNOUNCEMENT

Report of Investigations No. 58. NOMENCLATURE REVISION OF BASAL CRETACEOUS ROCKS BETWEEN THE COLORADO AND RED RIVERS, TEXAS, by W. L. Fisher and Peter U. Rodda. 20 pp., 8 figs., geologic map, December 1966 \$1.00

Basal Cretaceous sediments north of the Colorado River in Texas are mapped and designated according to lateral changes in facies and distribution of definitive overlying units. Units include: (1) Antlers Formation, used to designate basal Cretaceous sands and clays beyond the western and northern limits of the Glen Rose Formation; (2) Twin Mountains Formation (new name), including sands, clays, and siliceous gravels overlain by the Glen Rose Formation northward from northeastern Brown County; and (3) Travis Peak Formation, to include undiffer-

continued on page 14

PROFESSIONAL DIRECTORY
Space for Professional Cards of Members

JOSEPH L. ADLER
Geologist & Geophysicist
Chamber of Commerce Bldg.
CA 2-7925
Houston, Texas 77002

R. P. AKKERMAN
Geologist EXPLORATION Engineer
Review of Subsurface Data
3425 Bradford Place MO 8-4327
Houston, Texas 77025

ALLEN & GILKISON
Oil and Gas Consultants
Harris H. Allen and D. C. Gilkison
963 San Jacinto Bldg. CA 8-9329
Houston, Texas 77002

JOY J. ANNELER
Consulting Geophysicist
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7054 Hendon
PR 4-6562
Houston, Texas 77036

CRAMON STANTON
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CA 4-2759

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LESLIE BOWLING
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316 California Bldg. JA 2-0432
New Orleans, Louisiana

WAYNE F. BOWMAN
Independent Geologist
1314 Niels Esperson Bldg.
CA 2-0279
Houston, Texas 77002

ORVAL L. BRACE
Geologist
2206 South Coast Bldg. CA 8-5404
Houston, Texas 77002

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822 Americana Bldg.
CA 4-2656

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Petroleum Geologist and Engineer
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Houston, Texas 77025 MO 8-0471

GEORGE H. CLARK
Petroleum Geologist
404 First City National Bank
FA 3-1187
Houston, Texas

JACK COLLE & ASSOCIATES
Consulting Geologists
and Paleontologists
817 C & I Building
Houston, Texas 77002
Associate CA 7-6266
E. H. Stork, Jr. SU 2-4555

MORGAN J. DAVIS
Petroleum Consultant
MORGAN J. DAVIS, JR.
Geologist
Suite 709 Capital National Bank Building
CA 7-7209 Houston, Texas 77002

ERNEST A. ELWOOD, JR.
Prudential Drilling Company
1418 Bank of the Southwest Bldg.
CA 4-7741 Houston, Texas 77002

PAUL FARREN
Geophysical Consultant
Geodata Building MO 7-3317
5603 S. Rice Ave. (77036)

KENNETH L. GOW
Geologist and Engineer
1511 C & I Bldg.
CA 2-9921
Houston, Texas 77002

MICHEL T. HALBOUTY
Consulting Geologist
Petroleum Engineer
Independent Producer and Operator
The Michel T. Halbouty Bldg.
5111 Westheimer NA 2-1130
Houston, Texas 77027

HILLORD HINSON
Consulting Geologist
CA 8-9455
2138 Bank of the Southwest Bldg.
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Consulting Geologist
Oil and Sulphur
3524 Sunset Blvd. MO 8-9196
Houston, Texas 77005

S.I.P.E.S.
SAM M. PENA
Consulting Geophysicist
Offshore
(Geophysical Data Trades)
2601 Esperson Bldg.
Houston, Texas 77002
Bus: FA 3-8455 Res: SU 2-6802

WALLACE E. PRATT
Geologist
1620 El Paso National Bank Bldg.
El Paso, Texas 79901

RAYMOND D. REYNOLDS
Geologist
436 Bankers Mortgage Bldg.
Houston, Texas 77001
CA 7-5309

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1907 Bank of the Southwest Bldg.
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Houston, Texas 77002

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Petroleum Evaluation Engineer
CApitol 7-3949
1119 Bank of the Southwest Bldg.
Houston, Texas 77002

GENE VAN DYKE
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Southwest Tower
CA 8-8174

MERLIN J. VERRET
Geologist
Route 2, Box 109
Lake Charles, Louisiana
Phone: 477-1477-8

LAWRENCE J. VITTRUP
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Representing
Goodale, Bertman & Co., Inc.
1925 Bank of the Southwest Bldg.
FA 3-1191 Houston, Texas

J. C. WALTER, JR.
Geologist and Petroleum Engineer
3055 Humble Bldg. CA 7-1246
Houston, Texas 77002
Home Phone: HO 5-9773

JAMES A. WHEELER
Geologist
C.P.G. No. 109
926 Americana Bldg. CA 3-1618
Houston, Texas 77002

PROFESSIONAL DIRECTORY
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JAMES M. WILSON
Geophysical Consultant
415 San Jacinto Building
CA 7-7845

WOODHAM CONSULTING CO.
Geological-Geophysical Consultants
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1200 C & I Building
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JOHN D. MARR
Petroleum Exploration Consultant
Geophysics, Geology
Seismic Data: Acquisition, Processing
and Interpretation
2130 Chamber of Commerce Building
CA 4-9624

THOMAS O. HALL
Geophysical Consultant
NA 2-8680

*On The
Distaff Side*

Vivian and Charlie Ross celebrated their 25th wedding anniversary Christmas Eve with a few close friends.

Maxine and Earl Fry took a Mexico City playcation shortly before the Yuletide festivities.

Marjorie and Charles Edwards entertained his folks from Florida during the later part of December.

Enjoying bird shooting near Laredo last week were HGSer's Jack and Grace Chambers, Marybelle and Kenley Clark, and former Houstonites Virginia and George Hardin.

Lois Perryman is off to Africa on a safari with another woman friend and yours truly thinks they are mighty brave to try it alone. Lillian and Bob Moehlman had daughter, Linda, and her family with them from San Francisco during the holidays.

Kay and Harry Killian haven't left the home fires for they are momentarily awaiting grandchild no. 3. Their son was home last month from New York University.

Heading up a long list of travelers to Los Angeles next spring for the National AAPG will be Louise and Jesse George. Prex, that is Heddie Rowe finished off a gay whirl of activities celebrating Pat Reagan's retirement by hostessing guests from Georgia, California and Oklahoma.

Paul and June Farren are planning on finding if "rain is on the plain mainly in Spain" this spring with the International Rotary.

Kathryn and Roland Theis were delighted to hear from their Son Lt. Mack Theis, who is fighting in Viet Nam.

The recent premiere of the movie "Hawaii" looked like an HGS convention, so many members turned out to see it.

... Virginia Edgecomb

entiated sequences of sands and carbonate gravels beneath the Glen Rose Formation bordering the Llano Uplift.

Included in the report is a colored geologic map at scale of 1:500,000 showing outcrop of the Antlers, Twin Mountains, Glen Rose, Paluxy and Travis Peak Formations north of the Colorado River.

The complete publication is immediately available. Texas residents should add State sales tax of 2 cents to the sale price shown above.

BUREAU OF ECONOMIC GEOLOGY
The University of Texas
University Station, Box X
Austin 78712

PUBLICATION ANNOUNCEMENT
Bulletin 3232 -- Fifth Printing

THE GEOLOGY OF TEXAS, Vol. I, STRATIGRAPHY, by E. H. Sellards, W. S. Adkins, and F. B. Plummer. Published in 1933 with reprintings in 1947, 1954, and 1958. Fifth printing, November 1966 \$3.00 + 6¢ tax.

Bulletin 3232, which has been out of print for some months, is again available as shown above. Orders are invited and can be filled immediately.

The fifth printing was made in order that this basic reference in Texas geology would be available until such time as a revised edition, which clearly is needed, is written; it will require several years to complete such revision. This new printing is accompanied by the 1963 edition of the Geological Highway Map of Texas published by the Dallas Geological Society and made available by the Society as a public service.

A BASEMENT MAP OF NORTH AMERICA

A "Basement Map of North America," published jointly by AAPG and the U. S. Geological Survey, went on the market January 3, it was announced nationally by the Dept. of Interior.

The map will help in locating those areas in which substantial amounts of oil and natural gas may have accumulated. It will have other uses, such as helping to pinpoint the origins of earthquakes.

In announcing the map, the Interior Dept., quoted AAPG President Michel T. Halbouty, of Houston, as follows:

"Contour lines on the map show the extent and depth of the sedimentary basins which provide the greatest opportunities for discovery of the 55 billion barrels of oil and 300 trillion cubic feet of gas required to maintain an adequate reserve position for the United States in the next 10 years."

U.S.G.S. scientists who contributed to the map said that the new map will also provide data for:

Calculating the volume of sedimentary deposits in basins from which estimates of the total amount of oil and natural gas that might have formed in these basins can be based.

Interpreting seismic records from nuclear explosions and earthquakes.

Interpreting geophysical measurements obtained in the study of the crust and upper mantle of the earth being conducted by Federal agencies, universities and international scientific committees.

The wall-size, 1:5,000,000 (1 inch = 80 miles) scale map provides information on basement rocks from northern Mexico (latitude 24 degrees north) to central Canada (latitude 60 degrees north). It was compiled over a period of 10 years.

The contoured surface of the basement is shown at 500-, 1000-, 2000- and 4000- foot intervals; the deepest basins reached depths of more than 40,000 feet. The map also shows the nature of these rocks where exposed at the earth's surface in the Appalachian Mountains, over much of central and eastern Canada, in north central United States, in scattered mountain ranges of the Rocky Mountains, in the Sierra Nevada of California, and in the Coast Range of western United States and Canada.

Where concealed by overlying sedimentary rocks, geologists may study the basement rocks by examining the cores and cuttings obtained from thousands of deep wells that reach or are drilled into the basement. The new map shows the location of these wells. Records of wells used in preparing the map are available from AAPG headquarters in Tulsa.

This new map may be purchased by mail at \$1.00 per copy from AAPG headquarters, or from the U.S.G.S. distribution offices in Washington, D.C.; Denver, Colo.; and Fairbanks, Alaska. Copies may be purchased over-the-counter only at the following U.S.G.S. offices: Anchorage, Dallas, Denver, Los Angeles, Salt Lake City, San Francisco, and Spokane.

AAPG members participating on the basement rock project committee were Peter T. Flawn, chairman; Donald L. Blackstone, Jr., John F. Caley, Virgil B. Cole, Teodoro Diaz G., Richard V. Dietrich, Roy W. Foster, Eduardo J. Guzman, Michel T. Halbouty, Jonathan H. Halsey, William C. Hayes, Paul L. Lyons, Edwin D. McKee, Peter H. Masson, Laurence L. Sloss, Merritt B. Smith, Alfred O. Woodford, George P. Woollard, Addison Young, and Douglas M. Kinney.

CODE OF ETHICS

The founders of AAPG were concerned at an early date that companies, individuals, and institutions should be protected from unethical, untrained and inexperienced geologists. At the Fifth Annual Meeting of The American Association of Petroleum Geologists in 1920, a committee presented a resolution recommending that the oil-producing states certify geologists based on training and experience. In part, I quote the reasons as set forth in the resolution: "Whereas, we feel that regularly qualified geologists are not now sufficiently protected from unqualified and unscrupulous men practicing geology, therefore, be it resolved that efforts be made in every state in which petroleum is produced to obtain laws requiring that practicing geologists be licensed. " The Executive Committee wisely tabled this recommendation and recommended that the objectives of the Committee could best be obtained by careful attention to standards of membership in the Association and in the enforcement of them as well as the proper enforcement of discipline among its members.

The question of ethics continued as one of their important problems. In 1923, the Executive Committee again considered the problem, and it was decided to frame a code that would be acceptable to the majority of the members. A code of ethics was adopted by the Executive Committee on March 26, 1924, while in session during the annual meeting in Houston. At that time there were approximately one thousand active and associate members. The Code of Ethics as written and adopted in 1924, with minor changes, is practically the same today.

During the past several years, there has been a lot of discussion and action on certification. Certification vouches for a geologist's academic training and experience and, to a limited extent, his integrity and character. If all of the members of the geologic profession were aware of and adhered to the Code of Ethics, there would be little need for certification. Perhaps each member should occasionally refresh his memory and reaffirm his dedication to the profession by reading the Code of Ethics. The Code appears each year in the March issue of the Bulletin, or better yet, a copy suitable for framing can be obtained for \$1.00 from AAPG headquarters.

... Jed B. Maebius

TRANSPORTATION - HOUSTON TO LOS ANGELES

52nd ANNUAL MEETING A.A.P.G., APRIL 1967..

The Continental Airlines has agreed to reserve seats and make special efforts to accommodate A.A.P.G. members of Houston and vicinity on three particular flights between Houston and Los Angeles.

Couples who leave Houston on Saturday, April 8th at 5:00 P.M. on Flight 53 may buy tickets designated "30-day Excursion Fare", Club Coach, at a round trip cost of \$268.70 for two. Meals and drinks are included in round trip fare. These accommodations should appeal to those leaving early for committee work and assignments.

Those who wish to leave Houston on Sunday, April 9th, may do so on either Flight 59, leaving Houston at 8:00 A.M. and arriving in Los Angeles at 9:05 A.M., Pacific Standard Time; or on Flight 63, which leaves Houston at 1:45 P.M. and arrives in Los Angeles at 2:50 P.M. Pacific Standard Time. The cost, per couple, for tickets on these two flights are as follows:

| | |
|-------------|------------------------------------|
| First Class | \$361.31 - Meals and drinks served |
| Club Coach | 298.62 - Meals and drinks served |
| Economy | 305.76 - No meals served |

From the above it will be apparent that couples can save money by departing Houston on Saturday, April 8th, using the "30-day Excursion Fare". For those couples departing Sunday, April 9th, it will be more economical to use Club Coach accommodations than Economy accommodations.

Individuals traveling without their spouses will pay regular tariff on these flights.

It is suggested that reservations be made early, with Miss Jean Scallan, CA 3-1020, or Mr. Dick Nolan, CA 4-7611. Additional information may be obtained by calling these Continental Airlines representatives at the above listed numbers.

Carleton D. Speed, Jr.
Chairman of Transportation

NOTES

STRATIGRAPHY AND CARBONATE PETROGRAPHY
OF THE SIERRA DE PIACHOS AND VICINITY,
NUEVO LEON, MEXICOBobby Arnold Bishop
University of Texas, Ph.D. thesis, January, 1966

ABSTRACT

The stratigraphic section in the Sierra de Picachos is approximately 4,900 feet thick, is divisible into seven formations, and ranges in age from Nocomian to Campanian and possibly Maestrichtian (Early and Late Cretaceous). The formations are, from oldest to youngest: Cupido, La Pena, Tamaulipas, Sombretillo, Formation is introduced in this paper.

The Cretaceous section is composed predominantly of limestone, with minor amounts of dolomite, chert, and terrigenous clay. The limestone is of one type: lithified carbonate mud (micrite). Pore-filling sparry calcite is completely absent, which is unusual for such a thick section of limestone. The micrite differs mainly in the contained organic constituents, which consist principally of pelagic protists (Foraminifera, calcispheres, tintinnids, and radiolarians). The micrite average about 15 percent organic constituents by volume; some of the micrite in the Tamaulipas and San Felipe contains more than 50 percent organic constituents by volume.

Subdivision of the micrite into petrographic types is based principally on the kinds and relative abundance of allochemical constituents. Petrographic types include micrite, dolomitized micrite (restricted to the Cupido), intramicrite, ostracod-bearing micrite, calcisphere biomicrite, Foraminifera biomicrite, and others.

The study of electron micrographs suggests that recrystallization is the process by which an unconsolidated carbonate (aragonite) mud becomes a hard aphanitic limestone. The recrystallization, which involves the inversion of aragonite to calcite, results in crystal growth and a welding together of the calcite crystals to produce a lithified micrite.

Sedimentary silica, thought to be of both organic and inorganic origin, was deposited contemporaneously with the lime mud. The silica was reconstituted and redistributed during early diagenesis, probably as a response to changes in pH, to form lenses, stringers, and irregular nodules of chert. Chert occurs in the Cupido, La Pena, Tamaulipas, and Cuesta del Cura; it is especially abundant in the Cuesta de Cura.

The Cretaceous section is divided into seven zones, based principally on the identification of pelagic microfossils in thin section. The three best developed

zones are: 1) Colomiella (a tintinnid) zone, which is restricted to the lower 290 feet of the Tamaulipas, 2) thick-walled calcispheres zone (150 to 180 feet thick), which is restricted to the upper part of the Tamaulipas and the overlying Sombretillo Formation, and 3) Globigerina-Globotruncana zone (greater than 1, 150 feet thick), which is restricted principally to the San Felipe.

The Early Cretaceous (middle Albian to late Cenomanian) Stuart City reef trend of southwest Texas is postulated to extend into northeast Mexico and to pass west of the Picachos region. The reef trend developed along the outer margin of a broad shelf (undaform).

The lime mud is a basin facies and is interpreted to have been deposited on the clinoform, in front of the postulated undaform-edge Stuart City reef trend. The depositional interface was below wave base throughout deposition of most of the sediment. The rate of accumulation of lime mud during the Comanchean Epoch is calculated to be 3.0 to 3.5 cm per 1,000 years. Most of the lime mud is thought to have been precipitated from the relatively shallower and warmer waters that bathed the undaform, and then transported seaward by currents and deposited on the clinoform. Both algal (as suggested by abundant algae in contemporaneous shelf limestones) and physicochemically precipitated aragonite needles were probably important constituents of the lime mud. Intermittent rains of the calcareous tests of pelagic micro-organisms contributed substantially to the mud. Some of the Upper Cretaceous micrite (San Felipe) probably originated during the passage of shell fragments through the digestive tracts of burrowing organisms (possibly annelid worms).

Carbonate sedimentation was terminated by the widespread influx of terrigenous clay (Mendez Shale) during the late Cretaceous, as a response to increasing tectonism in the source area.

THE GLEN ROSE SECTION IN THE CANYON RESERVOIR AREA COMAL COUNTY, TEXAS

Patrick Leon Abbott
University of Texas, M.A. thesis, August, 1966

ABSTRACT

The area lies in the western edge of the Balcones fault system near the eastern margin of the Edwards Plateau. En echelon, down-to-the-coast faults repeat section which is well exposed in the rejuvenated, youthful topography.

The nearly horizontal Cretaceous strata range in age from Middle Aptian to Middle Albian and are covered in some places by Quaternary alluvium and colluvium. The concept of physically defined time-stratigraphic units of sub-series rank is useful in understanding the stratigraphic relationships within the Trinity and Fredericksburg Divisions.

Laterally persistent, essentially synchronous sedimentational units of the Glen Rose Formation weather into a diagnostic alternating bench and slope topography. Deposition took place in an extensive shallow back-reef sea formed behind the Stuart City reef. The Glen Rose of the report area is separated into twelve locally recognizable subdivisions.

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