January, 1988

BULLETIN

HOUSTON GEOLOGICAL SOCIETY

Volume 30

Number 5

HGS JANUARY CALENDAR

JANUARY 11, 1988 (Dinner Meeting)
"Post-Depositional Analysis of Producing Shelf-Slope Environments of Deposition, High Island Area"
D. A. Anspach, Pennzoil, Houston
Social Period 5:30 PM, Dinner and Meeting 6:30 PM
Westin Oaks Hotel, 5011 Westheimer
Reservations made by name only, telephone **771-8315.** Must be made or cancelled no later than **noon Friday, January 8.**

JANUARY 13, 1988 (Dinner Meeting)
HGS INTERNATIONAL EXPLORATIONISTS
"Oil Exploration in Non-Marine Rift Basins of Interior Sudan"
Thomas J. Schull, Chevron USA, Denver
Westin Galleria Hotel, 5060 Alabama, 5:30 PM
Purchase tickets by **Monday, January 11.**

JANUARY 27, 1988 (Luncheon Meeting)
"Depositional Environment of Downdip Yegua (Eocene) Sandstones, Jackson County, Texas"
C. J. Whitten, R. R. Berg, Texas A&M Univ., College Station
Social Period 11:30 AM, Luncheon and Meeting 12 noon.
Doubletree Hotel, 400 Dallas
Reservations made by name only, telephone **771-8315.** Must be made or cancelled by **noon Monday, January 25.**

JANUARY 12-14, 1988
HGS Environmental Committee School
"Introduction to Hydrogeology"
Hyatt Regency West, 13210 Katy Freeway

HOUSTON GEOLOGICAL SOCIETY
6916 Ashcroft Houston, Texas 77081
(713) 771-8315

Volume 30
Published monthly September through June

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HOUSTON GEOLOGICAL SOCIETY

BULLETIN

Vol. 30, No. 5
January, 1988

The Houston Geological Society was founded in 1923 and incorporated in 1975. The society's objectives are to stimulate interest and promote the advancement of Geology in this area, to disseminate and facilitate discussion of geological information and to enhance professional interrelationships among geologists. The society includes nearly 5,000 members locally and publishes a monthly Bulletin (September through June) in addition to special scientific publications. The HGS also provides student scholarships and continuing education programs for professional geologists.

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OUR COVER PHOTO

Buffalo Bayou within Barker Dam, looking upstream (west). Photo by Robert B. Rieser, ERICO Exploration Systems.

"If I were alive today, I'd place my ad in the HGS Bulletin"

Col. Edwin L. Drake

PRICE SCHEDULE— JANUARY MEETINGS

Westin Oaks Hotel, January 11
Dinner $18.00

Doubletree Hotel, January 27
Luncheon $14.00

International Meeting
Westin Galleria Hotel, January 13
Dinner $20.00

RESERVATIONS POLICY

When purchasing dinner or luncheon tickets at the door, names will be checked against a reservation list. Those with reservations will be sold tickets immediately and those without reservations will be asked to wait for available seats. **All who do not honor their reservations will be billed** for the price of the meal.

We realize that activities come up which keep members away from the meetings. If a reservation cannot be kept, may we suggest that you send someone in your place.

PUBLICATION ORDER FORM
HOUSTON GEOLOGICAL SOCIETY

	No. of Copies	Price	Total Amount
SPECIAL VOLUMES			
Houston Geological Society Membership Directory, 1986		$15.00	$
Directory of Oil Company Name Changes, Compiled by William K. Peebles. A handy reference of cross company name changes, September, 1986		8.00	
Exploration Software and Data Sources for Micros. Craig E. Moore, Editor; Bruce Grethen, Kari K. Rekoske and Barry L. Smith, Contributors. September, 1986		15.00	
Typical Oil and Gas Fields of Southeast Texas, Volume II, G.K. Burns Editor Ninety field reports - maps, cross sections, type logs and text including production data. Synopsis of regional geology.		60.00	
Finding Deep Sands in the Gulf Coast Tertiary, by Doris M. Curtis. Short course notes, November, 1984		10.00	
Houston Area Environmental Geology: Surface Faulting, Ground Subsidence, Hazard Liability, E.M. Etter, Editor, 1981		10.00	
Deltas in Their Geologic Framework, M. L. Shirley, Editor, J. A. Ragsdale, Asst. Editor. 1966, 3rd printing 1981, Hardbound book		15.00	
Deltas — Models for Exploration, M. L. Broussard, Editor. 1975, 2nd printing 1981, Hardbound Book		25.00	
THE TWO-VOLUME HARDBOUND SET of **Deltas in Their Geologic Framework** and **Deltas — Models for Exploration**		30.00	
Abnormal Subsurface Pressure by HGS Study Group, 1971		5.00	
CROSS SECTIONS			
Stratigraphic Cross Sections of Southeast Texas by HGS Cross-Section Committee, 1979		25.00	
FIELD TRIP GUIDEBOOKS			
Field Seminar of the Big Bend, Trans-Pecos Region Texas, James B. Stevens, Leader, 1986		20.00	
Damon Mound, Texas, Field Trip Guidebook. E.M. Etter, Editor. 1979		8.00	
Lignite Resources in East-Central Texas, Field Trip Guidebook by J. L. Jobling, 1979		3.00	
Lower Tertiary of the Brazos River Valley, Field Trip Guidebook, D. G. Kersey, Editor, 1979		8.00	
Oil Fields, Subsidence and Surface Faulting in the Houston Area, Field Trip Guidebook by M.M. Sheets, 1979		3.00	

Total of Publications Requested $

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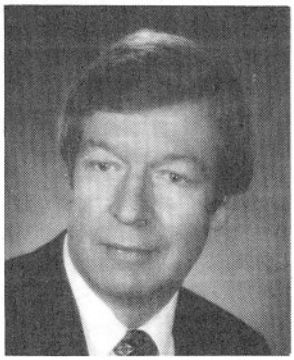
PRESIDENT'S COMMENTS



I was just reminiscing about the GCAGS Convention in San Antonio and am happy to report that the mood there could best be characterized as one of optimism. Gone was the mood of despair that dominated the convention in Baton Rouge the previous year. Attendance was 1,885 paid delegates, up from approximately 1,300 last year. I am fortunate to have attended 28 of the past 30 GCAGS conventions. In my opinion, this was one of the best ever with a lot of good exhibits, excellent papers, and fun entertainment. Those attending were very upbeat and confident about the future. The background music was filled with low rumblings of available jobs and retainers for geologists — unheard of last year. The "Crisis Committee" encountered only one major glitch. The scheduled keynote speaker called at 3:00 p.m. the day before and cancelled. Bill Fisher did an excellent job as the last minute replacement.

* * * * * * * * * * *

Speaking of conventions, the AAPG National Convention is right around the corner — March 20th-23rd at the Brown Convention Center. You should have received your advance registration material by now. The convention committees, under the very able leadership of Chairman Dick Bishop and Vice-Chairman Ron Harlan, have been hard at work for nearly two years preparing for this extravaganza. Estimated attendance is projected to be 50% over last year's meeting in Los Angeles.

The Houston Geological Society is very much involved in the convention. First of all, we stand to benefit financially, as we will receive a percentage of the surplus (assuming that there will be one). Secondly, most of the field trips and short courses will be staged by HGS. Your Field Trip Committee will sponsor eleven interesting trips, some being 1/2 day trips to nearby points of interest. The Continuing Education Committee will sponsor four short courses. Please consult your convention registration material for details. I want to emphasize that although these will take place during the convention, they are the sole responsibility of HGS. It is important to note that you may register for a field trip or short course without registering for the entire convention. If you cannot attend the convention but wish to participate in one of these activities, please use the AAPG registration form and check only the items of interest. Registration will be through AAPG instead of using the usual forms that appear in the HGS Bulletin. HGS will be financially responsible, but the money will flow through AAPG. Please make your plans in advance. For at least two years, HGS has dealt with the problem of last minute registration for everything we undetake. This is primarily a result of the poor economy. Of course, last minute "walk-ons" will be accepted.

Another HGS involvement will be to host a VIP reception on Friday evening, March 18, for AAPG officers and various industry leaders. I have appointed Chuck Noll to coordinate this with Rick De Camara of the Convention Committee. Chuck and Rick will raise the money for financing this event through industry donations.

The golf tournament is always a popular sporting event. I have issued a challenge wherein HGS will put up a foursome against a representative foursome from each of the local societies within AAPG. The winner will receive a prize as yet to be determined. The challenge letters were sent in December. You may be interested to know that golf is the fastest growing sport in the country, both in terms of those who play the game and those who provide the equipment.

If you attended the November luncheon meeting, you were probably appalled at seeing your Executive Board members show up in T-shirts. AAPG has provided us with the shirts, inclusive of the convention logo, as an advertising and fund raising project. They sell for $7.00 each. All proceeds on T-shirts sold prior to the convention will go to the HGS Undergraduate Scholarship Fund. The proceeds from sales during the convention will go to the

AAPG student chapters. They will be available for purchase at our dinner and luncheon meetings.

Another innovative happening will be a "first ever" sailing armada, which will originate from Corpus Christi and other points along the Gulf Coast. Geologists who are boating enthusiasts will sail in and be the guests of the Lakewood Yacht Club, compliments of Commodore John Broderick. The club is located on the north side of Clear Lake. To date, about fifteen boats have signed up for the fleet. If you are interested in learning more about this, call Don Prior in San Antonio (512) 494-9624, or John Drake in Corpus Christi (512) 857-7054. Dudley South of HGS was instrumental in making arrangements.

* * * * * * * * * * *

In these tough times, your Society leaders are guided by the ancient Scottish proverb which says: "There are no alternatives to thrift in the absence of money." I feel the responsibility to inform you of some basic facts regarding your Society's financial condition and the structure under which we operate. First of all, we are in good shape financially. It's great to be able to make both ends meet, but it's even better if they overlap a little! We are staying within an overall balanced budget of $258,000 which is broken into two separate accounts, the Operating Fund and the Academic Fund.

Briefly, the Operating Fund is an account for all transactions that are necessary for the Society to operate or function as an entity (i.e. membership dues, meeting costs, administrative expenses). The budget for this account is set at $130,000 in income and $130,500 in expenses. The Academic Fund is an account for all transactions which are not necessary for the Society's existence but instead are philanthropic or enriching to members (i.e. continuing education, Boy Scouts, field trips). The budget for this fund is set at $128,000 in income and $127,500 in expenses.

In addition to the budget, approximately $75,000 will be spent on luncheon and dinner meetings. This is carried as a zero budget item with the idea that meetings should break even; however, this has not been the case lately. We usually lose money due to no-shows and other expenses. Furthermore, management at the Doubletree Hotel where we hold luncheon meetings has informed us of an increase in price due to the recent increase in sales tax and other higher costs. Beginning in February, the price of the luncheon meetings will be $15.00, a $1.00 increase over the current price. An increase has been expected for some time inasmuch as it has been seven years since the last increase. We will hold the line on the price of dinner meetings as long as possible.

Current assets consist of Operating Fund checking and savings accounts, Academic Fund checking and savings accounts, Entertainment Committee checking account, Outstanding Student Loans, Graduate and Undergraduate Scholarship Funds, and Publications in Inventory, for a combined total of $474,000. We currently have a higher amount than usual tied up in publication inventory ($126,000) due to the recent printing of the Field Studies Volume. The latter constitutes a significant investment which will be returned by future sales of the publication.

I trust that you haven't been too bored with these figures, but you should be aware that over $500,000 will pass through our hands this year. I am continually reminded of the old adage "When your outgo exceeds your income, your upkeep causes your downfall." You can rest assured that "Chapter 11" is not in our vocabulary this year.

* * * * * * * * * * *

As usual, please check the front of the Bulletin for details on luncheon and dinner meetings. Two important short courses are planned for January and February, and both are sponsored jointly by the Continuing Education and Environmental Committees. The "Introduction to Hydrogeology" course will be held the evenings of January 12th, 13th and 14th. The instructors are associated with ERM-Southwest, Inc. This is a repeat of the same course that was oversubscribed by forty people last spring. Then on Saturday, February 13, the two committees will sponsor a course titled "Site Selection and Investigation for Critical Facilities". Registration forms for both of these courses can be found in this issue.

You will note the announcement of the Calvert Memorial scholars found in this month's Bulletin. With fewer students enrolled in geoscience courses these days, it is a pleasure to encounter those who are eagerly pursuing an education in the geosciences. The HGS is pleased to have a hand in furthering the education of these fine students.

* * * * * * * * * * *

I am continuing to hear hard luck stories from fellow geologists, especially independents and consultants. The independents who do most of the drilling in this country have suffered more from the oil patch depression than have the international majors. Operating primarily in the USA, which is the world's highest-cost producer of oil, the independents have a smaller cash flow and are less able to spread their risks. Danny Conklin, Chairman of the Independent Petroleum Association of America, put it very well at its recent annual convention in Chicago: "We're out of the emergency room as a patient, but we're not out of danger. We're certainly stabilizing. Hopefully, we'll get out of the recovery room at some point."

Frustration at every turn seems to dominate our business activities. Every day I encounter new problems that crop up simply because of the economic plight of the industry. As a result, a large percentage of my time is taken up with work that is counter-productive and cost-inefficient, but necessary to survive. I recently ran across the following piece, "Just for Today", which has helped me get through each day. It holds a message for all of us:

> Just for today, I will try to live through this day only, and not tackle my whole life problem at once. I can do something for 12 hours that would appall me if I felt I had to keep it up for a lifetime.
>
> Just for today I will be happy. This assumes to be true what Abraham Lincoln said: "Most folks are about as happy as they make up their minds to be."
>
> Just for today I will try to strengthen my mind, I will learn something useful. I will read something that requires effort, thought and concentration.
>
> Just for today I will adjust myself to what is; and I will not keep trying to adjust everything else to my own desires.

Just for today I will exercise my soul in three ways: I will do somebody a good turn, and not get found out. I will do at least two things I don't want to do — just for exercise. And today, if my feelings are hurt, I will not show it to anyone.

Just for today I will look as well as I can, dress becomingly, talk low, act courteously, criticize not one bit, and not try to improve or regulate anybody except myself.

Just for today I will have a program. I may not follow it exactly, but I will have it. I will save myself from two pests: hurry and indecision.

Just for today I will have a quiet half hour all by myself for meditation and relaxation. During this half hour I will try to get a better perspective of my life.

Just for today I will be unafraid. Especially I will not be afraid to enjoy what is beautiful, and to believe that, as I give to the world, so the world will give to me.

Dan Smith

DANIEL L. SMITH

HOUSTON GEOLOGICAL AUXILIARY

MARDI GRAS AND ALL THAT JAZZ
February 6, 1988

Couples, get ready!! Watch for your invitation to this very exciting party. A committee of sixteen energetic ladies co-chaired by Hjordis Hawkins, Zoe Vest, and Daisy Wood has been working hard to make this year's HGA Couples' Party another success. The natural charm of the Cohen House at Rice University, enhanced by the ladies' imaginative touches, will resound with the sounds of Dixieland music. Costumes not required, dancing at your own risk, fun a must for all!! Mark your calendars now — **FEBRUARY 6, 1988.**

The Board of the Houston Geological Auxiliary hosted a coffee for the newcomers to the group at the home of Mary Walters on November 4th. The coffee was well attended and we are happy to welcome all the new members to the HGA. We were so delighted to have Gwinn Lewis and Leta Gipson, both wives of the candidates for President of the AAPG, in attendance.

ANNA MAE THOMPSON

8th ANNUAL RACQUETBALL TOURNAMENT
FEBRUARY 20, 1988

The Houston Geological Society will hold its Eighth Annual Racquetball Tournament on Saturday, February 20, 1988. The location will be downtown at the **Texas Club,** atop the Texas Commerce Parking Garage (corner of Travis Street and Texas Avenue). Park in the garage (validated sticker cost $1.10), proceed down elevator to the concourse level, and then take one of the two "Club" elevators up. The tournament is open to all H.G.S. members and family. Sorry, Club rules prevent children 10 and under on the premises.

First round matches will begin at 9 AM. All players should be notified in advance of their starting time. However, everyone is encouraged to attend all day.

Each person should indicate level or skill on the entry form (please—no sandbaggers). The tournament director may reclassify people if necessary. The tournament will be by single elimination with a consolation round. Round robins will be used if any division has less than six players. Matches will consist of two games to 15 points, with a tie breaker (if necessary) to 11. Penn racquetballs will be used this year.

Entry fees are $15.00 per person and include court time, balls, refreshments, T-shirts and trophies. The deadline for signing up is **Wednesday, February 17, 1988.** The field may be limited, so entry fees should be mailed as early as possible.

HGS RACQUETBALL TOURNAMENT

NAME: _____

BUSINESS ADDRESS: _____

_____

BUSINESS PHONE_____

CLASS (circle one) A B C NOVICE

Entry fee: $15.00. Make check payable to: **HGS Entertainment Fund**

Mail to: Herb (Stu) Stouffer, Hunt Oil Company, 2950 North Loop West, Suite 900, Houston, TX 77092; Phone: 681-9742

HGS FIELD TRIPS

AAPG Chairman — Ray Levey
HGS Representative — Gary Moore

Recent Sediments of Southeast Texas ..... March 19
Environmental Geology of East Harris County ..... March 19
Schlumberger Well Services, Houston
Downhole Sensors Facility ..... March 19
3-D Seismic Data Acquisition ..... March 19
Chevron Drilling Technology Center ..... March 20
Geology of Big Bend National Park ..... March 23-27
Avery Island Salt Dome ..... March 23-24
Upper Jurassic-Lower Cretaceous Platform
Basin System of Northeastern Mexico ..... March 23-27
Modern Carbonate Sedimentation,
San Salvador, Bahamas ..... March 24-27
Southern Oklahoma Aulocogen ..... March 24-27

EDITOR'S NOTES.....

What a pleasure it was to travel 6 hours across Texas recently, deep into central Texas. I have lived in Houston all my life, so you might think I would not have such a yearning to get away from the flat, clayey landscape which is so familiar to those of us who have lived a "lifetime" in Houston. I have never really been able to escape the Tertiary sediments of the Gulf Coastal Plain for more than a few days at a time. Even when I went away to college, I was less than 200 miles from Houston at Stephen F. Austin in Nacogdoches, a beautiful campus with gently rolling hills made of — you guessed it — red Eocene sediments. And I wouldn't have been any better off when I earned my Master's degree at Texas A&M except that I had an understanding professor who suggested an outcrop study as a thesis topic. As far as I was concerned, there was nothing more interesting as the Cretaceous limestones of central Texas — and besides, these were actually rocks, not Gulf Coast mush.

My recent trip into central Texas was really a bit of nostalgia. Four hours or so into the drive, I was on the lookout for the Eocene/Cretaceous contact. I had the urge to grab a hammer and beat on the first Cretaceous rock I could see. And in the passes between hills I felt a real thrill at the first trace of a real, honest-to-gosh roadcut.

Those of you who were raised in a part of the country where rocks and mountains are found in abundance, please realize just how lucky you are. My first look at rock was in the elevator lobby of a downtown Houston office building. The limestones were beautiful, but it took a geology course to make me realize that the laws of nature had been overruled in favor of vertical bedding planes, which were more aesthetically pleasing.

Some people might find enjoyment in gazing at the granites used to face Houston's downtown office buildings. At one point I might have enjoyed looking at the fossil imprints in the limestone plastered to the sides of One Shell Plaza. But as a geologist, give me a rock hammer and an outcrop at the side of a road — I'll take rocks in their native habitat any day.

ON THE MOVE

Peter Laux, formerly VP Exploration with Cenergy Exploration Company, is now an independent petroleum geologist developing Gulf Coast drilling prospects. His office is Texas American Building, 921 Main St., Suite 2210, Houston, Texas 77002. Telephone 655-0099.

Ernie Gomez has been appointed District Geologist in charge of Home Petroleum's Gulf Coast District office, Houston. Home Petroleum's headquarters, HPC, Inc., are located in Denver, Colorado.

YOUR BULLETIN NEEDS YOU

Technical Articles

The Houston Geological Society is seeking brief-but fresh articles for the Bulletin on a wide range of Geology-related topics. Technical articles of 1000-3000 words in length with one or two figures are particularly appropriate for our audience. Many MS thesis and dissertations are amendable to such condensation and we encourage graduate students and faculty to submit appropriate material. Publication in the Bulletin provides exposure to nearly 5,000 geologists and would not preclude publication elsewhere. Copy deadline is 6 weeks before publication.

Reviews

In addition to technical articles, we welcome reviews or summary reports of meetings and conferences of interest to our members. These include AAPG, GSA, SEPM, GCAGS, SEG, research seminars, and others. Reviews of significant new books or articles also constitute suitable material for the Bulletin.

Photos

The Bulletin Committee is always on the lookout for good photographs to use on the front cover of the Bulletin. The subject matter should relate to Geology, the Petroleum Industry or Environmental Sciences. Specific topics can be historical or modern, geological or geophysical, domestic or international. All questions or contributions should be directed to the Bulletin Editor.

Letters To The Editor

The Editor welcomes letters that comment on articles in this issue or that discuss other matters of importance to Earth Scientists and Petroleum professionals. The Bulletin publishes these letters under the heading HGS Pipeline. Letters should be less than 500 words, concise and typed double-spaced for easy editing. Send your letter to: Editorial Staff, Houston Geological Society, 6916 Ashcroft, Houston, Texas 77081.

Other Bulletin Features

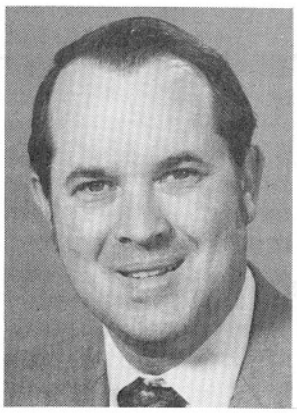
On the Move — Accepts announcements of professional and organizational changes.

Trader's Column — Makes free advertising space available to HGS members who have items available for one time transactions.

MEETINGS

DINNER MEETING—JANUARY 11, 1988

DAVID H. ANSPACH—Biographical Sketch



David H. Anspach received both his undergraduate and graduate degrees in geology at Texas A&M University, completing his BS in 1968 and MS in 1972. His thesis involved surface and subsurface mapping as well as depositional environmental interpretations of Eocene and younger strata in the Normangee Lake area of Leon County, Texas. In addition, his graduate work included the following investigations: 1) petrology of the Muddy Sandstone, Bell Creek Field, Wyoming; 2) marine geology of Quaternary sediments, Gulf of Mexico; and 3) Rocky Mountain structural geology for the USGS.

In 1972, Mr. Anspach began work as a geologist with Pennzoil Producing Company. From 1976 to 1986, he was the Texas District Exploitation Geologist for the Houston Marine District, U.S. Offshore Division. This district covered offshore West Cameron, Louisiana, Texas, California and Alaska. His duties consisted of subsurface investigations for the exploration and development of offshore fields in these areas, including Point Thompson Field, Alaska, Point Arguello Field, California, and High Island, Blocks A-474/A-499 Field, Texas.

Mr. Anspach is presently with Pennzoil Company in Houston, Texas, working as an Advanced Explorationist in the Western District, U.S. Offshore Division.

The paper Mr. Anspach is presenting was co-authored by Mr. S. E. Tripp, of Pennzoil Company and Mr. R. E. Berlitz and Mr. J. A. Gilreath of Schlumberger Offshore Services.

POST-DEVELOPMENT ANALYSIS OF PRODUCING SHELF-SLOPE ENVIRONMENTS OF DEPOSITION, HIGH ISLAND AREA*

The High Island A-474/A-499 prospect was originally acquired as a structural play with some suspicion that stratigraphic traps were present. Subsequent drilling demonstrated stratigraphic traps played the most important role in hydrocarbon accumulation.

The study area is located on the outer continental shelf 80 miles southeast of Galveston, Texas. The primary geologic structure consists of an elongated northwest-southeast trending dome associated with a deep-seated shale or salt diapir. The dome is bisected by two large, northwest striking, down-to-the-northeast growth faults.

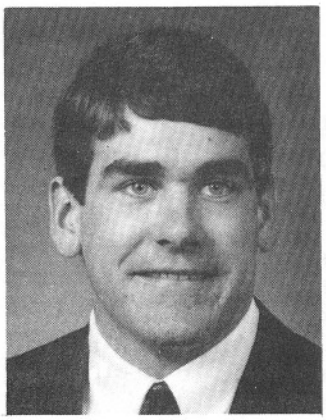
Paleontologic studies indicate the productive intervals were deposited during late Pliocene-Pleistocene time. The large growth faults, combined with associated secondary faulting, provide the primary trapping mechanism for the Upper and Middle Pleistocene C-17 through F-8 horizons. Paleontologic evidence indicates these pay horizons were deposited in an outer shelf environment of deposition (Eco. Zone 3). These sands originated from prograding deltas located to the southwest, north, and northeast. Sediments with a southwesterly source were transported as sand plumes by northeasterly flowing currents. Greatest sand accumulation occurred at the intersection of the growth faults and the northeasterly trending sand plumes.

In contrast, stratigraphic traps are the primary trapping mechanism in the Lower Pleistocene and Upper Pliocene G-5 through G-25 horizons. These laterally discontinuous, highly productive sands consist of submarine fan and slope facies indicative of an upper to lower slope depositional environment (Eco. Zones 4 and 5). The sands were transported into the area by turbidity flows from the north and northeast and by deepwater currents flowing to the northeast from a southwest depocenter. Many of these current-transported sands were deposited on the downthrown side of down-to-the-northeast growth faults.

**With S. E. Tripp, R. E. Berlitz, and J. A. Gilreath*

LUNCHEON MEETING—JANUARY 27, 1988

CHRISTOPHER J. WHITTEN—Biographical Sketch



Christopher J. Whitten is currently completing his M.S. in Geology at Texas A&M University. He obtained his B.S. in Geology from Trinity University in San Antonio in May of 1985. At Trinity University, Chris was President of Sigma Gamma Epsilon Geological Honor Society, a member of Alpha Lambda Delta National Honor Society, a member of the Triniteer Social Fraternity. Chris was employed by the Trinity Geology Department as a lab instructor. He is currently an undergraduate lab instructor at Texas A&M.

A native of Midland, Texas, Chris has spent several summers working on projects in the Permian Basin. Employed by Amoco in Houston during the summer of 1986, Chris worked on the Alabama Ferry field in Leon County. He is a member of the AAPG, the South Texas Geological Society, and the West Texas Geological Society.

ROBERT R. BERG—Biographical Sketch

Robert Berg is Professor of Geology and holds the Michael T. Halbouty Chair at Texas A&M University. His academic experience was preceded by industrial experience of 16 years with The California Company,, Cosden Petroleum Corporation, and as a consulting geologist. In 1967 he became Professor and Head of Geology at Texas A&M, and from 1972 to 1983 was Director of the Office of University Research. His publications include a textbook entitled **Reservoir Sandstones** (1986, Prentice-Hall, Inc.) and papers on the role of hydrostatic and hydrodynamic pressures in oil accumulation.

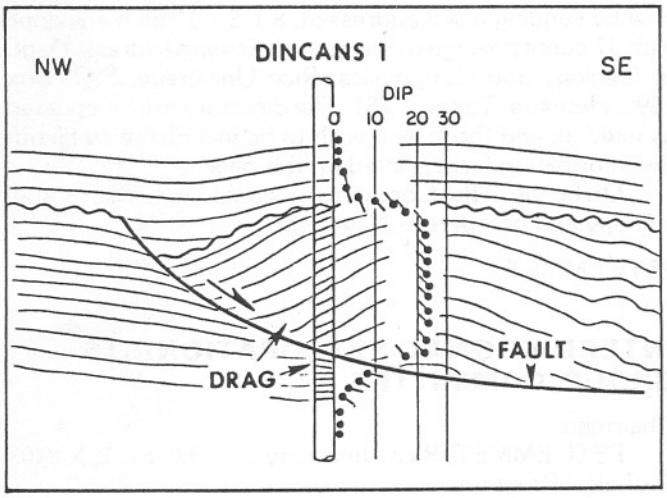
He received his B.A. and Ph.D. degrees in geology from the University of Minnesota (1948, 1951), and he has served as President of the Rocky Mountain Association of Geologists (1966) and the American Institute of Professional Geologists (1971). He is a Fellow of the Geological Society of America, an Honorary Member of the Gulf Coast Association of Geological Societies. He has been a Distinguished Lecturer of the AAPG and has received the Association's A. I. Levorsen Memorial Award on four different occasions. In 1981 he was awarded the AIPG's Ben H. Parker Medal for "Outstanding Service to the Profession".

DEPOSITIONAL ENVIRONMENT OF DOWNDIP YEGUA (EOCENE) SANDSTONES, JACKSON COUNTY, TEXAS

Downdip Yegua sandstones at a depth of 8300 to 8580 ft (2530 to 2615 m) were partly cored in the ARCO Jansky 1. Total thickness of the sandstone section is approximately 240 ft (73 m). The sandstones are enclosed in thick marine shales and are about 20 mi (32 km) downdip from thicker and more abundant sandstones in the Yegua Formation. The section is similar to reservoirs recently discovered in the area at the Toro Grande (1984), Lost Bridge (1984), and El Torito (1985) fields. The sandstones are fine-to-very-fine-grained and occur in thin beds that are 0.5 to 9 ft (0.15 to 2.7 m) in thickness. Sedimentary structures within the beds range from a lower massive division to a laminated or rippled upper division. Grain size within beds fines upward from 0.18 mm at the base to 0.05 mm at the top. The sandstones are interpreted to be turbidites of the AB type that were deposited within channels. The sandstones contain an average of 50% quartz and are classified as volcanic-arenites to feldspathic litharenites. Carbonate cement is variable from 0 to 27%. Average porosity is 29% and permeabilities are in the range of 60 to 1600 md in the clean sandstones. Much of the porosity is secondary and is the result of the dissolution of cements, volcanic rock fragments, and feldspar grains. Yegua sandstones produce gas and condensate at nearby Toro Grande field on a gentle, faulted anticline. The local trend of reservoir sandstones is controlled in part by faulting that was contemporaneous with deposition.

Correlation of the available cores with the dip log shows that zones of increasing dip (see diagram) are structural, and not depositional, features. The pattern of increasing dip downward forms normal fault patterns that coincide with contorted beds in the core. The faulting apparently caused soft sediment slumping shortly after deposition.

Our interpretation holds that the Yegua stratigraphic and structural relationships in the Toro Grande area demonstrate turbidite transportation across the shelf from the Yegua delta complex to a depositional site on the downthrown flank of an active growth-fault structure.



Diagrammatic illustration of rotated slump block in the downdip Yegua turbidite channel sandstones, Cities Service Dincans 1, Gas Unit 1, Toro Grande field, based on core examination and dip-log interpretation. Slumped section is about 60 ft (18.3 m) in thickness.

INTERNATIONAL EXPLORATIONISTS

Chairman's Column

As the New Year begins we have much to look forward to as International Explorationists. This month's meeting features Tom Schull of Chevron, who will speak on exploration in non-marine rift basins of the Sudan. This is a topic of interest to many of our members. Please keep in mind that we will meet Wednesday evening, January 13 (the second Wednesday instead of the third Wednesday of the month), because of a scheduling conflict with the hotel. Subsequent meetings will follow our normal schedule.

Jim Helwig, Editor of AAPG, has circulated a "Call For Papers" for the 1988 Mediterranean Basins Conference and Exhibition to be held in Nice, France, September 25-28, 1988. The conference will be sponsored jointly by AAPG, SEPM and the Institut Francais du Petrole. Please contact me if you would like a copy of the "Call for Papers". The deadline for abstracts is February 1, 1988.

The annual AAPG Convention will be held in Houston March 20-23, 1988. I have seen a preliminary list of scheduled talks and sessions and find much of interest to International Explorationists. One session, consisting of ten invited papers and entitled "Major Foreign Exploration Successes, 1983-1987", should be of particular interest. This session will include an overview of international exploration in the last five years, and detailed discussions of such significant discoveries as Cano Limon, Colombia, El Furrial, Venezuela, and new plays in the Norwegian North Sea, the Yemen Arab Republic, and the Peoples Republic of China.

A copy of the directory of members of the International Explorationists Group will be handed out to attendees of the January meeting. Those who wish may receive a copy by mail by sending a self-addressed, 8-1/2 × 11 inch envelope with 37 cents postage to me at the following address: Dept. of Geology and Geophysics, Rice University, P.O. Box 1892, Houston, Texas 77251. The directory will be updated as needed, and those who wish to be included may fill out the information form printed on this page.

On behalf of the Committee, I would like to wish you all a happy and prosperous New Year.

PETE EMMET

INTERNATIONAL EXPLORATIONISTS GROUP COMMITTEE

Chairman:
PETE EMMET, Rice University 527-8101, X-2403
Technical Program:
PINAR YILMAZ, Exxon Prod. Res. Co. 966-6033
Finances:
DENISE STONE, Amoco International 556-4207
Ticket Reservations:
CHRIS NICHOLSON, Marathon Int'l 629-6600 X-3903
Audio-visual/Arrangements:
GEORGE TAPPAN, Consultant 358-4061

INTERNATIONAL GROUP MEETING INFORMATION

Westin Galleria Hotel, January 13
Dinner (5:30 PM) $20.00

Admission to all International meetings is by **advance ticket purchase only.** Tickets may be purchased from representatives in the International departments of most companies or by sending a **check for $20.00 and a stamped, self-addressed envelope to:**

Houston Geological Society
6916 Ashcroft
Houston, Texas 77081

Ticket distribution and receipts are handled by **Chris Nicholson (629-6600, X3903).All inquiries should be directed between 8 AM and 4 PM.**

INTERNATIONAL EXPLORATIONISTS GROUP MEMBERSHIP INFORMATION

NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

PHONE NUMBER: _____

HGS MEMBER? ☐ YES ☐ NO

INTERESTED IN HGS MEMBERSHIP INFORMATION?
☐ YES ☐ NO

OTHER PROFESSIONAL SOCIETIES: _____

_____

_____

AREA(S) WORKED:

☐ LATIN AMERICA	☐ FAR EAST
☐ EUROPE/NORTH SEA	☐ AUSTRALIA/OCEANIA
☐ AFRICA	☐ DOMESTIC
☐ MIDDLE EAST	☐ OTHER

SEND TO: Pete Emmet
Dept. of Geology and Geophysics
Rice University
P.O. Box 1892
Houston, Texas 77251

INTERNATIONAL EXPLORATIONISTS GROUP EVENING MEETING JANUARY 13, 1988

THOMAS J. SCHULL—Biographical Sketch

Thomas J. Schull received his B.S. degree in Geology in 1964, from Wittenberg University, Springfield, Ohio. In 1966 he received an M.A. degree in Geology from Indiana University, Bloomington, Indiana.

Schull began his career with Chevron U.S.A. in 1966, working as a geologist and geophysical interpreter for East Texas, Oklahoma, and the Texas Panhandle. From 1972 to 1983 he was involved in international exploration with Chevron Overseas Petroleum, Inc., first in Columbia, South America, and then in southeast Asia and the Sudan. In 1983 Schull became District Supervisor of Onshore Coastal California, again with Chevron, U.S.A. Currently, he is Rocky Mountain and Mid-Continent Division Manager for Chevron and is located in Denver, Colorado.

Thomas Schull is a member of the Rocky Mountain Association of Geologists and the Denver Geophysical Society, and is a Distinguished Lecturer and member of the American Association of Petroleum Geologists.

OIL EXPLORATION IN NONMARINE RIFT BASINS OF INTERIOR SUDAN

In early 1975, Chevron Overseas Petroleum Inc. commenced what became a major petroleum effort in previously unexplored interior Sudan. With the cooperation of the Sudanese government, Chevron has acquired a vast amount of geologic and geophysical data during the past 11 years. These data include extensive aeromagnetic and gravity surveys, 36,000 mi (58,000 km) of seismic data, and results from 86 wells. This information has defined several large rift basins that are now recognized as a major part of the Central African rift system.

The sedimentary basins of interior Sudan are characterized by thick Late Jurassic-Cretaceous and Tertiary nonmarine clastic sequences. More than 35,000 ft (10,671 m) of sediment has been deposited in the deepest trough, and extensive basinal areas are underlain by more than 20,000 ft (6,098 m) of sediment. The depositional sequence includes thick lacustrine shales and claystones; flood-plain claystones; and lacustrine, fluvial, and alluvial sandstones and conglomerates. The lacustrine claystones that were deposited in an anoxic environment provide good oil-prone source rocks. Reservoir sandstones have been found in various nonmarine sandstone facies.

The extensional tectonism that formed these basins began during the Late Jurassic to Early Cretaceous. Movement along major fault trends continued intermittently into the Miocene. This deformation resulted in a complex structural history, which led to the formation of several deep fault-bound troughs, major interbasin high trends, and complex basin flanks. This tectonism has created a variety of structures, many of which have become effective hydrocarbon traps.

During the past 7 years, Chevron has made several important oil discoveries. Significant accumulations have been delineated in the Heglig and Unity areas, where estimated recoverable reserves of 250-300 million bbl of oil have been established.

ENVIRONMENTAL/ENGINEERING GEOLOGISTS

Chairman's Column

Our committee is growing rapidly as more environmental geoscientists continue to join the HGS. As such, we are expanding our program schedule to offer an event almost every month. The first quarter of 1988 will contain two short courses, a dinner meeting in February and a field trip for the AAPG Convention.

The environmental field trips continue to be popular, with thirty-six people attending the "Environmental Geology of West Harris County" field trip on November 14, 1987. Sincere thanks and gratitude are due to the authors, guest lecturers and field trip workers. Together, everyone cooperated in offering a trip that was of great interest to the geoscientist. This field trip will be offered again in April.

We are pleased to present the "Introduction to Hydrogeology" course again this month. The course will be offered on January 12, 13 and 14, from 6:00 to 9:00 PM. More course details are provided on the registration form printed below.

On February 13, 1988, we will be offering an advanced course in site assessment techniques for environmental geoscientists. This course will be taught by Mr. Norman Tilford, Center for Engineering Geosciences, Texas A&M University. This month's Bulletin also contains a registration form for this course.

The Environmental Committee meets the second Wednesday of every month at Charlie's Hamburger's Joint, 2222 Ella Blvd. The meeting is open to anyone interested in environmental topics. All geoscientists are encouraged to submit articles for the "Environmental Update" column as well as technical articles, book reviews, course reviews and thesis abstracts. Also, companies who would like to advertise their products and services in the Environmental/Engineering Geologists section of the Bulletin are welcome.

ARLIN HOWLES

HGS SHORT COURSE

INTRODUCTION TO HYDROGEOLOGY

(jointly sponsored by Education and Environmental Committees)

DATE & LOCATION: January 12, 13 and 14, 1988; 6:00 - 9:00 PM. Hyatt Regency West Houston, 13210 Katy Freeway (Exit Eldridge).

SCOPE OF COURSE: This course will provide geologists and other professionals with a basic understanding of hazardous waste consulting, including an overview of RCRA, CERCLA and SARA regulations, principles of hydrogeology and remedial/corrective action measures.

Tuesday, Jan. 12: Principals of Basic Groundwater Hydrogeology
Wednesday, Jan. 13: Overview of Federal and State Regulations
Thursday, Jan. 14: Case Histories and discussion.

INSTRUCTORS: Professional Staff of ERM - SOUTHWEST

Rick Bost — Director of Hydrogeological Projects
Brian Flynn — Professional Engineer, 12 years experience, negotiation of federal and state regulations.
Bill Stevens — Professional Geologist, 9 years experience field applications.

COST: $30 pre-registration postmarked by January 8, 1988
$45 after January 8 and non-members

REGISTRATION FORM - INTRODUCTION TO HYDROGEOLOGY

Name_____

Address_____

Phone (home and work)_____

Affiliations_____

Enclose check payable to HOUSTON GEOLOGICAL SOCIETY.
Return with this form to Houston Geological Society, 6916 Ashcroft, Houston, Texas 77081

ENVIRONMENTAL UPDATE

BUFFALO BAYOU AND TRIBUTARIES, TEXAS

Buffalo Bayou and its major tributaries provide drainage to a 1,034 square-mile area, including most of metropolitan Houston. The drainage basin lies within a flat, generally treeless plain extending along the Texas coast. Land elevations range from approximately 10 feet above mean sea level (msl) near the Houston Ship Channel to approximately 160 feet above msl in the far western headwaters of the basin. Land elevations near the headwaters of Brays Bayou are about 65 to 90 feet above msl. Land elevations in the upper reaches of Greens Bayou are about 125 to 130 feet above msl. The land and streams slope generally eastward to southeastward at about 2 to 3 feet per mile.

Land surface subsidence has affected Harris County and the Buffalo Bayou watershed to various degrees for many years. This subsidence has been caused primarily by excessive ground water withdrawals over the years for municipal, industrial and agricultural purposes. Subsidence has caused a slight and generally insignificant increase in stream gradients, while subjecting more of the streams and land areas to tidal influence.

Nearly 2 million people currently reside in the Buffalo Bayou drainage basin. Because of inadequate drainage facilities, a large segment of the population is adversely affected by severe flooding. Nearly 96,000 acres and over 97,000 structures valued at over $9 billion would be subjected to stream flooding by a 100-year-frequency flood. On an average annual basis, overbank stream flooding could currently cause over $192 million in damages. Unless corrective measures are taken, this amount could increase to over $340 million by the year 2045.

The Galveston District U.S. Army Corps of Engineers has completed a draft feasibility study defining the water resource problems and needs in the Buffalo Bayou watershed and establishing the potential for federal participation in resolving such problems and needs. Overbank stream flooding, resulting in frequent inundation of urban properties, was identified as the primary water resource problem of the study area. The evaluation of alternatives to reduce urban flood damages has been the primary focus of the Congressionally funded investigation.

Surface and subsurface soil conditions are important in evaluating the engineering viability of potential project proposals. Available data indicate that the foundation soils are primarily Beaumont formation clays mixed with some sands and silts. The heavier clays predominate the southern and midsection portions of the study area, while some sandy clays are found in the northern part of the basin. Previous experience with similar soils has found that side slopes of 1 vertical on 3 horizontal for channels, basins, and levees would be stable and require minimal maintenance.

Buffalo Bayou and Tributaries, Texas, a Draft Feasibility Report Summary by the Galveston District of the U.S. Army Corps of Engineers (September, 1987), sets forth the following information:

An array of alternative flood control plans, including stream enlargement, diversion, flood detention, selective stream clearing, floodproofing, and buyout of flood prone properties, has been evaluated to provide flood damage reduction. The economic, social, and environmental impacts of each alternative have been assessed. Additionally, the opportunities for incorporating environmental quality improvements, recreational facilities, and water supply features into the plans have also been evaluated.

A comprehensive plan, consisting of structural and nonstructural measures, has been formulated for Buffalo Bayou and its tributaries. The plan includes six major flood damage reduction elements, which have met the test of economic justification, produce no unresolvable adverse environmental impacts, and warrant federal participation in their implementation. The comprehensive plan consists of 75.3 miles of stream enlargements, 14.0 miles of stream clearing, 7 flood detention basins, 7.0 miles of diversion channels, acquisition of 7 flood prone properties, and modification or removal of 7 obstructive bridge and utility crossings. In addition, environmental features, consisting of revegetation on project lands, would compensate for fish and wildlife habitat losses. To take full advantage of the opportunities provided by the project lands, recreation features, including 14.7 miles of trails, 502 picnic facilities, 12 group pavilions, 2 boat launching ramps, 10 restrooms, playgrounds, exercise stations, and parking facilities have also been incorporated into the plan.

The total first cost of the proposed comprehensive plan is estimated at $541,190,000 of which $6,007,000 is allocated for the recreation features. The annual operation and maintenance costs are estimated at $1,807,000, including $229,000 for recreation. The proposed flood protection features would reduce existing average annual damages by 91.1 percent. About 30,600 acres would be removed from the existing 100-year frequency floodplain. This represents a 79 percent reduction in floodplain area for the streams affected and nearly 32 percent reduction for the entire basin. The flood protection features have a benefit-to-cost ratio of 3.8 and the recreation features have a benefit-to-cost ratio of 4.1.

The six major elements, which comprise the Buffalo Bayou comprehensive plan have been formulated on an independent tributary basis. Feasible flood protection plans were developed separately for Carpenters, Greens, Halls,

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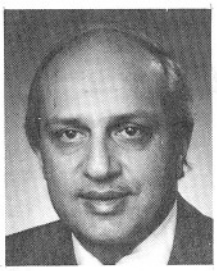


AN ENERGY RESEARCH CENTER FOR HOUSTON?

Guest Opinion/Manik Talwani

Many questions arise when an energy related research center focussed on exploration and production of oil and gas is proposed. Is there enough oil and gas left in the ground to make the effort worthwhile? Is there any hope of recovering it at costs that are economically reasonable? Why bother anyway, because much cheaper oil is always going to be available from the Middle East? What kind of research and what specific research projects should be undertaken? Who will support this research and who gets the benefits? How is the research to be carried out, and how are the results of the research to be transferred to actual operations in the field? What are the roles of oil companies (small and large), contractors (small and large), universities, government laboratories and other interested parties, in this effort? And finally, will such a center be beneficial to the geologists and geophysicists in Houston, to the energy industry in general, and indeed, to the nation, and not end up being another boondoggle?

Some of these questions were dealt with succinctly in a recent editorial in *Science* magazine by Philip Abelson:

> The estimated resource of petroleum (in the U.S.) is 625 billion barrels, which far exceeds the reserves of Saudi Arabia. However, in general the cost of converting U.S. resources into reserves far exceeds the $18 per barrel established by OPEC. Because of this low price, the major oil companies have downgraded the coterminous 48 states as an area for exploration. Instead they are emphasizing offshore, frontier areas, and foreign prospects. Targetted R&D could go far to reduce costs of converting an important fraction of the 625 billion barrels resource to producible reserves. However, the small independent companies who will drill for and find most of the oil that is to be discovered do not have research capabilities. The federal government retains the outdated policy that the majors will do what is needed - consequently, this year $43 billion for imports; small change (from the federal government) for liquid fuel research.

Since the U.S. is consuming at a faster rate than the reserves are being added to, the trade imbalance attributed to oil imports will only get worse. Surely, relatively modest expenditures for oil and gas related research that would help redress the balance are worthwhile. We know that appeals to the federal government for support for the beleaguered domestic oil and gas industry on grounds of national security and continued ill-health of small independent producers have failed. But it is quite likely that an argument for support on the grounds of the increasing trade imbalance should now get much more support. Reducing the cost of oil produced domestically is obviously a better solution than relying ever increasingly on imported oil.

THE TARGETS

There are various estimates for the total amount of oil present in the ground in the U.S. Abelson cites the figure of 625 billion barrels. Others have cited somewhat different figures—an amount of 300 billion barrels is quite commonly mentioned in connection with presently discovered fields. The difficulty, of course, is that we are talking about oil that has not yet been discovered or recovery processes that have not yet been developed. Therefore the uncertainty in estimates is large. However, all estimates are at least about an order of magnitude larger than the present oil reserves of 28 billion barrels and therefore even large uncertainties in the amount of total oil present in the ground do not materially change the arguments presented here.

Not all of the oil in the ground will, of course, ever be recovered. However, research and development efforts can undoubtedly accelerate the finding and production of some fraction of the total oil. Let us consider two categories of oil in the ground whose recovery in the future may be most amenable to research and development efforts and hence be most likely to add to existing U.S. reserves.

Mobile oil left in unswept parts of known fields—the infill drilling target. Fisher and his colleagues at The University of Texas Bureau of Economic Geology have forcefully stated the case of mobile oil left in unswept parts of known fields. Fisher argues that if reservoirs were homogeneous, then existing recovery techniques would sweep the entire reservoir, recovering all the mobile oil and leaving only immobile, residual oil. But many reservoirs are not homogeneous and large amounts of mobile oil are at present not recovered.

Geological and geophysical research focussing on determining reservoir inhomogeneities and discovering complex and subtle traps can be of enormous help in targetting infill drilling in complex reservoirs. Such research will yield the most immediate benefits for several reasons. Most importantly, the amount of mobile oil that is recoverable is large. Fisher estimates it at **80 billion barrels** for the entire U.S. Because no new recovery processes need to be developed to recover this oil from known fields, the possibility that the cost of recovering oil may actually be lowered by using advanced technology is a very attractive one and should be vigorously pursued.

Oil left in the swept part of known fields—the enhanced oil recovery (EOR) target. In spite of the fact

Continued on page 28

DIGITAL DIGEST

"...But What Have You Done For Us Lately?"

By Terry J. Sheehy

CAC is not what one says when swallowing castor oil. CAC is an acronym for the Houston Geological Society's Computer Applications Committee. Founded in March 1984 with little more than a desire to serve the HGS membership, the committee has flourished under the dynamic guidance of Mr. Ken Aitken.

Houston GeoTech is probably the committee's most visible accomplishment. Conceived in 1984 as "some kind of technical conference", GeoTech has mushroomed into a major convention devoted to computer usage in the geosciences. Originally envisioned as "perhaps a weekend with some papers and possibly a few vendors", Houston GeoTech now spans four days of short courses, technical papers and an exhibit hall filled with the latest in high tech. Recently incorporated as an entity of its own, Houston GeoTech now has the sponsorship of the four local professional societies.

While GeoTech may be its most striking contribution, the Computer Applications Committee has a number of other projects that more directly impact the membership of the Houston Geological Society. At one time a member could make HGS luncheon reservations, not show up and expect to get away free. Not any more. Thanks to the Society's computer system, no shows are promptly reminded to pay for the seat they had set aside for them.

Shortly after CAC's inception, the HGS Board asked the committee for assistance in the purchase and use of a computer system. As presently configured, the HGS has an IBM PC with hard drive and two printers, one of which is a laser printer.

Implementation of the system has allowed the HGS to computerize its membership list, thus facilitating changes and additions, a slow and cumbersome task in the past. The computer also keeps track of dues and billings such as the luncheons mentioned earlier. The annual Membership Directory is compiled on the computer, and plans are in progress to actually publish the directory via the new laser printer.

The Personnel Placement Committee has been working with the CAC, on and off, for several years to institute a database of employable geoscientists and potential employers. A prototype of such a system was tested for several months but is presently stalled.

The Computer Applications Committee also publishes an annual Software Catalog which has gained favorable national attention. With the ambitious goal of listing all the software written for use in the oil and gas industry, the guide comes remarkably close. For sale at about twenty dollars, the HGS Software Catalog is a steal compared to a similar commercial offering at ninety-dollars.

CAC's most recent undertaking is the co-sponsorship of an oil and gas special interest group in HAL-PC. The Houston Area League of Personal Computer users bills itself as the world's largest such organization. A joint undertaking of the world's largest local geologic professional society and HAL-PC should provide tremendous benefits to both groups.

A new project on the Computer Applications Committee slate will benefit Houston area geologists whether they are computerists or not. The Houston Public Library recently acquired a large collection of well logs but is unable to put them on shelves until the logs are cataloged. Short on staff, the Houston Public Library is allowing the Log Library to collect dust. Plans are afoot for the CAC to computer-catalog the well logs. If such an effort is successful, the listing may be available both in hard copy and on floppy diskette.

This monthly Bulletin column, the *Digital Digest*, is also a function of the Computer Applications Committee.

Not quite three years old, the Houston Geological Society's Computer Applications Committee has been both busy and effective. The CAC has nurtured Houston GeoTech into a major convention. They have streamlined the Society's membership data and improved billing procedures. The Committee's Software Catalog is updated annually, with the next issue promised for the annual AAPG Convention scheduled in Houston. CAC alignment with HAL-PC looks like a real plus for all involved. If the proposed indexing of the Houston Public Library's well log collection becomes a reality, untold geologists will benefit.

So what has the HGS-CAC done for us lately? Perhaps more than we ever realized.

HGS SHORT COURSE

SITE SELECTION AND INVESTIGATION FOR CRITICAL FACILITIES

(jointly sponsored by Education and Environmental Committees)

DATE & LOCATION: Saturday, February 13, 1988, 1:00 PM - 5:00 PM. Hilton Southwest, 6780 Southwest Freeway.

SCOPE OF COURSE: This course should benefit the introductory-to-advanced professional in engineering geology. The first half of the course will discuss the principles of site selection and investigation; the second half will cover case histories and discussion.

Geologic, or geologically dependent, factors are crucial to the optimal development of large engineered projects. The emphasis of this course will be on identifying and integrating geologic elements into the engineering and economic setting of large projects.

INSTRUCTOR: Mr. Norman R. Tilford is Professor of Engineering Geology in the graduate faculty of Texas A&M University. Prior to Texas A&M, he was for 10 years Chief Geologist of Ebasco Services, Inc., one of the world's largest engineering and construction firms. Mr. Tilford has 25 years experience in geological work involving civil engineering projects, water resource development, coal, radioactive wastes, and hazardous chemical wastes. At Ebasco he was responsible for the work of 30 earth scientists worldwide. At Texas A&M he continues a career-long interest in research in neotectonics, and teaches "Site Selection for Critical Facilities" and "Advanced Engineering Geology" in the Department of Geology.

COST: $30.00 pre-registration postmarked by February 9, 1988.
$45.00 thereafter and for non-members.

REGISTRATION FORM - SITE INVESTIGATION

Name: _____

Address: _____

PHONE (home & work): _____

Enclose check payable to HOUSTON GEOLOGICAL SOCIETY,
return with this form to: Houston Geological Society, 6916 Ashcroft, Houston, Texas 77081

HGS PIPELINE

TO THE EDITOR:

This is a nit-picking point. However, when someone writes and an editor agrees to publish an article with as broad a title as that of Pyron and Feder's on "Remote Sensing for the Petroleum Industry" (HGS Bulletin, November, 1987), there is an obligation to at least mention some of the recognized reference works on the subject. For example, the *Manual of Remote Sensing* published by the American Society of Remote Sensing, the acclaimed text books of Lillesand and Kiefer on *Remote Sensing and Image Interpretation*, as well as Sabin's *Remote Sensing - Principles and Interpretation* to name a few.

The Pyron and Feder article is unique in that the **only** references they cite are five of their own publications.

ROBERT H. BARTON
Manager, Remote Sensing Dept.
Tenneco Oil Exploration and Production

Recent correspondence between myself and Garry Mauro, Commissioner of the General Land Office, has led me to believe that Texas may relax the environmental restrictions and possibly lower the royalty to 20% where it can be shown that prospects are uneconomical under the current leasing regulations. Those who would like to see lower state royalties and less restrictive environmental regulations should write to Steve Roberts, Associate Deputy Commissioner, Energy Resources Div., 1700 North Congress, Rm 640A, Austin, TX 78701-1495. Identify the acreage of interest and cite what problems need to be addressed to cause a well to be drilled. The state seems very willing at this time to help spur wildcat drilling.

DAVE LAZOR
Independent Geologist

JAN. CALENDAR of EVENTS 1988

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6 OIL & GAS SIG	7	8	9
10	11 HGS DINNER MEETING D. A. Anspach Westin Oaks	12	HGS INTL. 13 DINNER MTG. Westin Galleria HGS ENVIRMTL. COMM. SCHOOL Intro to Hydrogeology UH Geology Alumni Luncheon	14	15	16
17	18 GSH Luncheon	19	20	21 SIPES Luncheon	22	23
24 31	25	26 SPWLA Double Presentation Lunch Petroleum Club Dinner Sheraton West Belt	27 HGS LUNCHEON C. J. Whitten R. R. Berg Doubletree Hotel	28	29	30

GEO-EVENTS

MEETINGS

IN HOUSTON

OIL & GAS SIG, M.D. Anderson Hall, University of St. Thomas, 7 PM, January 6.

HGS Dinner Meeting, "Post-Development Analysis of Producing Shelf-Slope Environments of Deposition, High Island Area", D. A. Anspach, et. al., Pennzoil, Westin Oaks Hotel, 5:30 PM, January 11.

UH Geology Alumni Association Luncheon, Petroleum Club, 11:45 AM, January 13.

HGS International Dinner Meeting, "Oil Exploration in Non-Marine Rift Basins of Interior Sudan", Thomas J. Schull, Chevron USA, Westin Galleria Hotel, 5:30 PM, January 13.

GSH Luncheon, "Interval Velocity Estimation and Map Migration", David Hadley, Sierra, Stouffers Greenway Plaza Hotel, 11:30 AM, January 18.

SIPES Luncheon, Petroleum Club, 11:30 AM, January 21.

SPWLA Double Presentation, "Dipmeter Interpretation Rules"; Luncheon meeting, Petroleum Club, 11:15 AM; Dinner meeting, Sheraton Westbelt, 5:15 PM, January 26.

HGS Luncheon, "Depositional Environment of Downdip Yegua (Eocene) Sandstones, Jackson County Texas", C. J. Whitten and R. R. Berg, Texas A&M University, Doubletree Hotel, 11:30 AM, January 27.

AROUND THE COUNTRY

11th Annual Energy-sources Technology Conference and Exhibition, Hyatt Regency Hotel, New Orleans, January 10-13.

SCHOOLS AND FIELD TRIPS

IN HOUSTON

HGS Environmental Committee School, "Introduction to Hydrogeology", January 12, 13, 14.

COMMITTEE NEWS

ACADEMIC LIAISON COMMITTEE

The purposeof the Academic Liaison Committee is "to work with teachers, schools, and other groups to promote interest in, and appreciation of Geology." At present, the Committee works only with elementary, middle, and high schools. The Committee promotes the geologic profession by giving lectures in schools, by advising high school students on careers in geology, and by judging Science Fair projects.

The Committee consists of a Chairman and as many members as the Chairman thinks are needed. At the start of the school year the Chairman sends a letter to the Superintendents of the 23 Greater Houston school districts, announcing the program. He also sends a letter to those HGS members who indicated on their annual registration card that they are interested in participating in the Committee. This list includes about 40 HGS members, and all these geologists are considered to be members of the Committee. In late August, the flow of requests for speakers, science fair judges, and career advisors starts and reaches a maximum in early spring. During the year 1986-1987, the Committee had requests from 42 schools for speakers, and six school districts asked for science fair judges. The Chairman's main task is to find the right committee member(s) to handle the requests from the schools.

The Committee has a small rock, mineral, and fossil collection which is heavily used by the members. Also available are 35mm slides and some maps and charts. In the near future the Committee will also have some 16mm films. These teaching collections are beginning to be inadequate, mainly because of the increase of requests for speakers. The HGS has given the Committee a small budget to maintain and improve the collections. To get quicker improvement, the Committee is soliciting materials from the HGS membership. Especially needed is improvement of the fossil collection, but rocks and minerals (particularly from Texas) are welcome. Also needed are films, video tapes, and 35mm slide collections for which you have no more use. If you want to be involved in the Academic Liaison Committee's lecture program, please contact the Chairman, Hans G. Ave Lallemant.

The members of the Academic Liaison Committee are listed below:

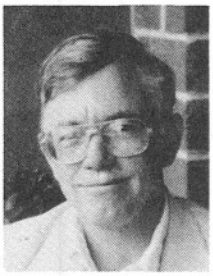
Gary C. Adams	Steven C. Comstock	J. David Lazor
Jeffrey B. Aldrich	Ana-Marie Cox	Gerald B. Langille
Bruce S. Appelbaum	Rebecca L. Dodge	Sally B. Lewis
Robert H. Appelbaum	Jack D. Edwards	Robert B. Lieber
Frank V. Bifano	Michael F. Erpenbeck	Karen E. Manyak
Daniel J. Bonnet	M. L. "Newt" Feldman	John W. Marks
Virginia G. Bowen	Samuel J. Flarity	Robert J. Maurer
James E. Brasher	Wynn A. Gajkowski	Millis H. "Bud" Oakes
E. Craig Brooks	George M. Greene	Daniel L. Oyler
Jack D. Burgess	Marvin E. Hairgrove	Walter C. Pusey
Charles A. Caughey	Martin Halpern	David Reimers
Rich D. Charrington	H. W. Hardy	Allan D. Scardina
John Chronic	Janet L. Hess	

AAPG MEMBERS NEEDED FOR IMPORTANT JOB

The Houston Geological Society has more than 50 members in the AAPG House of Delegates. Each year you are asked to elect approximately one-third of this group. Why not place your name on the ballot?

A delegate has one of the most important jobs in all of AAPG—to check the geological experience and professional ethics of the applicants to AAPG from the Houston area. Delegates are also expected to attend the annual meetings during their three-year term.

If you would like to participate, please call Chuck Noll (621-9556) or Martha Lou Broussard (527-4880) for further information. In the event neither is available, please leave your name with Margaret Blake at the HGS office (771-8315).



Hans G. Ave Lallemant, Chairman of the Academic Liaison Committee, is Professor and Chairman of the Department of Geology and Geophysics at Rice University. Ave Lallemant was born in Benkulu, Indonesia, and studied geology at the University of Leiden, the Netherlands, where he received his B.A. (1960), M.A. (1964), and Ph.D. (1967). His Ph.D. work dealt with structural analysis of alpine-type peridotites in the French Pyrenees. In 1967 he became a post-doctoral fellow at Yale University.

In 1970 he became an Assistant Professor at Rice University; in 1974 he became Associate Professor, and in 1981 he was promoted to Full Professor. He was Vice Chairman of the Department from 1980 to 1983, and became Chairman in 1986.

His interests have included the physical properties of the Earth's upper mantle, a structural study of the Canyon Mountain ophiolite in eastern Oregon, lunar research, and the tectonic history of the Blue Mountains province in eastern Oregon. Currently he is involved in structural studies in Canada, Venezuela, and northern Alaska. He has authored or co-authored more than thirty published papers.

Ave Lallemant is a member of the Royal Geological and Mining Society of the Netherlands, American Geophysical Union, the Geological Society of America, Houston Geological Society, and The American Association of Petroleum Geologists. He is Associate Editor of *Tectonophysics*. In 1981 he received the Basic Research Award from the U.S. National Committee for Rock Mechanics and in 1987 he was elected correspondent of the Royal Dutch Academy of Sciences.

Hans Ave Lallemant is married to the former W. Marjolyn J. de Boer, who currently teaches (part-time) Early European History and Literature at the University of Houston at Clear Lake. They have two children.

LIBRARY COMMITTEE

HELP!!! 45,000 ELECTRIC LOGS NEED HOUSING!

The object of the Library Committee is "to work with the Houston Public Library to build and maintain a comprehensive geological library." The exciting news is that the approximately 30,000 electric well logs that were discovered in the storage area of the Houston Public Library (HPL) plus the 15,000 Flaitz and Mitchell electric logs that the library already had, are partially sorted, filed, numbered and computerized. Great progress in this area has been made this past year by the Greenspoint Log Library due to Jim Lammons, independent geologist, and volunteers in the enormous job they undertook for the Library Committee and the Houston Public Library. There is still much work to be done with these logs, however, before they are ready for the HPL. Volunteers are badly needed to speed up the process. You can help and have a free day at the Greenspoint Log Library. Some great surprises are in store for you in those 45,000 electric logs! Call the Greenspoint Log Library, 330 North Belt (Phone 447-8906), to participate in this great trade.

The disappointing news is that we, the HGS members, cannot use these logs at the HPL until filing cabinets and envelopes are found for a reasonable price or are donated to the HPL (which is still tax deductible). PLEASE HELP IN THE SEARCH FOR THESE ELECTRIC LOG FILING CABINETS AND ENVELOPES. Call Evelyn Wilie Moody (654-0072) or Tom Depetro at the HPL (247-1622).

Tom is the good news at the HPL. It is the first time that the HPL has made an appointment of this kind, and it is a great advantage to the HGS. Tom Depetro, well-qualified and interested, is the Ordering Librarian for the Earth Sciences in the Business, Science, and Technology section of the HPL. If you know anything about the acquisition of the much needed filing cabinets or would be kind enough to volunteer for one of the urgent filing jobs, please call him.

Important additions have become available to everyone at the Houston Public Library in the last few years, courtesy of the HGS, Library Committee, and the Houston Geological Auxiliary. These are special treasures unique to the HPL and are available for your study in the Central Library, 500 McKinney Street:

* The private libraries of these famous pioneers in geology—Edwin L. Dunbar, Donald C. Barton, and Frank DeWolf—are out of storage and can be found on the second floor in the Science Section, set apart in the GC collection open stacks.
* The rare collection of over 500,000 paper driller's logs, dating from 1920 and acquired from the Texas Well Log Service, are now carefully filed in redrope folders (thanks to the HGA), making them easily retrievable. These are a valuable tool for exploration in our increasingly mature Gulf Coast province. Only a few drawers remain to be filed. VOLUNTEERS NEEDED.

Other useful acquisitions provided to the geological library at the HPL are:

* Two filing cases, one oak for atlases, one double-doored for maps. Partial contents for these were purchased with $2500 donated by HGS two years ago. Contributions for either of these would be appreciated.
* Six requested VHS tapes and three audio cassette tapes from AAPG are now available in the film section on the fourth floor of the Central Library. Three more requests are being processed. Your suggestions for books, maps, films, cassettes, and projects are welcome. Please call Evelyn Wilie Moody (654-0072) or Tom Depetro at the HPL (247-1622).

Evelyn Wilie Moody, Chairman of the Library Committee, came to Houston in early 1975 as a consulting exploration geologist for General Crude Oil Company. In 1977 she opened her own office at 956 The Main Building, 1212 Main Street, in Houston, where she is still presently located.

Evelyn holds a BA degree in geology and education and a MA degree in geology, all with honors, from the University of Texas at Austin.

Her publications include her Master's thesis on the Balcones fault zone, several co-authored papers published in AAPG Bulletins, and a co-authored book *How (To Try) to Find an Oil Field,* published by Penn Well. She was editor for the Society of Independent Professional Earth Scientists (SIPES) book *A Manual for Independents* and co-editor of SIPES Bulletins #10, #11 and recently the book *The Business of Being an Independent (A Road Map for the Self-Employed).*

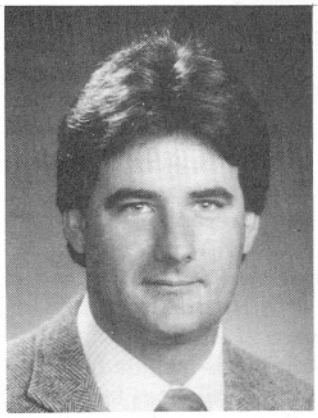
She has been active in the Houston Geological Society since she joined in 1975, representing the Society as a judge at AAPG and GCAGS conventions, working with the Special Publications Committee to write a book, Chairing the Library Committee from 1978 to present, and representing the HGS as a Delegate to AAPG's House of Delegates for the term 1986-1989.

In SIPES, Evelyn has served as Secretary, Vice Chairman, and Chairman of the Houston Chapter. She has been a national Director in the governing National Board of Directors and was elected to President of the SIPES Foundation in 1985. In 1986 she chaired the committee that produced the highly successful 2-day seminar *The Business of Being a Petroleum Independent.* That same year she became the first recipient of the SIPES Chapter Chairman Award for outstanding contributions to that society and the profession.

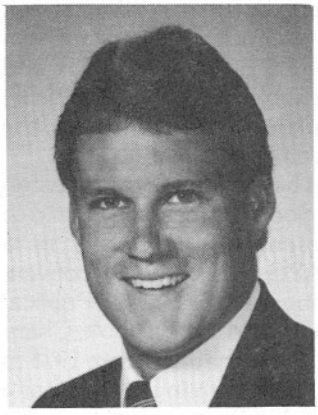
Other professional activities are in AAPG, GSA (Archeological Geology Division), SEPM (ISAG), and AIPG.

HGS MEMORIAL SCHOLARSHIP FUND ANNOUNCES RECIPIENTS

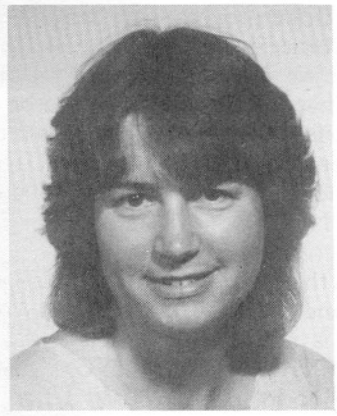
The Board of the Calvert Memorial Scholarship Fund is pleased to introduce three new recipients of graduate scholarships for the 1987-1988 academic year — Mr. Kirk Barrell, Ms. Rosanne Lindholm, and Mr. Kim Patty. Amounts of the awards range from $1500.00 to $2000.00



Kirk Barrell received his B.S. degree in geology from Louisiana State University in December, 1985. He is presently working on his M.S. degree at Texas A&M University where he is undertaking a study of the "Distribution of Abnormal Pressures in the Lower Vicksburg, Slick Ranch Field, Starr County, Texas" under the guidance of Professor Robert R. Berg. A major goal of the study will be to understand the role of abnormal pressures in the development of secondary porosity.



Kim Patty headed east after completing his B.S. in geology at New Mexico State University in Las Cruces in July, 1985, and enrolled in the geosciences Ph.D. program at the University of Texas at Dallas. With the aid of his advisor, Dr. John Humphrey, he plans to investigate and write his dissertation on "Carbonate Diagenesis of the Rodessa Formation, Ingram-Trinity Field, East Texas". Like Kirk Barrell, he expects by this means to gain a better understanding of porosity distribution in the formation.



Rosanne Lindholm began her college work at Union College in Cranford, New Jersey, and completed her Bachelor's degree in geology at the University of North Dakota. She continued there for her M.S. degree which she completed in 1984, writing her thesis on depositional environments of the Paleocene Cannonball Formation of the Williston Basin. In 1985 she began work on her Ph.D. degree at the University of Houston, where Dr. Jack Casey is supervising her dissertation on Cambrian and Ordovician rift and flysch sequences in western Newfoundland. Her goal is to apply her investigative talents in the research division of a major oil company.

The scholarship fund is also providing second-year support to Tim Fleming, an M.S. student at Louisiana State University, and to Danny Westphal, an M.S. candidate at the University of Arkansas at Fayetteville.

CARL NORMAN

BUFFALO BAYOU

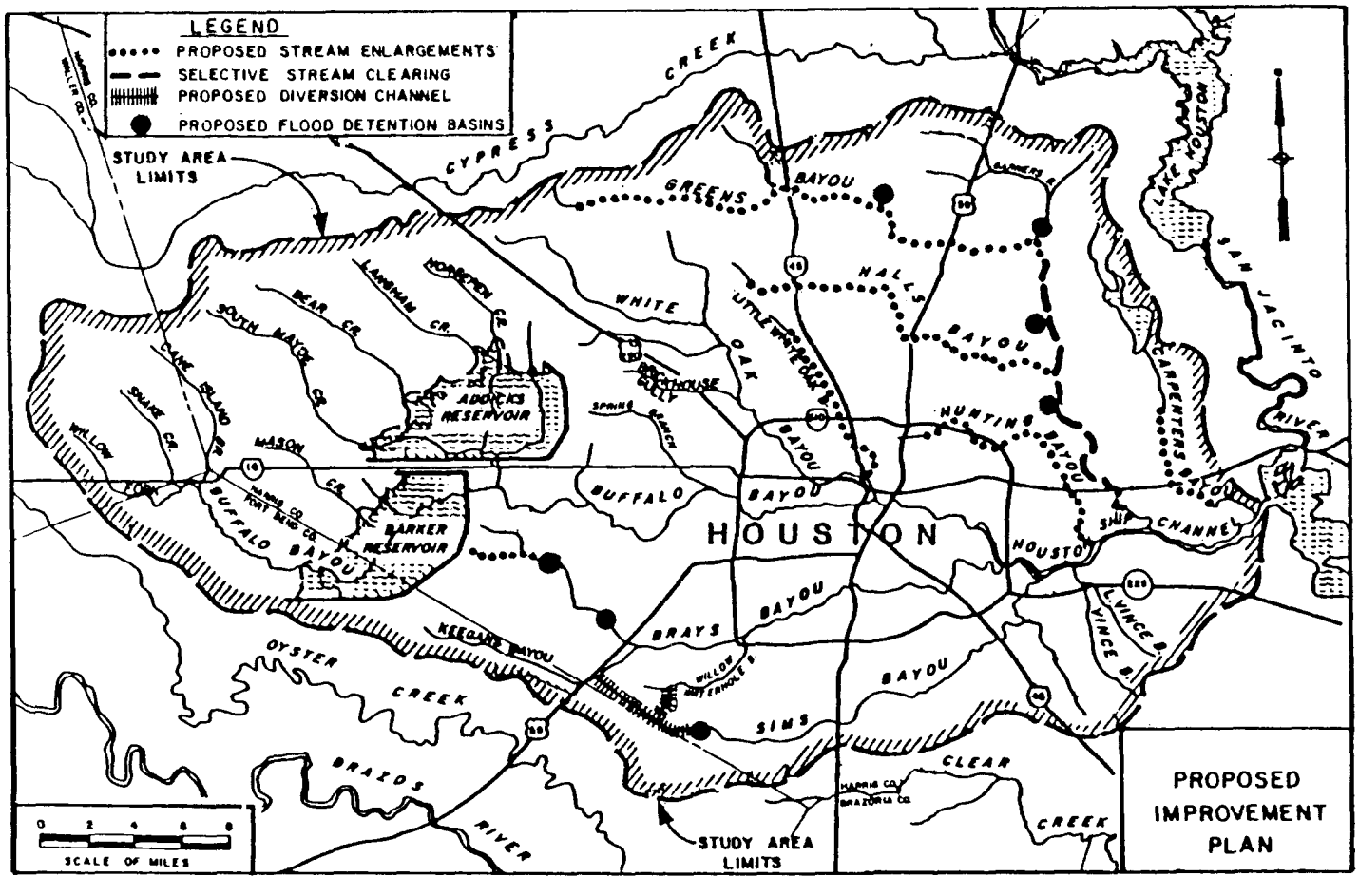
Continued from page 15

Hunting, Little White Oak, and Brays Bayous. Recreation features were also developed for each element. Each of the six tributary elements is economically justified on an incremental basis, and, could be constructed separately. The types of flood control features proposed and their general locations are shown on the accompanying figure. Recreation features would be constructed on lands acquired for flood control and sited so as not to increase flood control maintenance or operations.

The tributary elements of the proposed plan of improvement are summarized as follows:

- The **Carpenters Bayou** plan consists of 6.5 miles of stream enlargement work, providing approximately 25-year frequency flood protection, and 1.3 miles of recreation trails and picnic facilities on project lands. The total first cost is estimated at $5,112,000 including $116,000 for recreation facilities. The benefit-cost ratio is 1.7 for the flood protection features and 4.5 for the recreation features. Average annual potential flood damages would be reduced by about 81.5 percent.
- The **Greens Bayou** flood damage reduction features include 14 miles of selective stream clearing, 25.2 miles of stream enlargement, 4 flood detention basins, and acquisition of 7 flood prone properties. In addition, 1.9 miles of trails, picnic facilities, access and parking areas, and other recreation facilities would be installed on project lands. The flood protection features, providing approximately 40-year flood protection, have an estimated first cost of $115,753,000. The benefit-cost ratio is 2.6. Average annual flood damages would be reduced by about 91.2 percent. The recreation features have a first cost of $2,338,000 and produce a benefit-cost ratio of 3.7.
- The **Halls Bayou** plan consists of 18.0 miles of stream enlargements, providing about a 30-year level of protection, and 1.9 miles of trails, picnic facilities, a boat launching ramp, a parking area, and a comfort station to accommodate recreation. The improvements are estimated to cost $51,346,000, including $484,000 for recreation. The benefit-cost ratio is 5.5 for the flood control features and 2.6 for recreation. Potential flood damages would be reduced by nearly 95.0 percent.
- The **Hunting Bayou** plan includes 14.3 miles of stream improvements, 1.2 miles of trails, with picnic facilities, a comfort station, and access and parking areas. The flood protection features, which would provide about 40-year flood protection, are estimated to cost $59,113,000. The benefit-cost ratio for the flood control features is 10.3. The first cost for the recreation features is $425,000 with a benefit-cost ratio of 4.0. Flood damages would be reduced by about 96.9 percent.
- The **Little White Oak Bayou** project consists of 8.3 miles of stream enlargements, providing 25-year frequency flood protection, with 1.6 miles of recreation trails, and picnic facilities. The first cost of the flood control features is estimated at $43,380,000. The benefit-cost ratio is 1.2. The first cost for recreation is $151,000 and the benefit-cost ratio is 7.1. Existing flood damages would be reduced by about 87.0 percent.

(continued)



"Support those who support our Society."

• The **Brays Bayou** flood control improvements include 3 miles of channel improvements, 3 flood detention basins, 2 diversion dams, 7.0 miles of diversion channels, and modification of 7 obstructive bridge and utility crossings. In addition, 6.8 miles of recreation trails, with picnic facilities, sports fields, comfort stations and parking areas would be provided on project lands. The flood control features, which would divert flood flows to a Sims Bayou flood detention basin, would upgrade the level of flood protection along Brays Bayou to about 100 years and would reduce average annual damages by about 95.0 percent.

The project would also provide substantial flood protection to the tributary of Willow Waterhole Bayou by diverting a portion of its flood flows from the basin. The first cost of the plan is estimated at $261,079,000. The project's benefit-cost ratio is 3.1. The recreation features developed for the area have a first cost of $2,493,00 and a benefit-cost ratio of 4.8.

Federal projects of this nature require local governmental participation for implementation. Cost apportionment between the federal government and local sponsor for flood control would be in accordance with the Water Resources Development Act of 1986. For local flood protection projects, the Act requires that the local sponsor provide all lands, easements, rights-of-way and relocations as well as a cash contribution of 5 percent of the cost assigned to flood control. The local sponsor would then be responsible for maintenance and operation of the completed project. The Federal Water Project Recreation Act of 1965 (PL 89-72), as amended, established the federal interest and cost sharing arrangements for recreational development on project land for local protection projects. For recreation, the local sponsor would be required to contribute 50 percent of the initial construction cost. In addition, the local sponsor would be responsible for all operation, maintenance, policing, and facility replacement costs. The following table summarizes the economic parameters of the six elements of the proposed comprehensive plan of improvement for Buffalo Bayou and its tributaries.

The flood control features of the proposed plan have been coordinated with the Harris County Flood Control District and are compatible with local long-range plans. The recreational development features have been coordinated with the Harris County Parks staff and with personnel from the City of Houston Parks Department. These local agencies have provided input in plan development and additional coordination is planned.

A draft feasibility report, including a draft environmental impact statement, has been completed. With habitat replacement features included in the proposed flood control plans, no adverse environmental impacts would result from plan implementation. The draft report is being coordinated with all federal, state and local agencies, local civic, environmental, recreation and other groups, the affected public, and others known to be interested in the project. The final feasibility report is scheduled for completion in February 1988. The final report, with assurances of local sponsorship, will recommend Congressional authorization for detailed planning, design, and construction of the proposed improvements.

PROPOSED PLAN FEATURES
SUMMARY OF BENEFITS AND COSTS

PROJECT PARAMETERS	Carpenters Bayou	Greens Bayou	Halls Bayou	Hunting Bayou	Little White Oak Bayou	Brays Bayou	Total Plan
Project First Cost ($1000)							
Flood Control	$4,996	$115,753	$60,842	$60,113	$43,380	$261,079	$536,163
Recreation	116	2,238	484	425	181	2,493	5,937
TOTAL	5,112	118,001	61,346	60,538	43,531	263,572	541,190
Federal First Cost ($1000)							
Flood Control	2,956	79,088	39,766	36,229	26,344	130,530.5	307,921.5
Recreation	58	1,169	242	212.5	75.5	1,246.5	3,003.5
TOTAL	3,014	80,257	40,007	36,441.5	26,419.5	131,786	310,925
Non-Federal First Cost ($1000)							
Flood Control	2,040	36,665	17,097	23,884	17,036	130,530.5	227,251.5
Recreation	58	1,169	242	212.5	75.5	1,246.5	3,003.5
TOTAL	2,098	37,834	17,339	24,096.5	17,111.5	131,786	230,265
Project Annual Cost ($1000)							
Flood Control	823	12,130	6,216	6,003	4,366	28,822	57,049
Recreation	19	345	73	62	20	341	860
Annual Operation & Maintenance Cost ($1000)							
Flood Control	46	459	216	191	90	576	1,578
Recreation	6	27	22	17	5	82	229
TOTAL	52	566	238	208	95	658	1,807
Average Annual Benefits ($1000)							
Flood Control	871	31,877	28,656	62,025	5,294	90,358	219,225
Recreation	86	1,271	186	249	142	1,627	3,561
Net Excess Benefits ($1000)							
Flood Control	348	19,747	23,640	56,026	879	61,536	162,176
Recreation	66	926	113	187	122	1,286	2,701
Benefit-Cost Ratio							
Flood Control	1.67	2.63	5.53	10.33	1.20	3.14	3.84
Recreation	4.46	3.68	2.56	4.02	7.12	4.77	4.14

ENERGY RESEARCH CENTER

Continued from page 17

that large amounts of residual oil are known to be present in swept reservoirs, only a small amount of this oil is being recovered at present by EOR operations in the United States (about 7% of domestic production, which corresponds to about 15% of crude oil imports). High costs and lack of complete understanding of the details of some of the processes involved have inhibited the rapid development of EOR operations. More fundamental and longer term research is needed to develop and bolster EOR methods.

It is not quite certain how much oil in the ground can be recovered by EOR operations. The Department of Energy and Lewin & Associates estimate that if the price of oil were $50 per barrel, **14 billion barrels** could be added to the reserves. Recently Hirsch in *Science* magazine cited a possible range of **7-110 billion barrels.** At current prices, 100 billion barrels is worth 2 trillion dollars—a sum well worth going after. We recognize that the mobile unswept oil may be an easier target and the recovery of residual oil by EOR a more distant and expensive target.

RESEARCH THEMES

Recent studies have addressed in detail the question of research targetted at recovering oil from existing domestic fields. A number of research themes are emphasized in these reports. Summarized here, they include the following:

- reservoir characterization
- subtle, complex and hard-to-see traps
- enhancement of seismic methods
- seismic determination of lithology and fluid content
- borehole measurements
- physical and chemical properties of rocks
- prediction of transport mechanisms in reservoirs
- dispersion/mixing
- integration of geological, geophysical, and engineering methods

RESEARCH FACILITIES

The importance of up-to-date facilities in support of first rate research is obvious. The following facilities are judged most important for the research themes mentioned above.

Subsurface Test Facilities. One or more subsurface test facilities are needed, in conjunction with studies at the regional, field and reservoir scale in a hydrocarbon producing area. A subsurface test facility will ideally have the following attributes:

- subsurface geologic framework from drilling
- availability of a good data base (logs, cores)
- a grid of good quality 2-D seismic data which extends beyond the productive area
- correlative outcrop sections
- long-term access for monitoring
- cost-effective additional drilling, coring, and logging

The subsurface test facility will be used for the testing of tools and concepts to be used in exploration, infill drilling, EOR and reservoir management. The test facility will provide a geologic system having known structural, stratigraphic, and reservoir properties in three dimensions for testing geophysical techniques such as 3-D seismic, cross hold, VSP, logging, etc., and for testing reservoir performance to the fullest extent possible.

Seismic and Electrical Instrumentation and Interpretation Facilities. A considerable effort is needed in the development of new exploration seismic tools, e.g., higher frequency seismic sources, shear wave sources, and generation and detection of multi-component seismic signals. Test facilities should provide the possibility to test various acquisition schemes and geometrics. Also available should be closely related processing and interpretation facilities.

Facilities for Petrophysical Measurement and Study. For the conduct of research, it is essential to have access to one or more centers for petrophysical measurement and study. Reservoir characterization and all advanced geophysical techniques depend on accurate petrophysical measurements. In addition to the conventional measurements of porosity, permeability, and capillary pressure, facilities for measuring the sonic and electrical properties are essential. In addition, the facilities should be able to handle the special requirements needed for evaluating EOR processes and various aspects of reservoir management, such as the effect of completion and stimulation procedures. As dictated by the needs of more advanced geophysical techniques or recovery processes, it may be desirable in the future to provide state-of-the-art laboratories capable of simulating subsurface temperatures, pressures, direction stresses, and fluid-fill conditions for measurement of rock properties, fluid properties, and rock-fluid and fluid-fluid interactions.

Computing Facilities. Advanced seismic data processing in particular, requires extensive computing facilities. Development of 3-D seismic, considered essential to delineation of traps and description of reservoirs, makes large demands on computer speed and storage capacity. These demands will be amplified when 3 component seismic signals are generated and recorded. Supercomputers with large storage capacity and high input output rates are needed to deal with these data. Computing centers should include multiple workstations, interactive high speed graphic facilities and extensive networking.

Integrated Modelling and Analysis System Facility. This facility is not designed simply to store or organize archival data. Rather, by using proven elements of artificial intelligence software, it will be designed to integrate and interactively improve the interpretations made by using diverse sets of data. For example, by using well logs, seismic data, rock properties, fluid properties, and production measurements, it should be possible to develop a system that improves the definition and calibration of given reservoirs as well as of predicting the properties of new reservoirs. Similarly, conceptual structural and stratigraphic models, outcrop data, well logs and core data, and detailed seismic data can be used to define more precisely and more automatically, subsurface geologic conditions.

ORGANIZATION OF RESEARCH AND TRANSFER OF TECHNOLOGY

At the present time, targetted research in the fossil fuel area is largely carried out (or sponsored) by the major oil companies. Fundamental research is carried out to a considerable extent at universities. The federal government has generally pursued the policy of not providing much support for research in the fossil fuel area. Of a Department of Energy total budget of about $2 billion, only about $30 million is spent on research related to exploration and

production of oil and gas.

As Abelson has pointed out, the major oil companies have decreased their research efforts. They have reduced their research budget and laid off research personnel, especially during the last two years.

Smaller oil companies and independents cannot be expected to take up the slack. They do have great interest in increasing production from existing domestic fields, but they generally do not have large research staffs to engage in the necessary research. If the payoffs are not in the short term, it becomes especially difficult for them individually to sustain large-scale research efforts.

Universities have an obvious and important role to play in performing fundamental research and in training future oil geologists, geophysicists, and petroleum engineers. Many universities are enhancing their efforts in the direction of oil and gas related research. University of Houston's newly created Petroleum Research Center is an excellent example. However, academic researchers and students cannot be expected to shoulder the total burden of greatly increased research activity. Very large and expensive facilities and staffing in a large number of disciplines is necessary but may be difficult within conventional university arrangements. Furthermore, requirements for applied research such as tight deadlines, stringent accountability, and the necessity of keeping research results proprietary are often viewed as incompatible with the traditional roles of university professors and students.

ENERGY RESEARCH CENTER

If Houston is to continue to be the energy capital of the world, the focus of future large scale energy related research should be in Houston. This focus should be attained by creating an Energy Research Center in Houston. The Energy Research Center will include a number of players - large and small energy companies, large and small contractors and service companies, and universities.

We summarize below the roles that the various players might play in conjunction with a Houston based Energy Research Center:

	Who Should Do?			
TASK	**E**	**U**	**C**	**O**
Choosing Research Targets	X			X
Planning Research	X	X	X	(x)
Executing Basic Research		X		Y
Executing Applied Research	X	X	X	Y
Development & Field Testing	X	(x)	X	(x)
Technology Transfer to Contractors	X	(x)		
Technology Transfer to Oil Company Operating Personnel	X	(x)	(x)	
Applying the New Technology			X	X

E = Energy Research Center
U = Universities
C = Contractors
O = Oil Companies
X = Major Role
Y = Major role, but not necessarily associated with Energy Research Center
(x) = Minor Role

The Energy Research Center will: (1) provide a central focus for planning and coordinating a targetted program of research, (2) house a number of research facilities at this site and monitor the activities of research facilities at other sites, (3) coordinate and carry out development and field testing efforts, and (4) effect the transfer of technology to contractors and oil company operating personnel.

A large and multifaceted Energy Research Center cannot be created overnight. It has to be ramped up. From a starting annual budget of, say $10 million, a ramp up to, say $100 million annually over a period of five years is well within the realm of possibility. Such a center would provide more than a thousand new jobs to earth scientists and engineers; it would provide a great boost to the oil and gas industry locally and could make an important impact on the national problem of ever increasing oil imports. The time to establish an Energy Research Center is **now.** It will take several years before its impact will be felt. The energy industry must provide the leadership to create an Energy Research Center in Houston. Without strong initiatives from the energy industry, an Energy Research Center will simply remain an idea whose time came and went.

I acknowledge the help of a number of colleagues and associates who contributed ideas to this paper.

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EXPLORATION ACTIVITY REVIEW

National Rig Count: November 16—1,174; Year Ago—910

ONSHORE GULF COAST

Texas Gulf Coast

Transamerican Natural Gas will drill a 13,800' **Wilcox** test 1-3/4 miles southwest of Queen City, Carrizo and upper Wilcox production at South Davis Field in **Zapata** County. The #2 Dolores is 4 miles east of nearest deep Wilcox production at the Sanchez-O'Brien #2 Laurel, discovery well for the South Las Ovejas Field. At the Carrizo Wilcox horizon the wildcat spots on east dip, in close proximity to a down-to-the-southeast fault; but structure in the deeper Wilcox may be considerably different.

Farther east, in **Brooks** County, Union Pacific has staked location for an 11,700' **Yegua** wildcat 4-1/2 miles south of shallow Miocene and Frio production at Alta Verde Field. The #1 Alexander Estate is 3-1/3 miles southeast of the closest deep test (Tenneco #1 Saunders), which reportedly bottomed in the Wilcox at14,002' and tested the Yegua at 8203-8349' before abandonment. At the Yegua horizon the wildcat appears to be located on the extreme distal south flank of the Alta Verde dome.

Also in **Brooks** County, Lobo Res., Ltd. will drill a 12,000' **Vicksburg** wildcat 1-1/4 miles southeast of Frio production at Skipper Field. The #1 Ruelas Gas Unit is also 2 miles northeast of nearest Vicksburg production at La Encantada Field. At the middle Frio horizon the new test spots on a broad, east plunging nose.

Delray Oil has opened Southwest Brundage Field at their #2 Wilson, et al Unit A, a new **Olmos** discovery 2-1/4 miles southwest of Brundage in **Dimmit** County. Flow rate was 87 BOPD and 30 MCFGPD from 3706-14'. At the Olmos horizon the new producer spots on the south flank of an eastward plunging structural nose.

A 6900' wildcat has been scheduled by the Venex Corp. 1-1/2 miles northeast of Hockley production at Rowena East Field in **Jim Wells** County. The #1 Rippen should reach TD in the **Yegua,** and is about 6000' south of a 6910' dry hole (Howell #1 Rokohl) which encountered reservoir quality Yegua sands below 6100', in addition to thin porous Hockley sands uphole. At the Yegua horizon the new test spots on the northeast flank of a faulted anticline and downthrown to a small fault.

Farther north, in northern **Live Oak** County, Challenge Operating will drill a 5000' upper **Wilcox** test 4-3/4 miles south of Wilcox gas production at Atkinson West Field. The #1 Roberthon is about 4700' northeast of the R&H #1 Strickhausen, a 10,600' dry hole which encountered porous upper Wilcox sands between 4740' and 4820'. Structure at the Carrizo Wilcox horizon appears to be regional southeast dip.

An 8000' **Vicksburg** wildcat has been scheduled by Frio Trend Development Co. one mile south of Frio and Miocene production at McKenzie Field in **Victoria** County. The #2 Heller is 1000' south of the same operator's #1 Huber, for which no completion data have as yet been released, and one mile north of a 6518' dry hole (Dougherty #1 Huber) which encountered reservoir quality Frio sands interbedded with thick marine shales between 4690' and 6302'. At the Vicksburg horizon the wildcat spots on east dip between two down-to-the-southeast faults.

Standard Oil Production will drill a 12,500' wildcat 1-1/2 miles south of El Campo in **Wharton** County. The #1 Chappell should reach the **Yegua** and possibly the **upper Wilcox.** Vicksburg and Frio production is common in the area, with the closest Yegua wells being about 2 miles northeast. At the Vicksburg horizon the new test spots on southeast dip and upthrown to a small down-to-the-north fault.

In **Tyler** County, ARCO Oil & Gas has opened Little Oak Field at the #1 Exxon Fee 143, a new **Yegua** discovery 2 miles north of Yegua production at Beech Creek East Field. Flow rate was 1,261 MCFGPD from 7016-41'. Structure at the Yegua horizon is irregular southeast dip with possible nearby faulting.

South Louisiana

Two deep **Hackberry** wildcats are scheduled for **Calcasieu** Parish. The Exploration Co. of Louisiana will drill the #1 MGGT-GL to 14,000' 2 miles south of Anahuac and Frio production at Choupique Field and 1-1/3 miles southeast of the closest Hackberry test, the Calco #1 Moss dry hole. At the *Camerina 'A"* horizon the wildcat spots on the south flank of the the large faulted south-plunging nose upon which Choupique Field is located.

Farther east, Bechtel Exploration has staked a 15,000' test 1-1/4 miles southeast of multi-pay Anahuac and Frio production at East Moss Lake Field. The #1 Burton will evaluate **Hackberry** sands logged in the LL&E #1 Bacon dry hole, 3/4 mile northeast. At the *Cam 'A'* horizon the wildcat spots on fairly steep south dip, in close proximity to a southeast dipping fault.

Sabine Corporation will drill a 16,000' ***Bolivina mexicana* (Frio)** test 1-1/2 miles northeast of lower Miocene, Anahuac and Frio production at Ridge Field in **Lafayette** Parish. The #1 Judice is about 3500' northeast of the nearest *Bol mex* test, the Warren #1 Lafayette, a 15,754' dry hole. At the *Marg tex* horizon the wildcat spots in a shallow trough between the Ridge Field and Judice Field structures.

In **Terrebonne** Parish, Sandefer Petroleum will evaluate **middle Miocene** sands at a 17,200' directionally drilled wildcat about 1-1/2 miles northwest of middle Miocene production at Crescent Farms Field. Primary target of the #1 Breaux is probably the Hollywood sand, logged in the Bass, et al #1 McCollum, about 2000' east of the proposed BHL. Structure at the *Cristellaria 'I'* horizon is moderate northeast dip with local nosing.

Keck Partners have completed their #1 Clemons as another **lower Tuscaloosa** discovery in extreme southwest **St. Helena** Parish, 3-2/3 miles northwest of the 1986 discovery of Beaver Dam Creek Field. Flow rate was 1,400 MCFGPD, 14 BCPD and 24 BWPD from 14,538-48'. Lower Tuscaloosa structure here is regional southwest dip with some broad local nosing.

MESOZOIC TREND

East Texas

Conoco has staked location for a 10,500' **James** test 2-1/2 miles northeast of Boynton in **Angelina** County, and

1-1/2 miles south of several shallow Claiborne and Wilcox oil producers. The #1 Medford is also about 1300' northwest of the McMillan #1 Longbell, a 10,365' James dry hole which tested salt water from Georgetown perfs at 7534-42'. Structure at the base Austin Chalk is regional south dip.

In **Upshur** County, Prairie Producing will drill a 12,500' **Jurassic** test about 2 miles southwest of their recent Cotton Valley Lime gas completion and extension to Delrose Field. The #1 Foster is one mile northwest of the Home (orig. Texas Interstate) #1 Gilmer which cored dense Smackover limestone between 12,860' and 13,033' and tested non-commercial shows in the Travis Peak and Cotton Valley sands before abandonment. At the top Cotton Valley Lime the wildcat appears to be located in a low-relief saddle between the Delrose and Gilmer Field structures.

Samedan Oil has staked a 12,500' **Norphlet** wildcat, the #1 IPC, one mile northwest of Rodessa production at Hosey Driskill Field in **Cass** County. Closest Norphlet production (oil) is 3-3/4 miles northeast at the one-well Colville Field. Structure at the top Smackover is moderate northwest dip off the Sabine Uplift.

TXO Production has completed the #1 Blalock as a new **Smackover** gas discovery about 3/4 mile north of Paluxy production at Sugar Hill Field in **Titus** County, opening Yaweh Field. Flow rate was 72,250 MCFGPD (CAOF) through perfs at 8894-8936'. At the top Smackover horizon the new producer spots upthrown and in close proximity to the south-bounding fault for the east-west trending Talco fault system.

North Louisiana-South Arkansas

Hurley Petroleum will drill a 10,800' **Smackover** test about a mile east of Northwest Colquitt Field (Rodessa through Smackover production) in **Claiborne** Parish. The #1 Tillman is less than a mile east of the Hunt #1 Loving, which encountered an exceptionally thick Buckner section and bottomed at 11,097' without reaching the Smackover.

In northern **Miller** County, Arkansas, Mike Rogers Drilling has scheduled a 6300' **Smackover** wildcat, the #3 Bachelor, 1-1/2 miles north of Smackover production at Paup Spur Field. Structure at the top Smackover is regional south dip, while a Buckner isopach indicates northward thickening off Paup Spur Field.

Mississippi

First Energy Corp. has opened Learned Dome Field at a new **Rodessa** discovery 3-3/4 miles west of Rodessa and Pine Island production at West Raymond Field in **Hinds** County. The #1 Irving Estate flowed 329 BOPD and 474 MCFGPD from tight Rodessa sands at 12,176-228' after fracturing. The new producer is located on the northern flank of Learned Dome, a shallow salt piercement structure.

Farther east, in **Jones** County, Cities Service will drill a 17,500' wildcat near the community of Lanham. The #1 Walker "A" is located on the eastern flank of a major north-south trending salt ridge with a crestal graben system, locus of several oil and gas fields, including Reedy Creek and Laurel. The 17,500' projected depth should enable the wildcat to test late **Jurassic** targets pinching out against the intrusive salt ridge as well as proven younger age reservoirs.

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