# **BULLETIN**

## Corpus Christi Geological Society



and

## Coastal Bend Geophysical Society



November 2014 ISSN 0739 5620

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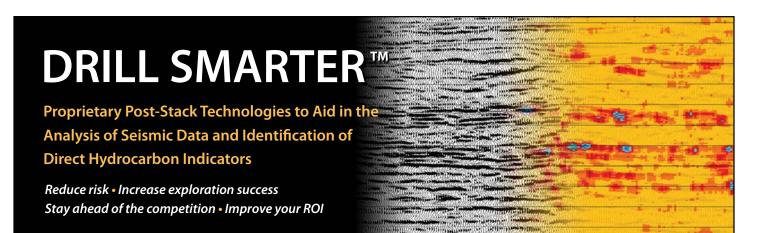
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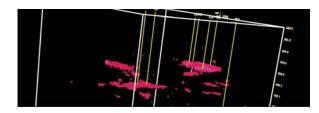
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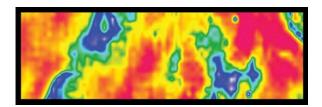
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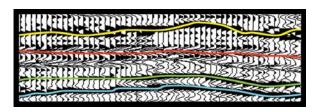
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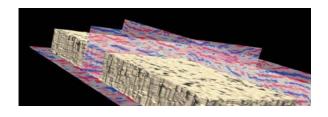
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www.ccgeo.org

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## \*\*\*BLOOD DRIVE\*\*\*

# THE BLOODMOBILE – IN **NOVEMBER- 2014**WILL BE AT SOME CONVENIENT LOCATIONS PLEASE CALL 855-4943 for those locations or see below:



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Society. Our number	with them is 4254 & it would be helpful if you
can please give them th	nat number also.
	Thanks! Mike Lucente
	44 4 4

www.coastalbendbloodcenter.com

## CCGS/CBGS JOINT MEETING SCHEDULE 2014-2015

		Se	ptem	ber			October							November						
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
			2014	Ļ				2014									201	4		
	1	2	3	4	5	6				1	2	3	4							1
7	8	9	<u>10</u>	11	12	13	5	6	7	8	9	10	11	2	3	4	5	6	7	8
14	15	16	17	18	19	20	12	13	14	<u>15</u>	16	17	18	9	10	11	12	13	14	15
21	22	23	24	25	26	27	19	20	21	22	23	24	25	16	17	18	<u>19</u>	20	21	22
28	29	30					26	27	28	29	30	31		23 30		25	26	27	28	29

Sept. 10, 2014 5:30p.m.—8:30p.m. Kickoff BBQ Howard's BBQ & Catering 1002 Antelope Street Oct. 15—11:30a.m.—1:00p.m. Speaker: Ken Williams— Halliburton. "Barostratigraphy" Nov. 19—11:30a.m.—1:00p.m. Speaker: Tony Hauglum--Rivera Exploration. "Eagleford Update"

		D	ecem	ber				January								F	ebrua	ry		
S	M	T	W	Th	F	S	S	M	T	W	Th	F	S	S	M	T	W	Th	F	S
			201	4						201	5						2015			
	1	2	3	4	5	6					1	2	3	1	2	3	4	5	6	7
7	8	9	<u>10</u>	11	12	13	4	5	6	7	8	9	10	8	9	10	11	12	13	14
14	15	16	17	18	19	20	11	12	13	14	15	16	17	15	16	17	<b>18</b>	19	20	21
21	22	23	24	25	26	27	18	19	20	<b>21</b>	22	23	24	22	23	24	25	26	27	28
		_																		
28	29	30	31				25	26	27	28	29	30	31							

Dec. 10—11:30a.m.--1:00p.m. Speaker: Woodson Godfrey— PaleoSource. "Distinguishing a Resource Play Jan. 21--11:30a.m.—1:00p.m. Speaker: Lei Zhang— Schlumberger. "Seismic Inversion to Reservoir Simulation" Feb. 18—11:30a.m.—1:00p.m. Speaker: Collegiate Month. "Presentation by TAMUCC, TAMUK and DelMar"

## **CCGS/CBGS JOINT MEETING SCHEDULE 2014-2015**

March								April							May						
S	M	T	W 2015		F	S	S	M	T	W 2015		F	S	S	M	T	W 2015	Th	F	S	
1	2	3	4	5	6	7				1	2	3	4						1	2	
8	9	10	11	12	13	14	5	6	7	8	9	10	11	3	4	5	6	7	8	9	
15	16	17	<u>18</u>	19	20	21	12	13	14	<u>15</u>	16	17	18	10	11	12	13	14	15	16	
22	23	24	25	26	27	28	19	20	21	22	23	24	25	17	18	19	<u>20</u>	21	22	23	
29	30	31					26	27	28	29	30			24	25	26	27	28	29	30	
														31							

April 15—11:30a.m.—1:00p.m. Speaker: Richard Adams—Carr Resources. The Lower Woodbine Organic Shale of Burlenson and Brazos Counties, Texas: Anatomy

of a New "Old" Play

Special Guest Lecturer to be Announced

# **Calendar of Meetings and Events Calendar of Area Monthly Meetings**

Corpus Christi Geological/Geophysical SocietySIPES Corpus Christi Luncheons	
South Texas Geological Society Luncheons	
San Antonio Geophysical Society Meetings	
Austin Geological Society	First Monday
Austin Chapter of SIPES	First Thursday
Houston Geological Society Luncheons	Last Wednesday
Central Texas Section of Society of Mining, Metallurgy & Exp	2 <sup>nd</sup> Tues every other month
	In San Antonio

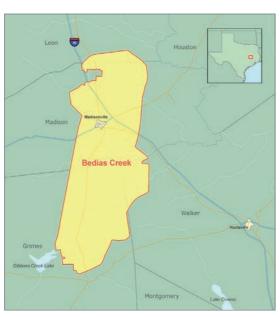


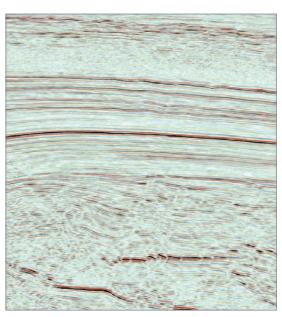




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#### PRESIDENT'S LETTER

Thank you to those who came out to hear Ken Williams from Halliburton give a very thought provoking talk on barostratigraphy. I really enjoyed hearing him speak, and I am thankful that I could walk away with a new tool to help with my craft. This month Tony Hauglum with Riviera Exploration will give us an "Eagleford Update." It is always great to hear a local success story. I hope you will come out and join us November 19<sup>th</sup> for our luncheon meeting.

The 2014 GCAGS Annual Convention was held last month in Lafayette, Louisiana, and it was a very entertaining and informative event. The convention was very well attended, and as many pointed out was of the same scale as is predicted when we host in 2016. The CCGS was well represented, and we learned a great deal of what it takes to host such an event these days. Please get with our GCAGS 2016 Chairman Dawn Bissell and volunteer.

Here are a few observations that I found interesting from the demographics report.

- 1) Only 33% of the attendees stated that they worked for companies that allocated 20% or more of their company assets in unconventional "resource" plays. 60% of folks claim they spend zero time in the unconventional plays.
- 2) Almost 20% of the attendees were students. This seems to be a real trend lately. It is great to see the future of our industry participating in these events. On that same note, over 50% of the attendees were over the age of 51.

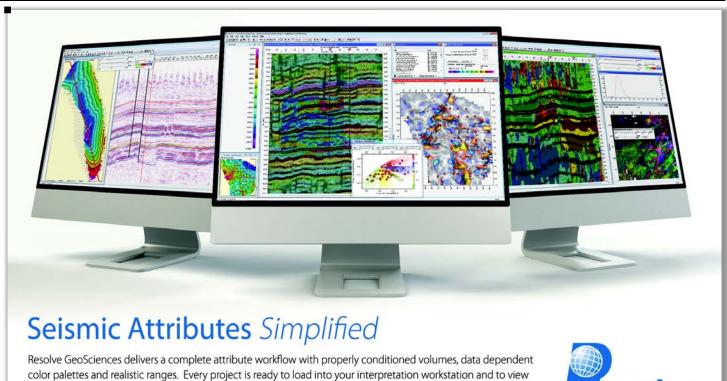
I was able to meet a bunch of great folks in Lafayette, and it is amazing how you can get the pulse of the industry while attending such an event. The decline in oil prices since early August was the topic of most discussion, and it seems I heard or had conversations that ranged from the sky is falling to this dip will provide a tremendous opportunity. Since the convention oil is down another 10%, and I am still having the same conversations. At these times I typically resort back to something my father reminded me of constantly. "Keep working hard, these things typically sort themselves out."

Leighton Devine

**CCGS** President

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#### **CBGS PRESIDENT'S LETTER**

<u>News -</u> Thanks to all sponsors and players who helped make the Annual CBGS Golf Tournament a success. We have awarded a scholarship this year to a Geophysics graduate student, University of Houston. We hope to bring the student to Corpus in the next couple of months. Thanks to Ed Egger for working with the U of H to identify/vett a good candidate. Thanks to Fermin Munoz for organizing this year's golf tournament--a great job. And by the time you read this we will also have had the CBGS Seismic Workshop. Thanks to Vicki Martlett and Geotrace for coordinating. I'll have more reports next month.

Did anyone go to the SEG Convention in Denver? Let me know what you found out that other CBGS members would be interested in.

**Business -** CBGS (and other local geophysical societies) have an agreement in principle with the Geophysical Society of Houston(GSH) to "market" educational events conducted by the GSH in return for a portion of the fees associated with the event. A win/win - They get more participation, we get part of the fees, geophysical knowledge/practice is progressed. They are having some good events with good instructors at a reasonable cost. If you participate, please note that you are a member of the CBGS and we will get our share...... So, in that thread.

#### **Education -**

GSH is sponsoring a Webinar by Leon Thomsen - \$390 Understanding Seismic Anisotropy in Exploration and Exploitation Monday 10-Nov-2014 8:00 AM to Thursday 13-Nov-2014 12:00 PM CST Parting Thought -

Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.

Albert Einstein

Read more at

http://www.brainyquote.com/quotes/authors/a/albert\_einstein.html#B9Pxx2pw0LJCJDvc.99 Learn from yesterday, live for today, hope for tomorrow. The important thing is to not stop questioning - Albert Einstein

Seismic Crews - US Onshore	Current Month	Last Month	Difference	(Per SEG/Seismic Crew Reports Survey)
	Onshore/Offshore	Onshore/Offshore		
	41/13	43/11	-	
	Current Month	Last Month	Last Year - Monthly	(Per Texas RRC, last reported)
Texas Production	MMBO/BCF	MMBO/BCF	MMBO/BCF	
Oil	69.6	69.8	661	
Gas	632	639	702	
	Current Month	Yr to date - 2014	Yr to date - 2013	
Texas Drilling Permits	3,013	19,732	16,558	
Oil wells	934	5,824	5,280	
Gas wells	173	1,085	1,037	
Oil and Gas wells	1,811	12,020	9,593	
Other	12	142	151	
Total Completions	2,492	23,149	19,114	
Oil Completions	2,048	19,835	14,518	
Gas Completions	328	2,498	4,101	
New Field Discoveries	4	31	40	
Other	118	816	495	

Lonnie Blake - CBGS President

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## Corpus Christi Geological Society & Coastal Bend Geophysical Society

## LUNCHEON MEETING ANNOUNCEMENT

## Wednesday, November 19, 2014

**Location:** Corpus Christi Town Club, 6<sup>th</sup> Floor (800 North Shoreline)

**Bar Sponsor:** Rhonda Broughton- Seismic Exchange (SEI)

Student Sponsor: Core Lab (Juan Cabasos) and the CCGS

Time: 11:30 a.m. Bar, Lunch follows at 11:45 a.m., Speaker at Noon.

**Cost:** \$25 (a \$3 surcharge if no reservation). No-shows will be billed.

**Reservations:** Please by Monday, November 17 – email allison@aaoperating.com

## **Luncheon Topic: The Whitsett South Eagle Ford Project**

Presented by Tony Hauglum, Riviera Exploration

Riviera recognized the potential of the emerging Eagle Ford trend in early 2008, and concentrated initial leasing efforts in LaSalle County, under 28,000 contiguous acres just north of the Stuart City Reef trend and ahead of the leasing efforts of others playing the new trend. By the time the full lease check was completed landmen from northeast had descended onto the area and Riviera's leasing efforts were quickly outbid by the competition.

Riviera continued to work the trend back northeast, looking for open acreage blocks with potential. One promising area was southwest of the Whitsett community, and Riviera began leasing in late July, 2009 and completed leasing in December, 2009.

The prospect was sold to Petrohawk in January 2010, and the first well was drilled in April, 2012. The well tested 984 BOPD + 2,000 MCFD with a FTP of 5650 psi. Initial production began in August 2013, 16 months later, by which time 22 wells had been drilled on the property.

To date, 32 wells of a 37-well program have been drilled, with development expected to be complete by early 2015. Wells come online producing 600-800 bopd plus 1.2-1.5MMCFD for the average initial production rates, while cost per well is \$10-11MM completed and fraced.

Reserves are estimated to be approximately 500,000 BO + 1.5 BCFG + 150,000 BNGL per well, with total reserves to the acreage about 13.5MMBO + 40-50 BCFG + 4.3 MMBNGL.

The South Whitsett Prospect has become the South Whitsett Project, due to the size and scope of the development program. In addition to building 12 pads for drilling wells, a pipeline gathering system for both oil and gas has been built, and an oil trucking facility is being constructed currently on Hwy 281 east of the area. The talk will encompass the project from initiation in 2009 up through the current development of the acreage.

**About our presenter: H. Tony Hauglum** has been continuously involved in oil and gas exploration since 1975. His thirty-nine years in the industry have involved exploration in most major trends of onshore Texas, offshore Texas, and offshore Louisiana. The last fourteen years have been spent as owner and operator of Riviera Exploration, LLC/Riviera Production Company, Ltd., an independent exploration company in Corpus Christi, Texas.

Prior to founding Riviera Exploration, LLC and Riviera Production Company, Ltd., he spent two years with BNP Petroleum as Manager of Exploration and five years working as the Geophysical Manager for Tana Oil and Gas Corp., a small Corpus Christi-based oil and gas exploration company which focused its effort in South Texas, South Louisiana and offshore. From 1984 to 1992, Mr. Hauglum ran his own business as a consulting geophysicist. The eight years spent in the industry prior to consulting were spent with McMoRan Exploration for five years in Corpus Christi, and Union Oil Company of California in Houston, Texas and Lafayette, Louisiana for 3 ½ years.

Mr. Hauglum earned a B.S. degree in Geophysics from Texas A&M University in 1975.

**David Kirk.** Tony would also like to recognize fellow CCGS member, David Kirk. A second generation Petroleum Geologist, David Kirk received his B.S. degree in Geology from Texas A&M University in 2002. He recently relocated to Boerne, TX and is working as an independent exploration geologist for Kirk Resources, Inc.

From 2007 to 2014, Mr. Kirk worked as an Exploration Geologist for Riviera Exploration, focusing on onshore South Texas. During his tenure at Riviera he carried out extensive exploration efforts in the Frio-Vicksburg and Cretaceous trends. Mr. Kirk conducted extensive regional mapping early in the development of the Eagleford Shale Trend that resulted in a multi-county leasing program. To date 24 consecutive 1000+ boepd wells have been completed.

Prior to his employment at Riviera, Mr. Kirk worked as an Exploration Geologist for Nova Oil & Gas, focused on onshore South Texas for 3 years. During his time at Nova, Mr. Kirk explored and developed leads and prospects in the Frio-Vicksburg and the Wilcox Trends.



# We want your presentations!



We are constantly looking for great luncheon presentations for our monthly events.

Some of the best talks are those from <u>our membership</u> – individuals and companies with fresh ideas and emerging technologies or new discoveries to showcase.

Or...Is there a presentation you've heard at SEG, SPE, AAPG, GCAGS, HGS, SIPES, TAMUCC, TAMUK, Del Mar or another forum? Please let us know. We may like it, too.

Ideas? Presentations? References? To Volunteer?

Please Contact: Randy Bissell, CCGS VP 2014-2015 <a href="mailto:randyb@headington.com">randyb@headington.com</a> or (361) 816-4920 or (361) 885-0113



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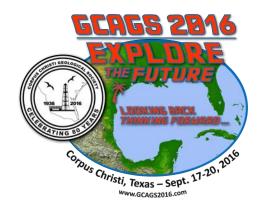
Acquisition

Processing

Results



September 17 - 20 Corpus Christi, Texas



October 16, 2014

Re: GCAGS 2014 Convention

The Lafayette Geological Society hosted the 2014 Gulf Coast Association of Geological Societies convention October 4<sup>th</sup> thru 7<sup>th</sup>, 2014. Many congratulations to the LGS for an excellent convention!

Six short courses, two field trips, and a 3 - 12 grade Teacher workshop were offered on Saturday and Sunday preceding the technical convention. There were two full days of three sessions of technical presentations on Monday and Tuesday, as well as four poster session and a prospect alley.

The technical sessions covered Emerging Shelf Plays, Conventional Onshore, a GOM Educational Forum, Turbidites, Salt Tectonics, Resource Plays, Technology, Environmental, and Ethics.

There were fun and social activities too. A Young Professionals Meet & Greet, ice breakers, receptions, guest activities, a party at the Science Museum, and a pub crawl.

A big thank you to the sponsors and exhibitors. All of our conventions are made possible through the support of our sponsors and exhibitors!

Corpus had a nice contingent of convention go-ers: Randy Bissell, Brent Hopkins, Leighton Devine, Rick Paige, Bob Critchlow, Rolf Woods, Casey Mibbs, Katelyn Wallace, and Darlene Murry. My appreciation to all of you.

Next year the convention will be in Houston, and it promises to be another great convention.

Dawn Bissell

GCAGS 2016, General Chair

aux S. Bissell

GCAGS 2016 General Chair Dawn Bissell Advent Enterprises, LLC bissells@swbell.net 361-960-2151 GCAGS 2016 BOARD President
Brent Hopkins
Suemaur Exploration & Production, LLC
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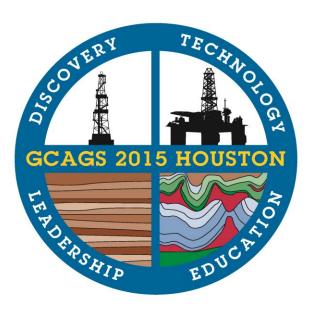
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## CALL FOR PAPERS

65th GCAGS Convention
September 19-22, 2015 •
George R. Brown center
Houston, Texas





New Oil and Gas Discoveries
Un-Conventional Plays
Development Field Studies
GOM Shelf and Onshore Plays
Salt Tectonics and Traps
Mexico and Caribbean Plays
Geophysical Technology
Gulf of Mexico Deepwater
Environmental Geology
Coastal Geology and Surface Impact
Geology-Geophysics-Engineering
Portfolio Management
Climate/ Public Awareness Issues

# To participate in the 2015 GCAGS Convention Oral and Poster presentations

An abstract of up to 250 words should be submitted no later than <a href="December 13, 2014">December 13, 2014</a> to Technical Program Chair, Linda Sternbach (<a href="linda.sternbach@gmail.com">linda.sternbach@gmail.com</a>).

After notification of acceptance on <a href="January 20, 2015">January 20, 2015</a>, authors submit extended abstracts (1-2 pages) or full papers up to 12 pages to the GCAGS Transactions by <a href="February 20, 2015">February 20, 2015</a> to GCAGS Transactions Editor, Steve Levine.

Full instructions for manuscript submissions will be posted online at <a href="https://www.gcags2015.com">www.gcags2015.com</a>.

# Publish your work in the upcoming GCAGS Journal !! (a new peer-reviewed journal of Gulf Coast Geoscience).

Instructions: An extended abstract of at least 600 words, including 1–2 representative figures, Should be submitted by December 2, 2014 to Journal Editor, Barry Katz (BarryKatz@chevron.com).

After acceptance, a full manuscript must be submitted by March 24, 2015.

Full instructions for manuscript submissions will be posted online at www.gcags2015.com.

# GCAGS Convention returns to Houston in September 2015 Call for Presentation and Posters ends December 13 2014

By Linda Sternbach , Technical Chair

Contact: <a href="mailto:linda.sternbach@gmail.com">linda.sternbach@gmail.com</a> 281-679-7333

The Houston Geological Society will host the 65<sup>th</sup> Gulf Coast Association of Geological Societies (GCAGS) at the George R. Brown Convention Center, September 19-22, 2015. The Gulf Coast Section of SEPM (GCSSEPM) plans to co-host the GCAGS 2015 convention. GCSSEPM will be organizing oral talks, posters, judging and the SEPM awards program.

The Houston 2015 GCAGS convention is opening up a "Call for Papers" and inviting geoscientists to submit a short 250 word abstract with title and authors by December 13, 2014. Submit a short word document (250 words) to Technical Program chair Linda Sternbach at <a href="mailto:linda.sternbach@gmail.com">linda.sternbach@gmail.com</a>, or check the convention web page and blog, hosted by GCAGS Secretary Dianna Phu at <a href="https://www.gcagshouston.com">www.gcagshouston.com</a>.

The session themes are: New Oil and Gas Discoveries, Un-Conventional Plays, Development Field Studies, GOM Shelf and Onshore Plays, Salt Tectonics and Traps, Mexico and Caribbean Plays, Geophysical Technology, Gulf of Mexico Deepwater, Environmental Geology, Coastal Geology and Surface Impact, Geology-Geophysics-Engineering, Business Portfolio Management, Climate/ Public Awareness Issues.

The 65<sup>th</sup> Annual GCAGS convention will feature Gulf Coast area oil, gas, and environmental topics, with the intent that Gulf Coast geoscientists will expand their technical training, knowledge and networking during the convention. The General Chair of the convention is Larry Bartell (Legends Exploration, email <a href="mailto:ldbartell@legendsexpl.com">ldbartell@legendsexpl.com</a>. GCAGS President for the 2015 convention is Charles Sternbach (Star Creek Energy, carbodude@gmail.com). GCAGS Non-Technical Chair is Deborah Sacrey, HGS President -Elect. The Technical Program is coordinated by Linda Sternbach (Star Creek Energy) and Paul Basinski (Burgundy Exploration- email <a href="mailto:pbasinski@comcast.com">pbasinski@comcast.com</a>). Dianna Phu (<a href="mailto:dianna@exabyte.org">dianna@exabyte.org</a>) is both Secretary for the convention and publicity, website and social media chair. Mike Erpenbeck is convention Treasurer.

The convention is proud to have the following hard working volunteers: Short Courses (Robert Pledger (rpledger@hotmail.com), Field Trips co -chairs Dr Julia Wellner ,University of Houston, email jwellner@uh.edu , and Dr. Robert Wellner – robert.w.wellner@exxonmobil.com.

Poster Sessions will be coordinated by Meredith Faber (Swift Energy- email meredith.faber@swiftenergy.com). Judging Co Chairs are Sandy Rushworth and David Risch (sandyrushw@aol.com, and davidlrisch@aol.com). If you have ideas on Short Courses and Field Trips or want more information on participating, contact Robert Pledger and Julia Wellner.

The convention will start on Saturday, September 19, 2015. The opening weekend will have one and two day field trips leaving from the George R. Brown convention center. These will be open to professionals and university students. There will also be one and two day short courses on the weekend of Sept 19-20 2015. The technical program is anticipating 100 or more talks in concurrent sessions. The talks and poster sessions will occupy two full days on the third level of the George R Brown convention center September 21-22, 2015 (Monday and Tuesday). Check the convention website <a href="https://www.gcagshouston.com">www.gcagshouston.com</a> for more information on contacting all the volunteers and log on to the latest

news as the convention planning continues from now till mid- 2015. Convention registration will open in August 2015.

There are other projects initiated by GCAGS that deserve mention. There will be a GCAGS Transactions Publication of all the talks and posters at the 2015 convention. This editor of the 2015 Transactions is past HGS President, Steve Levine (email: stephenlevine@sk.com).

In addition, GCAGS has a peer-reviewed technical journal called GCAGS Journal that publishes full length geosciences papers each year in hard copy and online as pdfs. The 2015 GCAGS Journal Editor is HGS Past -President and former HGS Bulletin Editor, Barry Katz. Geoscientists will need to submit a 600 word abstract detailing their proposed Journal paper by December 2, 2014 to be included in the 2015 GCAGS Journal. Contact Barry Katz at <a href="mailto:barrykatz@chevron.com">barrykatz@chevron.com</a> for more information. GCSSEPM editor will be Patricia Santogrossi, past HGS Bulletin editor.

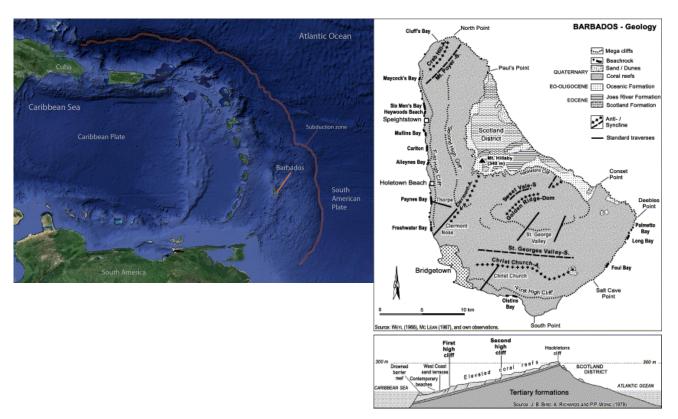
## SILICEOUS CLAY POTTERY OF BARBADOS

**AUTHOR: WENDY SCHWERTNER** 

#### Abstract

The island of Barbados is an accretionary prism of deformed sedimentary rocks that are brought up as a result of the subducting South American Plate under the Caribbean Plate. Barbados is rising above the sea surface and will continue to be rearranged and eroded. The eroding sedimentary rocks give way to pockets of soft clay deposits, which are predominantly iron oxide (FeO<sub>2</sub>) clay, and kaolin (P<sub>2</sub>O<sub>5</sub>/TiO<sub>2</sub>) clay. When combined, these two clay types create a smooth clay body that is resilient and enhances vibrant glazes. Natural Barbados clay is unique compared to hand mixed clay, which requires several components to achieve similar characteristics.

Key Words: Barbados, accretionary prism, tectonic uplift, Caribbean pottery, iron oxide clay



**Fig. 1** Physical map of Caribbean subduction zone. The South American Plate subducts under the Caribbean Plate, forming the Caribbean islands.

 $\label{eq:Fig.2} \textbf{Fig. 2} \ \text{Map of Barbados geology}. \ \ \text{The island contains} \\ \text{sediment and sedimentary rock}.$ 



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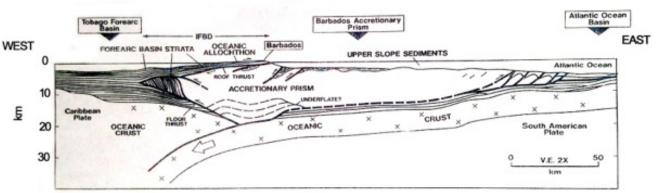


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The South American Plate was moving under the Caribbean Plate as early as 50 million years ago at the beginning of the Cenozoic era (Fig.1). The sea floor was starting to buckle and began the process of tectonic uplift around 10 million years ago. An accumulation of deep marine sediments and sedimentary rocks gathered over time to create an accretionary prism (Fig.3). Contrary to surrounding volcanic islands of the Lesser Antilles, Barbados does not contain any evidence to support the island's formation from volcanic activity (Fig.2). Barbados Island rose above sea level around 2-1 million years ago, allowing erosion to occur. Eroded sedimentary rocks gave way to pockets of soft clay deposits. Sedimentary rocks have also eroded into fine clay minerals such as Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, Na<sub>2</sub>O/TiO<sub>2</sub>, K<sub>2</sub>O/TiO<sub>2</sub>, and P<sub>2</sub>O<sub>5</sub>/TiO<sub>2</sub> (Muhs, 2001). Areas that are best known for clay mining are found all around the Scotland District and most notably around Chalky Mount (Fig.2). The weathered Pleistocene-age limestone has reviled the Scotland District's underlying oceanic sediments in 'erosional windows' (Machel, 1999).

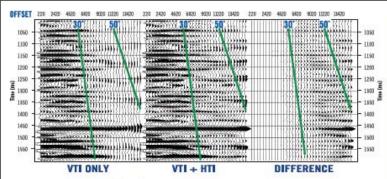
#### **TECTONIC CROSS-SECTION OF BARBADOS**



**Fig. 3** Tectonic movement of the South American Plate under the Caribbean Plate. Deep marine clay minerals and sedimentary rocks are forced above sea level.

#### continued on page 25

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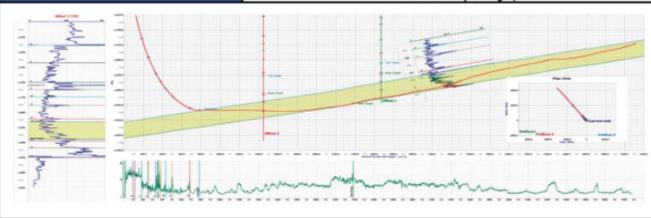
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#### **Localities for Mining and Collecting**

The forces of the Atlantic Ocean have worn away limestone on the northeastern side of Barbados, exposing soft clay minerals. This area has been defined as the Scotland District (Fig.4), and has been the most accessible place to retrieve clay deposits on the island. Potters almost exclusively use this area to harvest clay. Ancient limestone terraces also act as barriers all around the island and hold soil that allows soil horizons to form. The subsoil can contain clay that could be a viable resource for pottery or glaze production. These terraces stretch from North Point, along the western side of the island, and continue south to Foul Bay.

The red iron oxide clay is an accumulation of deep marine siliceous sediment that was forced up by tectonic movements. The eastern flank, or Scotland District, of the island is considered to be the locus of Atlantic basin sediment (Speed, 2012). The potters have combed Chalky Mount for a precise blend of deep marine clay and kaolin. Chalky Mount potters have used a 2:1 ratio of clay to water mixture to crate "green ware". The mixture would then rest for a day, after which the clay body would be ready for use (Hattuck, 2014).

Ancient terraces have been found to be composed of younger Pleistocene age limestone ~425,000 years old, which differ from the limestone found in the Central Highlands that are ~5.3 million years old. When compared to younger terraces, older terraces located in the Terraced Flank contain the highest concentrations of clay (Muhs, 2001). A high concentration of kaolin is found in these matured soil horizons. Since the abundance of clay found in Barbados is iron oxide rich; kaolin is used as a secondary component. The addition of kaolin increases the workability of the clay.

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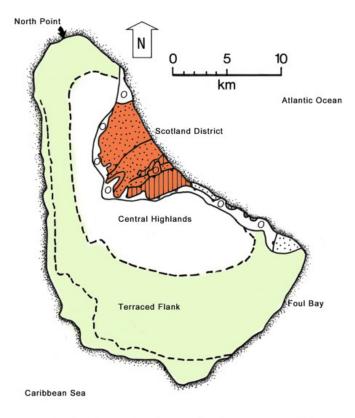


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Zone	Elevation	Surface	Shore	Rock	Hydrology
Central Highlands	130-340 m	Undulating sinkhole-rich surface plus riverine valleys; some fault scarps.	Zone does not intersect modern shore; no preserved ancient shoreline features.	Thick (50-130 m) limestone.	Max rain and min. evaporation of island; high infiltration; ground water flow to N, W, and S in karst conduits at base of limestone aquifer; runoff in large storms.
Terraced Flank	0-160 m	Partly stair- stepped with preserved marine terraces; partly hummocky and gullied by erosion.	Mainly cliffed rock shoreline; S: partly lined by bars and lagoons. W: intervals of beach and lagoon (filled estuary). N and E: rare beach in coves.	Thinner limestone (0-70 m); rare inliers of exhumed foundation.	Large variation in rainfall and evap.; high infiltration; water table at 0-5 m elev. and conduit flow above; runoff in large storms.
Scotland District	0-100 m	Deeply dissected riverine topography; steep interfluves between lowgradient floodplains.	Low and high bluffs and intervening estuaries in back of continuous beach and dune belt.	Silici-clastic foundation.	Large to small rainfall and evaporation; low infiltration; large emphemeral runoff.



GEOMORPHIC ZONATION OF BARBADOS

**Fig. 4** Central Highlands surrounded by possible mining locations. The Scotland District contains the most viable source of minerals, most notably at Chalky Mount.

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Other sources of kaolin could be found in the Scotland District, in the form of loose sediment or seams within another sedimentary rock type.

Clay ownership is a sensitive issue in Barbados; people have been known to take clay from property that does not belong to them. This action can become an issue of stolen property (Handler, 1963). Clay could be traded or used with permission of the landowner.

## Preferences for Certain Mineralogy, Geology and Texture

The variety of ceramic products manufactured by the potters in Barbados have shown different uses of white and red colored clay types, hand built or thrown techniques, and the utilization of many colored glazes. Ceramic ware requires a specific combination of minerals. Lighter clay bodies require a different mineral combination than darker clay bodies, yet each clay body needs proper balancing to allow glazes to react expectedly. The clay and glaze together require a chemical relationship to achieve the best possible outcome in color, texture, and brilliance. This has been a fundamental procedure when considering a recipe for marketable stoneware clay. The potters of Barbados have perfected a clay body that is not only consistent, but is harvested from the island's mineral deposits (Handler, 1963). The unique chemistry between the clay body and glaze creates iconic work.

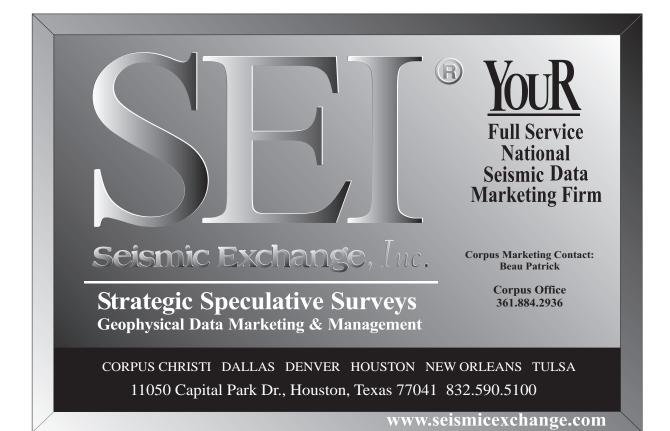
It is common for clay bodies to be balanced with the addition of several types of minerals. Barbados clay is unusual in that is it balanced and ready for use without additives (Fig.4). Compounds of elements found on the island make the iconic colors of Barbados pottery. The compound iron oxide (FeO<sub>2</sub>) is the strongest colorant that is used to create red tones. It is problematic for potters when bright white clay becomes

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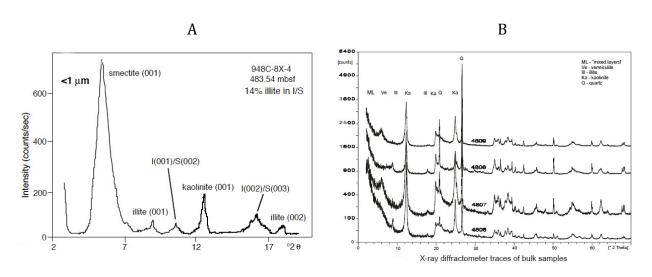
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contaminated with FeO<sub>2</sub> because of the irremovable stain. However, this red clay is favored among the potters because of its easy workability and harmony with bright, refractive glaze colors. Although red iron oxide clay is preferred and easily accessible, kaolin (P<sub>2</sub>O<sub>5</sub>/TiO<sub>2</sub>) is necessary to form optimal workable clay ("Sheffield Pottery", 2004). Easily manufactured clay that has produced a consistent product will result in a highly marketable product. The incorporation of kaolin has shown to increase the workability and strength of a clay body. Iron-bearing clays that are too dark could be lightened and could improve texturally when kaolin was added. If the clay is too dark, glazes applied to the surface would result in an unfavorable manor such as crazing, chipping, creeping in addition and not limited to unanticipated color. The partnership between kaolin and iron rich clay creates consistency and predictability to ceramic production in Barbados.

#### X-Ray Diffraction Comparison



**Fig. 4**A) X-ray diffraction of naturally derived Barbados clay sample. Illustrating simple mixture of smectite, illite, and kaolinite (Underwood, 1997).

B) X-ray diffraction of clay used to produce whiteware. This complex mixture of Quartz, kaolinite, illite, vermiculite, and "mixed layers" were used to create a clay body (Benea, 2002).

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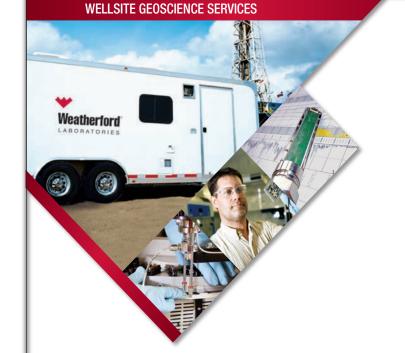
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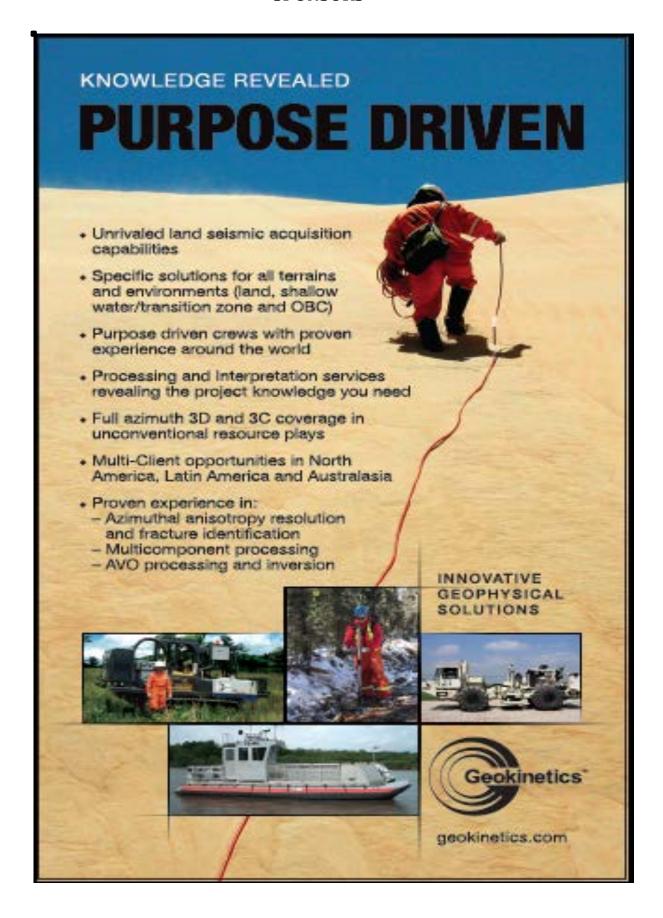


Compounds such as  $Na_2O/TiO_2$  and  $K_2O/TiO_2$  have been found abundantly on the island (Muhs, 2014), and can be utilized in glazes. The compound  $Na_2O/TiO_2$  will allow glazes to become brilliant, while sodium combined with high amounts of copper, cobalt, or iron; create deep aqua hues. Since the island of Barbados is known to have iron rich clays, there is a natural partnership between iron and sodium that produces a certain deep marine blue. Potassium ( $K_2O/TiO_2$ ) is used in glazes to brighten colors, it can push green glazes to blue hues, or it could intensify copper tones into deeper red tones.

The glaze on ceramic ware is a dense, vitreous coating. It is created from a recipe of minerals and chemicals that have been melted onto a clay surface during the firing process (Wandless, 2004). The difference between ordinary glass and the glaze on pottery are the colorants, alumina, and flux oxides that are added to silica minerals, where as glass is mainly composed of silica ("Sheffield Pottery", 2004). Glazes require different materials to properly attach to bisqued clay. Flux oxide can be defined as a compound to lower the melting point of silica, and alumina shrinks-to-fit the melted mixture to the clay. A precise mixture of silica, alumina, and flux oxides would be necessary to find the proper balance that compliments a clay type. Barbadian potters have developed a glaze using the flux oxide, similar to a native compound called Titanium dioxide (TiO<sub>2</sub>). In addition to being a glass former, TiO<sub>2</sub> increases opacity in colorants in the glaze; this contributes to the richness of each color. Imported minerals and chemicals are used in Barbados glazes; the relationships between clay and glaze have been harmonious.

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# **Products and Pieces Utilizing Deep-Marine Clays**

The smooth texture and strength of the red, deep-marine clay makes an ideal material for many kinds of ceramic products. The ability of the Barbados clay to cure at 1,204° C, resulted in a resilient stone-like vessel. It is a type of stoneware proved to be very durable, and chip resistant. Stoneware is more commonly used to make jugs, pitchers, vases, and sculptures, as opposed to flatware. The density and low absorption rate of the stoneware is more ideal for the larger forms produced on the island. When the vessel is full of liquid (per it's intended use), it could easily distribute the weight decreasing the chances of spilling or toppling over. The success of the pieces depended on the potter's ability to feel the size and thickness of walls when throwing on the pottery wheel. After hundreds of pots are made, one can expect a certain consistency that no longer required measurements or scales to ensure a series of pots are uniform.

The traditional red stoneware pottery that remains unglazed is a versatile material. This terracotta-style pottery does not allow liquids to seep through due to low absorbency properties. As opposed to other ceramic types like earthenware or porcelain, this stoneware could hold liquids without the use of glaze.

# **Number of Shops and Estimates of Production**

Families operate places of business such as Chalky Mount Pottery, and Earthworks Pottery. Galleries such as Pelican Village, Red Clay Pottery and Fairfield Gallery allow potters to come together and market their products (Hattuck, 2014). From a consumer point of view, there would not be an apparent difference between the quality of products made from a business or gallery collective. The trade of ceramic production

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SILICEOUS CLAY POTTERY OF BARBADOS

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was passed down from generation to generation. Shops usually hold multiples of the same items to accommodate popularity. Popularity could be seen as a good sign for business, however it could also pose some problems. Tourism is a main supporter to the potters and help merchandise travel, which increase product exposure. Some limitations come with the logistics of buying pieces while visiting Barbados. Limited luggage or the extra cost of shipping to the United States may discourage buyers from purchasing goods that are too large or intricate for fear of breaking in transport. In response to this, the potters make many smaller items and charged slightly more to offset the cost of unsold specialty items or larger items. Glazed pottery is traditionally more expensive than unglazed pottery simply because of extra care to finish the product. However, the lower cost of ceramic products in Barbados is the result of abundant minerals being accessible on the island, therefore negating the need for importation.

Barbados geology is unique in comparison to the volcanic Greater Antilles islands. This accretionary prism continues to be changed by the movement of the subducting South American Plate. Loose sediments that become exposed provide Barbadian potters limitless clay materials to create pottery. The simple chemistry of compounds found on the island facilitates cooperation of clay body and glaze to yield traditional Barbadian ceramics.

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SILICEOUS CLAY POTTERY OF BARBADOS

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**Contact Information- Guide in Pottery Production** 

Tour guided trails to view exposed clay and weathered sandstones. Other

geological aspects of Barbados would be discussed on the way to Chalky Mount, as well

as a drive tour through the Village of Walkers.

http://www.toursbylocals.com/BarclaysParkTrails

Tour guided trail hike up the Chalky Mount. The islands best clay deposits can be

seen here. For more information and booking:

http://www.ecoadventuresbarbados.com/barclays-park-trail.html

Earthworks Pottery cataloged the largest array of pottery available for purchase in

Barbados. These products truly have embodied the essence the Island's ceramic

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# **About the Author: Wendy Schwertner**

My first bachelor degree is in Fine Arts concentrating in ceramics, and I am currently pursuing a bachelor's degree in Geology. Working with minerals in clay and glazes inspired me to further research the science behind the craft. Any questions or comments about the article can be sent to wschwertner@islander.tamucc.edu.

# GEO LINK POST

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**USGS TAPESTRY OF TIME AND TERRAIN** <a href="http://tapestry.usgs.gov">http://tapestry.usgs.gov</a> The CCGS is donating to all of the 5th and 6th grade schools in the Coastal Bend. Check it out--it is a spectacular map. You might want to frame one for your own office. The one in my office has glass and a metal frame, and It cost \$400 and it does not look as good as the ones we are giving to the schools.

FREE TEXAS TOPOS'S <a href="http://www.tnris.state.tx.us/digital.htm">http://www.tnris.state.tx.us/digital.htm</a> these are TIFF files from your state government that can be downloaded and printed. You can ad them to SMT by converting them first in Globalmapper. Other digital data as well.

FREE NATIONAL TOPO'S <a href="http://store.usgs.gov/b2c\_usgs/b2c/start/">http://store.usgs.gov/b2c\_usgs/b2c/start/</a> <a href="http://store.usgs.gov/b2c\_usgs/b2c/start/">(xcm=r3standardpitrex\_prd)/.do</a> go to this webpage and look on the extreme right side to the box titled TOPO MAPS <a href="https://doi.org/10.2016/j.com/doi

http://www.geographynetwork.com/ Go here and try their top 5 map services. My favorite is 'USGS Elevation Date.' Zoom in on your favorite places and see great shaded relief images. One of my favorites is the Great Sand Dunes National Park in south central Colorado. Nice Dunes.

http://antwrp.gsfc.nasa.gov/apod/asropix.html Astronomy picture of the day--awesome. I click this page everyday.

http://www.spacimaging.com/gallery/ioweek/iow.htm Amazing satellite images. Check out the gallery.

http://www.ngdc.noaa.gov/seg/topo/globegal.shtml More great maps to share with kids and students.

www.ccgeo.org Don't forget we have our own we page.

http://terra.nasa.gov/gallery/ Great satellite images of Earth.

<u>www.ermaper.com</u> They have a great free downloadable viewer for TIFF and other graphic files called ER Viewer.

http://terrasrver.com Go here to download free aerial photo images that can be plotted under your digital land and well data. Images down to 1 meter resolution, searchable by Lat Long coordinate. Useful for resolving well location questions.

TYPE LOGS OF SOUTH TEXAS FIELDS by Corpus Christi Geological Society				
NEW (2000 2010)TVDE L			Christi Geological Society	
NEW (2009-2010)TYPE LO	Vista Del Mar	lost now found	MCMULLEN COUNTY	— Dlymauth
Aransas Pass/McCampbell Deep	COLORADO COUNTY	Maurbro StewartSwan Lake	Arnold-Weldon	Plymouth Portilla (2)
Bartell Pass	E. Ramsey		Brazil	Taft
	Graceland N. Fault Blk	Swan Lake, East	Devil's Waterhole	
Blackjack	Graceland S. Fault Blk	Texana, North West Ranch		Taft, East
Burgentine Lake	DEWITT COUNTY		Hostetter North	White Point, East
Copano Bay, South	Anna Barre	JIM HOGG COUNTY	Hostetter, North	STARR COUNTY
Estes Cove		Chaparosa	NUECES COUNTY	El Tanque
Fulton Beach	Cook *****Nordheim	Thompsonville, N.E.  JIM WELLS COUNTY	Agua Dulce (3)	Garcia
Goose Island			Arnold-David	Hinde
Half Moon Reef	Smith Creek	Freebom	Arnold-David, North	La Reforma, S.W.
Nine Mile Point	Warmsley	Hoelsher	Baldwin Deep	Lyda
Rockport, West	Yorktown, South	Palito Blanco	Calallen	Ricaby
St. Charles	DUVAL COUNTY	Wade City	Chapman Ranch	Rincon
Tally Island	DCR-49	KARNES COUNTY	Corpus Christi, N.W.	Rincon, North
Tract 831-G.O.M. (offshore)	Four Seasons	Burnell	Corpus Christi West C.C.	Ross
Virginia	Good Friday	Coy City	Encinal Channel	San Roman
BEE COUNTY	Hagist Ranch	Person	Flour Bluff/Flour Bluff, East	Sun
Caesar	Herbst	Runge	GOM St 9045(offshore)	Yturria
Mosca	Loma Novia	KENEDY COUNTY	Indian Point	VICTORIA COUNTY
Nomanna	Petrox	Candelaria	Mustang Island	Helen Gohike, S.W.
Orangedale(2)	Seven Sisters	Julian	Mustang Island, West	Keeran, North
Ray-Wilcox	Seventy Six, South	Julian, North	Mustang Island St.	Marcado Creek
San Domingo	Starr Bright, West	Laguna Madre	889S(offshore)	McFaddin
Tulsita Wilcox	GOLIAD COUNTY	Rita	Nueces Bay/Nueces Bay	Meyersville
Strauch_Wilcox	Berclair	Stillman	West	Placedo
BROOKS COUNTY	North Blanconia	KLEBERG COUNTY	Perro Rojo	WEBB COUNTY
Ann Mag	Bombs	Alazan	Pita Island	Aquilares/Glen Martin
Boedecker	Boyce	Alazan, North	Ramada	Big Cowboy
Cage Ranch	Cabeza Creek, South	Big Caesar	Redfish Bay	Bruni, S.E.
Encintas	Goliad, West	Borregos	Riverside	Cabezon
ERF	St Armo	Chevron (offshore)	Riverside, South	Carr Lobo
Gyp Hill	Terrell Point	Laguna Larga	Saxet	Davis
Gyp Hill West	HIDALGO COUNTY	Seeligson	Shield	Hirsch
Loma Blanca	Alamo/Donna	Sprint (offshore)	Stedman Island	Juanita
Mariposa	Donna	LA SALLE COUNTY	Turkey Creek	Las Tiendas
Mills Bennett	Edinburg, West	***Pearsall	REFUGIO COUNTY	Nicholson
Pita	Flores-Jeffress	LAVACA COUNTY	Bonnieview/Packery Flats	O'Hem
Tio Ayola	Foy	Halletsville	Greta	Olmitos
Tres Encinos	Hidalgo	Hope	La Rosa	Tom Walsh
CALHOUN COUNTY	LA Blanca	Southwest Speaks	Lake Pasture	WHARTON COUNTY
Appling	McAllen& Pharr	<b>Southwest Speaks Deep</b>	Refugio, New	Black Owl
Coloma Creek, North	McAllen Ranch	LIVE OAK COUNTY	Tom O'Connor	<b>WILLACY COUNTY</b>
Heyser	Mercedes	Atkinson	SAN PATRICIO COUNTY	Chile Vieja
Lavaca Bay	Monte Christo, North	Braslau	Angelita East	La Sal Vieja
Long Mott	Penitas	Chapa	Commonwealth	Paso Real
Magnolia Beach	San Fordyce	Clayton	Encino	Tenerias
	0 0 1	9		

Magnolia Beach Mosquito Point Olivia Panther Reef Powderhorn Seadrift, N.W. Steamboat Pass Webb Point S.E. Zoller

# **CAMERON COUNTY**

Holly Beach San Martin (2) Three Islands, East

San Fordyce San Carlos San Salvador S. Santallana Shary Tabasco Weslaco, North

# JACKSON COUNTY

Carancahua Creek

Weslaco, South

Francitas

Ganado & Ganado Deep

LaWard, North Little Kentucky

White Creek, East **MATAGORDA COUNTY** 

Kittie West-Salt Creek

Collegeport

Dunn

Harris

Lucille

Houdman

Sierra Vista

White Creek

Tom Lyne

Midway, North Odem

**Enos Cooper** 

Geronimo

Harvey

Hiberia

Hodges

Midway

Mathis, East

# **ZAPATA COUNTY**

Benavides Davis, South

Willamar

Jennings/Jennings, West

Lopeno M&F Pok-A-Dot

# **ZAVALA COUNTY**

El Bano

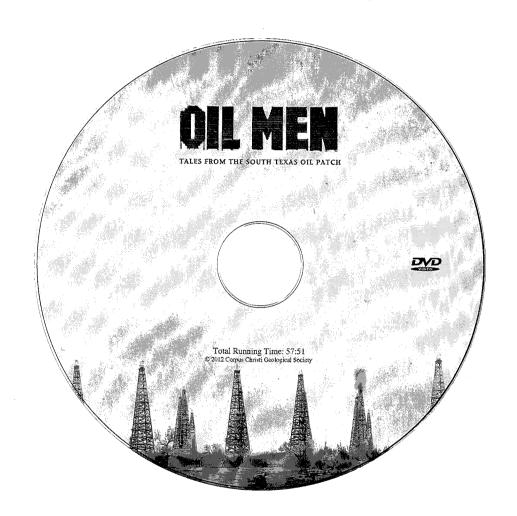
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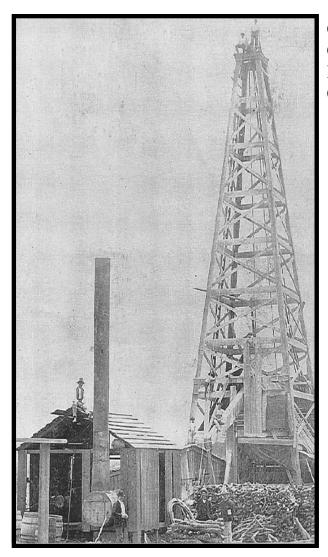
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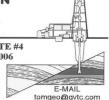
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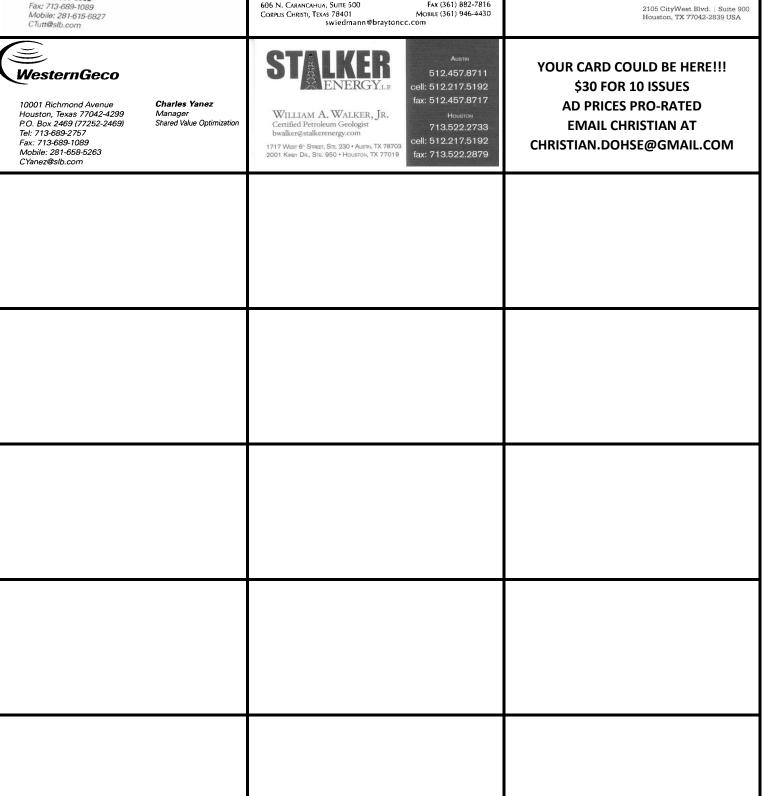
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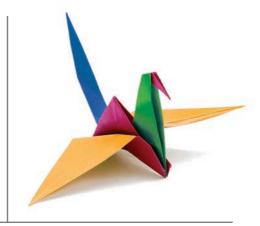


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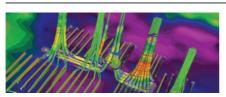




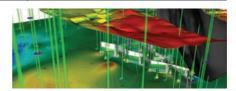
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