



# THE HAMMER

*Newsletter of the Geological Society of Trinidad and Tobago*



<b>Geological Society of Trinidad and Tobago</b> .....	3
<b>EDITOR'S NOTE</b> .....	3
<b>PAST EVENTS</b> .....	4
SPE/GSTT All Fours Competition .....	4
Calendar Competition Judging .....	5
Annual General Meeting .....	7
Annual Dinner and Dance .....	7
<b>TECHNICAL EVENTS</b> .....	9
Fourth Geological Conference .....	9
Sequence Stratigraphy, Depositional Environments and Reservoir Characterization of the Morne L'Enfer Formation, Southwest Trinidad .....	9
Wach-iking the Lower Morne L'Enfer! .....	9
4C Seismic Data .....	12
Overview of the Subsurface Petroleum Geology of Northern South America .....	13
<b>TECHNICAL FEATURE NOTE</b> .....	15
A Photographic Record Of Outcrops Of Lower Morne L'Enfer Formation At The Protected Areas 22 (PA22) Wellsite .....	15

## **Geological Society of Trinidad and Tobago**

UTT Building, Esperanza Road, Brechin  
Castle, Couva  
Tel: 679-6064 Fax: 679-7217  
Website: <http://gstt.org>  
Email: [gstt@tstt.net.tt](mailto:gstt@tstt.net.tt)

### **EDITOR'S NOTE**

This issue of the Hammer could not have been possible without the assistance of the many members who graciously submitted articles for this issue. I would like to thank them for the time and effort they have made. I hope that the inclusion of a technical presentation by Mr Curtis Archie of Petrotrin be noticed. With this in mind, I would like to make a call for more technical presentations or articles and responses or comments to them in order to foster conversations among the geological fraternity. From our experience in the Fourth Geological Conference, we have all seen the usefulness of presenting ideas in an open forum and I hope that in time the Hammer will become a medium for such discussion. If you wish to make a contribution or make a suggestion for the next issue of the Hammer contact me at [anndevika.ramsook@petrotrin.com](mailto:anndevika.ramsook@petrotrin.com).

## PAST EVENTS

### SPE/GSTT All Fours Competition

*Some things just don't change...*

The afternoon of Sunday the second of September was destined to be a day of predictable victory for the GSTT. For some there may even have been a sense of déjà vu, the event being replete with repeat performances of last year's tournament



***Card players in deep concentration***

As has become the norm in the ongoing Geoscientist versus Engineer feud, the GSTT by far outnumbered the SPE. Perhaps it is just by this sheer intimidating presence that we so easily overcame our opponents. Or maybe it is the fact that All Fours is a mixture of art and science that simply befuddles engineers who cannot comprehend this seemingly immiscible combination.

Anyway, the uneven representations led to another fast-becoming-tradition of some Geos (including the GSTT's own secretariat!!!) doing (out of necessity only) the most dishonourable deed of switching sides and playing *for* the enemy. There was also a particularly prominent GSTT pair who, although playing for the GSTT, seemed to be helping the SPE in their quest to first victory more than anything else. They shall, of course, remain unnamed. Eventually there were eleven tables of four, keenly battling it out for the first to 51 wins.

Some tables were quietly concentrating on their games while several others were markedly excited and raucous. There were roars of "Hang Jack!" "Bulls eye!" and "Marker!" every few minutes. Meanwhile Mrs. Meighu kept track of every victory and defeat, counting down the matchsticks and chalk to the battle's end. She made it easy for us to keep track of the progress, and this most objective writer will admit in fairness to the SPE that there were one or two moments when the scores were a little too close for comfort.

### ***Proud Prize Winners***



These moments were short lived though, in large part due to the efforts of Marisa Sooklal and Mohan Moonoo who copped the titles for most straights, most Hanged Jacks, most bulls eyes, first hanged Jack of Hearts, first hanged Jack of Spades, and consequently, the best pair for 2007. Congratulations to them!

In a repeat performance, Gabriella Kokaram and Tenille Khan took home the well-earned award for best female pair. They also had the distinction of winning the final game to bring the GSTT to 51 victories, well ahead of the SPE.

Those who know this writer would be well aware that this article could never be complete without the mention of the food. And there were eats a-plenty, with mini-rotis, batter-fried shrimp, samosas, meatballs, puffs, chicken drumsticks, corn soup and cake. All this was washed down with one's choice of drink from the open bar.

## **Calendar Competition**

### **Judging**

The 2008 calendar judging competition was held at the Normandie Hotel. Attendees were asked to select their favorite photos to be featured in the GSTT calendar. The following pictures were chosen



***All Fours winners Marisa Sooklal and Mohan Moonoo presented with prizes by Derek Meighu.***

Victories aside, the time spent was entertaining, filled with competitive camaraderie and good food. And so the evening ended, showing that when playing the game of Rock, Computer, Scissors (for computers have all but replaced paper today), that the rock always beats computer.

### ***Johan Lall (Repsol)***



***Calendar Selection Judges***

# Calendar Winners 2008



TRINITY HILL MEMBER OF THE MORUGA FORMATION, POINT RADIX  
CURTIS ARCHIE



SANDS OF THE MAYARO FORMATION EXPOSED IN THE CLIFFS AT MAYARO BAY, S.E. TRINIDAD  
JAVED ABDUL



FOLDED QUARTZITES AND PHYLLITES OF THE GYAYAMARA FORMATION, TOMPIRE BAY  
DEREK MEIGHU



ARCH DEVELOPED IN FRACUTRED QUARTZITES OF THE GUAYAMARA FORMATION, TOMPIRE BAY  
DEREK MEIGHU



FRACTURED GALERA PHYLLITES. SILICA INFILLED FRACTURES SHOWING FRACTURE DETAILS, WEATHERING POCKMARKS ON FRESHLY ERODED CLIFF FACE  
BOBBY DATOO



MUD FLOWING FROM ONE OF THE CONES AT PIPARO MUD VOLCANO  
RON DANIEL



ARCH DEVELOPED IN QUARTZITES OF THE GUAYAMARA FORMATION, TOMPIRE BAY, NE  
CURTIS ARCHIE



RINCON WATERFALL  
FAZAL HOSEIN



STACKS DEVELOPED IN SANDS OF THE CRUSE / GROS MORNE FORMATION, NEAR PT. CURAO, SOUTH COAST TRINIDAD  
CURTIS ARCHIE



ALTERNATING QUARTZITE AND PHYLLITE BEDS, BLANCHISSEUSE  
NANCY GALLAI



STEEPLY DIPPING BEDS OF QUARTZITE, PHYLLITES AND MINOR LIMESTONES OF THE GYAYAMAYA FORMATION, TOMPIRE BAY  
SAMANTHA SINGH



AERIAL VIEW OF PART OF THE CARONI ARENA RESERVOIR, CENTRAL TRINIDAD  
ANN RAMSOOK

## Annual General Meeting

The GSTT Annual General Meeting was held on Wednesday 24<sup>th</sup> October, 2007 at the UTT Compound Couva. The audited financial accounts of the society was presented and a new executive was voted in. We would like to welcome the new executive and thank the old executive for you contribution. We also urge new members from the society to volunteer their services for future positions both on the executive and as sub committee members. Your new executive for the the period 2007-2008 is

President Derek Meighu  
Presiden Elect Krishna Persad  
Secretary Tricia Andrews  
Director Curtis Archie  
Director Sushma Chatelal-Nattai  
Director Rajendra Maraj  
Director Leon Erriah



***Executive Members 2008***

## Annual Dinner and Dance



***Aloha!!!***

The Annual Dinner and Dance was hosted on 17<sup>th</sup> November, 2007 at the Garden Sanctuary , Centre of Excellence, Macoya. Guest were treated to a Hawiaan theme party and were given leis as part of their attire. The Garden Sanctuary was adorned with the soft lights of tikki torches and candlelights while lotus flowers floated in tranquil pools. Young and upcoming panist Johann Chuckaree provided entertainment as guest were treated to an appletising buffet and well stocked bar.



***Crowd Photo***

The formal part of the night was hosted by newly appointed executive members Sushma Chatelal and Leon

Erriah. Calender prize winners were presented their prizes and the GSTT raffle was drawn. Outgoing executive members were presented with plaques for their outstanding achievements. The rest of the night was spent with both the younger and older members trying out their dancing feet. The society would like to thank Nikeita Boodoodsingh, Sushma Chatelel, Simone Meigu, Curtis Archie and Lazina Archie for their contribution to this event. The event was enjoyed by all and we hope to see all members next year.

#### Achievement Awards

Outgoing Executive Presentations  
Past President Stanley Warton  
Secretary Samantha Singh  
Director Curtis Archie  
Director Ann Ramsook  
Director Sarika Ramnarine  
Director Gabriella Kokoram

Special Prize for Outstanding Contribution  
Fazal Hosein

Best Corporate Sponsor  
Schlumberger

Raffle Winners  
1<sup>st</sup> Kenrick Haynes  
2<sup>nd</sup> DK Daniel  
3<sup>rd</sup> Marlon Bruce



***Derek Smith presenting Damien Ferguson of Schlumberger with the Best Corporate Sponsor Prize***



***GSTT members can party!!!!!!***



***1<sup>st</sup> Raffle Prize Winner Kenrick Haynes collecting his laptop***

## TECHNICAL EVENTS

### Fourth Geological Conference

The Fourth Geological Conference was held on June 17<sup>th</sup> –22<sup>nd</sup> at the Trinidad Hilton, Port of Spain with the theme “Caribbean Exploration – Planning for the Future “. The conference hosted a series of field trips and short courses and to highlight their success, we would like to present reviews of some by the attendees themselves

#### *Sequence Stratigraphy, Depositional Environments and Reservoir*

#### *Characterization of the Morne L’Enfer Formation, Southwest Trinidad*

#### *Wach-iking the Lower Morne L’Enfer!*

Opting to participate in field trip which focused on the “Sequence Stratigraphic and Reservoir Characterization of the Lower Morne L’Enfer Formation” proved a very rewarding decision indeed.

The unwieldy title of this field trip belies its highly focused objectives--- - simply to walk a co-type section of the formation to discuss its stratigraphic & reservoir heterogeneity and distribution.

We set out at the “crack of dawn” from the Hilton Hotel in order to catch the low (spring) tide for mid-morning. After dispensing with the requisite safety tips and introductions, the mottley crew of junior and senior geoscientists, and independent oil finders, excitedly set out to assess the reservoir characteristics of the Morne L’Enfer Silt Member.

Hasely Vincent, doctoral student and veritable son of the “Morne L’Enfer silty soil” (his childhood home sits on an outcrop of the Morne L’Enfer Silt Member), set the backdrop for the field trip by highlighting the prolific nature of the Morne L’Enfer reservoir in the Couva, Forest Reserve and East Soldado oilfields among others. Cedros Bay, our first stop, offered excellent exposure of the uppermost section of the Lower Morne L’Enfer. Closer inspection revealed the Morne L’Enfer Silt Member dominated by the interlaminated silts and muds with sand laminae. The entire section showed upward coarsening and shallowing silty-sand to sand, with the current ripples increasing in both frequency and thickness upwards.

Disconformities occur as gradational contacts between the lower silty bedsets and the upper sand-rich

parallel to wavy flaser beds; "balls and pillow" structures and low angled scars and slumps that strongly suggest unstable pro-deltaic surfaces.

We meandered along most of the exposed Lower Morne L'Enfer Silt, (approx. 2km) until we identified the gradational contact which underlay the Morne L'Enfer Sandstone Member. On the seaward side, we just barely recognised the East-Soldado production facilities, which produce from the very same subsurface reservoir.

A key question which remains unresolved some minds when visiting this outcrop is the controversial nature of the observed "flooding surfaces" (indicated by the grey, bioturbated silts and shales). One school of thought, debatably, considers these as true flooding surfaces in response to relative sea-level changes, but they may otherwise represent shifting delta lobes in response to changes in paleocurrent directions within the basin.

Meandering further past the highstand sediments we encountered a transgressive sand unit (about 1.5m high). Increased deformation, contortion and swaley cross-stratification all distinguished the open-marine nature of this Morne L'Enfer Sandstone from the more tidal domination of the Silt member. The morning stimulated not only our minds but our gastronomic juices and both were satisfied by a regrouping and discussion over a

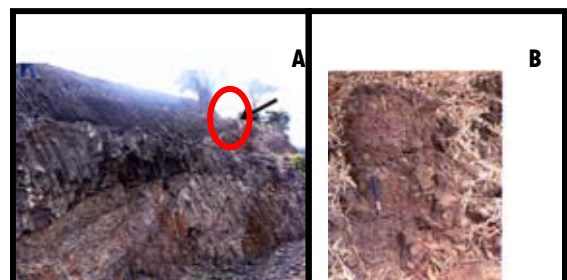
pleasant luncheon (courtesy GSTT) at the village "watering hole" before setting out to Stollmeyer's Quarry, Guapo.

Our second stop, Stollmeyer's Quarry further exemplified the sandy section described at Guapo Bay. These sediments exposed the uppermost section. Ostensibly oil impregnated, massive, lenticular sands were underlain by cobbled, muddy and sandy blocks resembling conglomerates.

Here, atop an upthrown "horst" block to the northeast of the quarry site, water wet (south-western) sands juxtaposed against visibly oil wet (north-eastern) sands clearly defined a brecciated fault plane.



Field trip stops: Stop 1 – Cedros Bay, and  
Stop 2 – Stollmeyer's Quarry at Guapo Bay



The Lower Morne L'Enfer Sandstone Member at Guapo Bay.  
Plate A: Oil-stained fluvial sands incised into bioturbated, swaley-cross stratified, marine sands. Arrow points to person's feet for scale at sequence boundary. Plate B: Fault plane indicated by brecciated sands on northern edge of quarry; geological hammer for scale.  
Photos courtesy Vincent & Wach, Feb. 2007)

Vincent & Wach 2007 estimated the total sandstone member representing the lowstand systems-tract as evidence of an underlying sequence boundary at Stollmeyer's Quarry at thirty-eight metres (*loc cit Vincent & Wach, February 2007, field Guide to the Sequence Stratigraphic and Reservoir Characterization of the Lower Morne L'Enfer Formation*)

These are interpreted to be fluvial sands within this Lower Morne L'Enfer Sandstone member. The massive, cross-bedded, lenticular sands are top-sealed by near 10metre- thick grey, shale lens. At the northeastern end of the quarry, bar crests (preferentially oriented) gave way to sigmoidal, cross-stratified scours, reasonably indicators of reworking along a channel margin.

Kudos to Hasley Vincent for so competently leading this field trip (under the guidance of Dr. Grant Wach) and for advocating the need for similar and more comprehensive "process-centred" approaches to the analysis of our basins and his reservoir and risk evaluation.

As we slumped into the maxi taxi, muddled, exhausted and "perfumed" with the oil from the Stollmeyer's Quarry, we journeyed back for the two and a half hour drive to Port-of-Spain. Thoughts of the heated discussions and the glorious weather of the hours past still radiated amidst of the balmy humidity of the afternoon. Soon these thoughts would be flooded by a fitting end to a great day – a

beastly cold bear on the banks of yet another bay.

***Tricia Andrews – Geologist,  
Petroleum Company of Trinidad  
and Tobago. (Attendee)***



Looking NE and shoreward: A view of the gradational contact between the lower silts and muds, and the upper, massive sands of the Lower Morne L'Enfer Silt Member at Cedros Bay

## *4C Seismic Data*

Keshan Zou, Principle Geophysicist Manager of Multicomponents at WesternGeco/Schlumberger lead a discussion on 4C Seismic, described as the next generation of 3D seismic exploration methods. Keshan reminded the audience from the beginning that 4C or multicomponent seismic is chiefly based on the recording of shear (transverse) wave energy at the sea bottom that would have otherwise been omitted due to the physical limitations of it moving through a liquid medium such as water.

According to Keshan, the industry at a purely business level, was satisfied with the results of traditional 3D streamer surveys recording only pressure (longitudinal) wave energy. The technical disadvantage to this was that the shear component was not recorded or taken into account. Valuable data was undoubtedly lost from the very beginning and this nonetheless presented several problems, which could have otherwise been solved or avoided.

Keshan briefly described the need of 4C Seismic and the critical role it would play. Firstly, he said that the world's largest and major reservoirs have already been found (not taking into account ultradeep waters). Newer ones are progressively smaller and more complex. Companies are focusing more on understanding reservoir

histories and properties, which could point them into the direction of future plays. They have also taken considerable interest in learning more about non reservoirs such as subsalts, diapirs, over-pressured layers, hydrates etc and even structural and stratigraphic extremities in the search of new oil and gas traps.

Multicomponent Seismic according to Keshan would provide that quality of subsurface imaging in this new quest of hydrocarbon exploration by the multinationals. The demand for oil and gas is so tremendous and unprecedented that seismic acquisition companies are charged with providing reservoir quality seismic. This higher quality seismic is demanded because it reaches the level of providing critical pieces of data such as water saturation, porosity, permeability etc of reservoirs that otherwise was not possible. Even previous acquisition effects due to fault shadow zones, shallow gas pockets, diapirs and salt domes can be reduced significantly.

Multicomponent Seismic technology provides: complete ground motion (fullwave field), higher resolution, broader frequency band (down to 1-2Hz), 3D Vp and Vs, anisotropic signature, no mode contamination (vector fidelity) and extremely reliable amplitudes. All these characteristics help to contribute to 4C's success thus far and it has definitely secured a healthy future in the seismic

acquisition business for years to come. Keshan continued his lecture with the mathematical concepts, theories and case histories of 4C seismic.

As a selling point to the audience he stressed on multicomponent successes by his WesternGeco/Schlumberger group and revealed their comprehensive, tested and proven workflow of 4C acquisition, processing and interpretation. The course was enjoyable, humorous, worthwhile and definitely recommended by all.

***Stephen Jagdeo – Geophysicist,  
Ministry of Energy and Energy  
Industries (Attendee)***

### *Overview of the Subsurface Petroleum Geology of Northern South America*

The course I attended at the 4<sup>th</sup> Geological Conference of the Geological Society of Trinidad and Tobago was entitled: "Overview of the Subsurface Petroleum Geology of Northern South America: From Onland Supergiants to Offshore Frontiers". It was a 2 day course hosted on June 21-22, 2007 by Dr. Paul Mann and Dr. Alejandro Escalona. Dr. Mann has been a research scientist at the University of Texas at Austin since 1983 and Dr. Escalona is an Associate Professor in Petroleum Geology at the University of Stavanger in Norway.

The course commenced with instructor and participant introductions, with the participants stating their reasons for attending the course. The objective of the early morning session on the first day was to discuss *tectonic framework and mature onland basins*. This part of the course dealt with 1. *Tectonics and hydrocarbons in the Caribbean and Gulf of Mexico region* and 2. *Recognizing Basin Types along Caribbean Plate Boundaries and Assessing their hydrocarbon Potential*. This objective concluded with an exercise on *recognizing major basin types and their hydrocarbon potential*. For the exercise the participants were given several seismic lines which passed through different basins. They then had to infer the basin type from the knowledge they gained in the previous lesson. The later morning session dealt with 1. *Overview of Tectonics and Basin Geology of Northern South America* and 2. *Magdalena Valley, Llanos Basin and Maracaibo Basin of Western Venezuela*.

The afternoon session began with an exercise on *recognizing major tectonic events in the Maracaibo Basin and understanding their implications for hydrocarbon trapping and secondary migration*. This exercise aided to put the theory of the previous course to use in a practical sense. The theme of the afternoon session focused on *Mature onland and offshore foreland basins with emphasis on 1. Barinas and Guarumen Foreland Basin* and 2.

*Eastern Venezuelan Basin and Heavy Oil Belt.* This part of the course was capped off with an exercise on *Recognizing major tectonic events in the Eastern Venezuelan Basin and understanding their implications for hydrocarbon trapping and secondary migration.* In the later afternoon there was a discussion on *Trinidad and the Columbus Basin* as well as an exercise on *Intersection fault families in the Columbus Basin and their controls on oil and gas fields.*

The topic of the morning on the second day was *Active strike-slip margin and deepwater frontier areas.* The subjects dealt with included *1.Active strike slip margin and related Basins, 2. Structure and Stratigraphy of the Ultra deep Areas of Offshore Venezuela and 3. Structure and Stratigraphy of Deepwater and Coastal Basins of Venezuela.* The morning session concluded with an exercise on *Recognizing offshore regions and hydrocarbon indicators on deepwater seismic data and their significance for offshore exploration.*

The last session dealt with *On and Offshore synthesis and summary of petroleum systems.* The topics dealt with were *1.Effects of Strike –slip offsets between the Caribbean and South American Plates and the Distribution of Ceozoic fluvial-deltaic and deepwater clastic sediments,* and *2. Major controls on source and reservoir rock.* This session ended with an exercise on *Finding creative yet constrained solutions to explain the possible occurrence of*

*widespread hydrocarbons in the Barbados Prism. Recognition of exploratory targets of offshore Northern South America.*

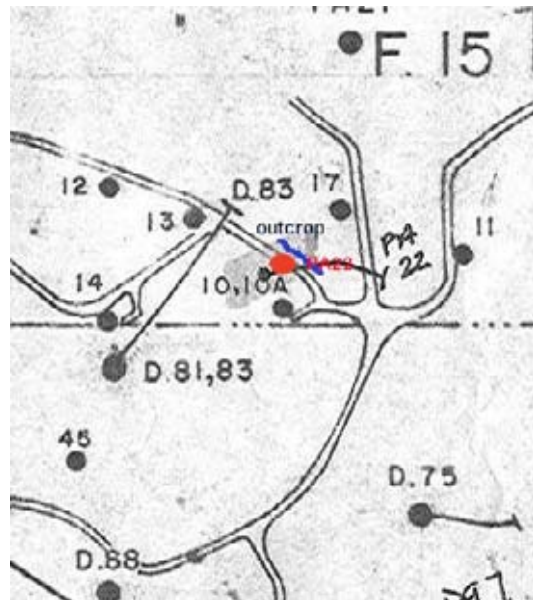
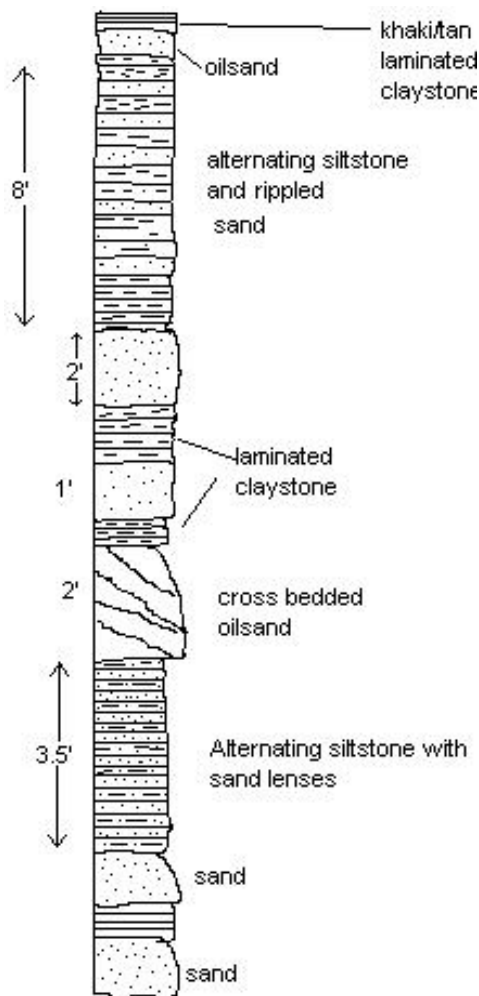
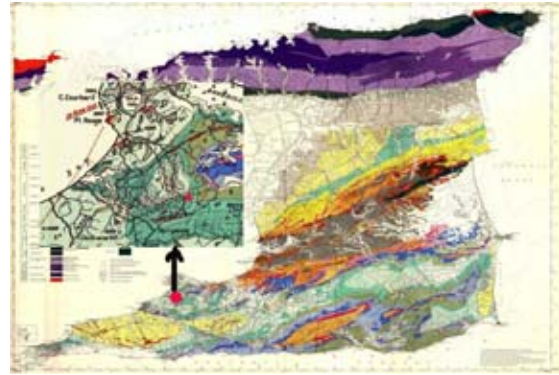
The course concluded with a review of the main points and a wrap-up discussion. The course was excellent and indeed very thorough. The exercises were definitely useful as they displayed to the participants how the theory imparted could be applied in a practical sense. They also helped to reinforce the material and ensure better understanding. The course gave good insight into the tectonic events that led to the formation of the different basin types along Northern South America and the Caribbean, the petroleum geology of these areas and their implications for hydrocarbon accumulations. This course was certainly relevant to the theme of the conference “Caribbean Exploration- Planning for the Future”.

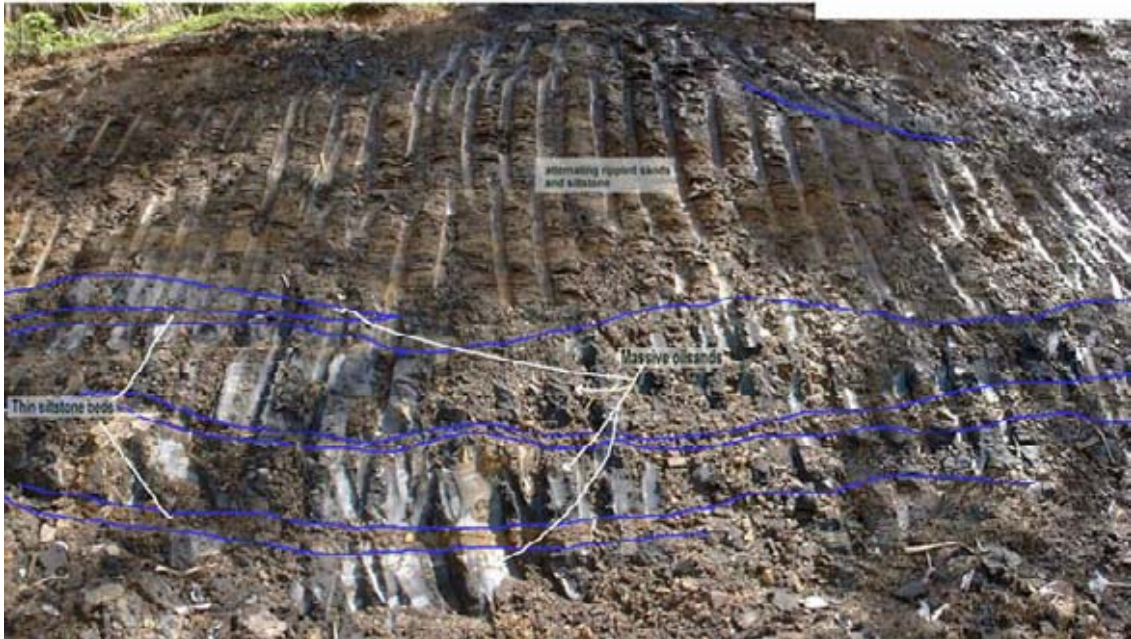
***Sonya Boodoo – Geologist,  
Petroleum Company of Trinidad  
and Tobago. (Attendee)***

## TECHNICAL FEATURE NOTE

### A Photographic Record Of Outcrops Of Lower Morne L'Enfer Formation At The Protected Areas 22 (PA22) Wellsite

Location : UTM (Naparima datum) N 1127396 , E 652094







Alternating siltstone and lenticular sand beds. The sand appear to fill the troughs of ripples or are asymmetric on one side of the ripples. Minor amounts of bioturbation (*Ophiomorpha*) are present.





This outcrop probably represents the transition from an upper offshore mud/silt dominated environment to a lower shoreface facies. The base of the section is dominated by thinly bedded siltstones and claystones with some thin lenticular sands. Overlying this are thinning and fining up, cross bedded sands, that are in turn conformably overlain by a sequence of alternating sand, siltstone and claystone.

***Curtis Archie (Petrotin)***

## Upcoming Events

The Geological Society of Trinidad and Tobago  
presents AAPG Distinguish Lecturer  
**Dr. Jose Luis Massafarro**  
Latin American 2007 DL Tour



A·A·P·G  
American Association of  
Petroleum Geologists  
An International Geological Organization  
www.aapg.org

---

### Three-Dimensional Seismic Imaging of Carbonate Reservoirs and Systems

Reefal carbonates are found in the Tamana, the Soldado Formation and Lower Cretaceous of Trinidad. There are minor shows and production from them. These carbonates provide an unexploited exploration target of unknown potential.

Date To Be Announced



## THE FUTURE OF ENERGY?



25TH - 27TH  
FEBRUARY,  
2008 HILTON  
TRINIDAD &  
CONFERENCE  
CENTRE

### TRINIDAD AND TOBAGO PETROLEUM WEEK 2008

CONFERENCE    WORKSHOPS    ENERGY TRADESHOW

#### CONFERENCE

25 & 26 FEBRUARY

##### DAY 1:

- GLOBAL PERSPECTIVES: KEYNOTE SPEAKER **DAVID HOBBS**, CERA VICE PRESIDENT AND MANAGING DIRECTOR OF GLOBAL RESEARCH



DAVID HOBBS

- ECONOMIC MANAGEMENT
- RESERVE MANAGEMENT
- CSR & TRANSPARENCY
- HOW DO WE BUILD A WORLD-CLASS ENERGY SERVICES SECTOR?

##### DAY 2:

- TT ENERGY POLICY
- DOWNSTREAM UPDATES
- MID-STREAM UPDATES
- UPSTREAM UPDATES
- SURINAME & BARBADOS BID-ROUNDS

#### WORKSHOPS

27TH FEBRUARY

- CARBON SEQUESTRATION
- SMART-FIELD TECHNOLOGY
- ROTATING EQUIPMENT
- WOMEN IN ENERGY
- SMEs IN ENERGY SECTOR
- SMART ISO

#### ENERGY TRADE SHOW

25TH - 27TH FEBRUARY

SCHLUMBERGER  
SMART ISO  
NOVA SCOTIA DEPARTMENT OF ENERGY  
TRINIDAD AND TOBAGO ENERGY GUIDE

COST OF BOOTHS: US \$3,500 + VAT

#### REGISTRATION

BY 31ST JANUARY & SAVE

EARLY-BIRD REGISTRATION:  
MEMBERS: US \$700 • NON-MEMBERS: US \$850

LATE REGISTRATION  
MEMBERS: US \$750 • NON MEMBERS: US \$900

(ALL PRICES VAT EXCLUSIVE)

#### OUR PRIME PARTNERS



To register contact us at: [petroconf@stcic.org](mailto:petroconf@stcic.org) • Tel: 868-652-5613

