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POSTER ABSTRACT

SEISMIC EXPRESSION AND INTERPRETATION OF STRUCTURES AND DEPOSITION IN THE GREATER TRINIDAD REGION

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Since 2000, Tectonic Analysis and several research associates have been conducting an intensive work program on the geology and tectonic and stratigraphic evolution of Trinidad, Eastern Venezuela, and the Barbados Ridge and Prism. Efforts in the three countries include: extensive field studies; comprehensive analysis of proprietary Trinidadian and most non-proprietary regional seismic data; heavy mineral analysis of over 150 samples and integration with published heavy mineral data; zircon and apatite fission track age determinations of numerous sandstone samples; paleontologic age dating of many samples; core analyses from Trinidadian wells; extensive thin section analyses of field and core samples; structural analyses of compressional, extensional and transcurrent deformations in the region; interpretation of gravity, magnetic, and seismicity patterns and occurrences; interpretation of mantle seismic tomography; and systematic integration and synthesis of all of the above with regional tectonic elements and plate kinematics.

The results are painting a new picture of Trinidad and the southeast Caribbean, one that is internally consistent with all data sets to hand. Examples of large scale advances include: definition of the "Proto-Caribbean Subduction Zone" along northern South America BEFORE the arrival of the Caribbean from the west in a "prism-prism collision", and how it controlled paleo-depositional tracts (and former Great Rivers) throughout the Tertiary; the realisation that Caribbean lithosphere continues beneath Northern Range and the Araya-Paria Peninsula to the El Pilar-Caroni Fault, thereby demanding some 200 km of dextral shear through onshore Trinidad since 10 Ma. Examples of meso-scale advances include: a bow-wave model for Maturin-Southern Basin foredeep subsidence in the absence of N-S plate convergence since 10 Ma; a model for Gulf of Paria Basin opening that incorporates 50

to 60 km of dextral low angle extensional detachment faulting; and an incremental depiction of the development of the Darien Ridge in the eastern offshore. Finer scale advances carry direct exploration implications, such as a new interpretation of the Los Bajos Fault, the South Boundary Fault, Nariva thrustbelt architecture, and evidence for Middle Miocene thrusting reaching the South Coast.

This poster displays numerous interpreted seismic examples with well control of the above and additional key structures, depositional relationships, processes, and other issues facing the Trinidadian geologist today, some of which are addressed in other verbal presentations at this meeting. It is intended to provide a forum for discussion with those interested in the structural and stratigraphic evolution of southeast Caribbean and Trinidad. Among the features highlighted in this poster are:

1) The Caroni-Sangre Grande-Fishing Pond Fault. The Arima Fault is conventionally considered the eastern continuation of the El Pilar Fault, but seismic lines show that it cannot be found in the eastern offshore. This newly defined fault system is marked by still active transpressional pop-ups and transtensional grabens that remain active to the present, and it has a clear continuation in the eastern offshore. The offset on the fault is substantial, being that portion of Caribbean-South American motion since 10 Ma not expressed as detached pull-apart formation in the Gulf of Paria or as relatively minor faulting on the North Coast Fault Zone.

2) The Gulf of Paria, where there is abundant evidence of large magnitude E-W extension which roots deep to the base of the former Middle Miocene thrust belt, and which therefore implies that there must be significant strike-slip offsets across onshore faults including the Point Radix Fault and Central Range Fault.

3) The Point Radix Fault and Darien Ridge are enigmatic structures which cross Central Trinidad and define the north side of the Columbus Channel. The map patterns of associated structures suggest but do not prove strike-slip offset. We outline the need for large dextral offset to explain the relationships of Plio-Pleistocene sediments north and south of the Fault (eastern Columbus Channel).

4) There is substantial evidence for thrust-stacking of the Cretaceous section in the Southern Basin prior to ca. 10 Ma, implying partitioning of petroleum systems prior to peak maturity and migration. Comparisons of the Cruse-Forest-Mayaro sections onshore southern Trinidad and farther south indicate that the base of the Late Miocene detachment fault system can be used as a proxy datum for flattening on 10 Ma, in the absence of suitable-aged paleo-horizontal strata.

5) The Los Bajos Fault initiated as an east-dipping lateral ramp within the Middle Miocene thrust belt. Subsequently it collapsed towards the east before Late Pliocene strike-slip reactivation. At depth the original east-dipping ramp accommodated this strike-slip but at a shallow level the former thrust belt wedged into the base of the younger Manzanilla Formation, and shallower expression of the fault is decoupled from the fault at depth. This

decoupling has previously caused substantial debate about the age and depth of detachment of the Los Bajos Fault.

6) Late Miocene growth faults occur onshore in the Cruse and Forest Formations and their equivalents. These detach close to the unconformity at the top of the Middle Miocene thrust belt and were active at the same time as E-W extension in the former Middle Miocene orogen to the north, although they were largely driven by gravity and sediment progradation and were not tightly coupled to faults affecting the orogen. We present interpretations of Southern Basin strike-lines which capture these structural styles and which support models of stratigraphic correlations which differ substantially from the Saunders et al. (1998) compilations but resemble more closely older correlation schemes.

7) We review the evidence for Late Pliocene and younger rejuvenated compression and the end of transtensional basin formation except within the Gulf of Paria Basin and explore the poorly imaged relationship of the Central Range Fault and other strike-slip faults to other tectonic and stratigraphic elements.

References cited:

Saunders, J. B., Roberts, C. L., Ali, W. M. and E. B. Eggertson, 1998, Geological Map of Trinidad and Tobago, Ministry of Energy and Energy Industries, scale 1:100,000.