Monday, January 16, 2006

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 non-members & walk-ups

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International Explorationists Dinner Meeting

by ***Gabor Tari***
Vanco Energy Company

Traditional and New Play Types of the Offshore Tano Basin of Côte d'Ivoire and Ghana, West Africa

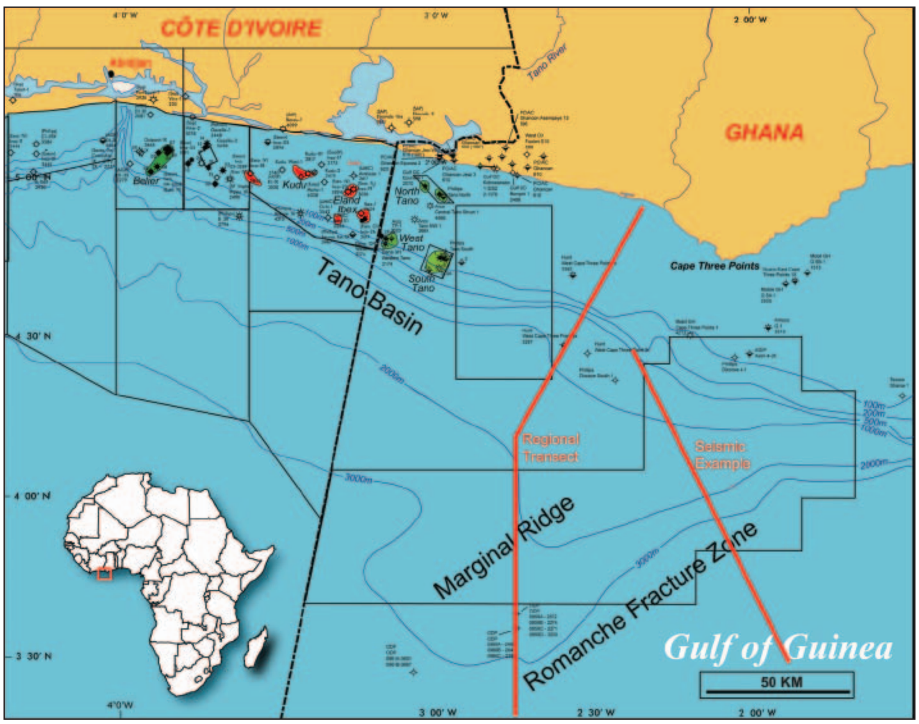

Figure 1. Index map of the Tano Basin of eastern Côte d'Ivoire and western Ghana.

The onshore Tano Basin (named after the border river between Côte d'Ivoire and Ghana) includes a small area between the coastline and the outcrops of the metamorphic Pan-African basement. The Marginal Ridge and the Deep Ivorian basin can be considered as the broader offshore Tano Basin, forming a large deepwater basin with present-day water depths from 200 m to 4,000 m (Fig. 1). To illustrate the basin-scale structure and stratigraphy of the Tano Basin downdip from Cape Three Points, a regional seismic transect is shown as a line drawing in Fig. 2.

The Marginal Ridge is a prominent structural and bathymetric feature separating the deep-water Tano Basin from the East Atlantic abyssal plain. As to its origin, traditionally, ridge development was subdivided into four major periods of structural evolution. These periods are a) early rifting and shearing of the southern border along the Romanche Fracture Zone during the Albo-Aptian, b) end of rifting and intracontinental transform faulting during the Late Albian, c) continent to ocean transform faulting from the Cenomanian until the Late Cretaceous(?) and d) passive margin evolution since the Late Cretaceous.

A different look on the existing data along strike, however, suggests a more specific structural scenario that has important implications for the exploration potential of the basin. Whereas the internal structure of the Marginal Ridge is very poorly imaged on the regional

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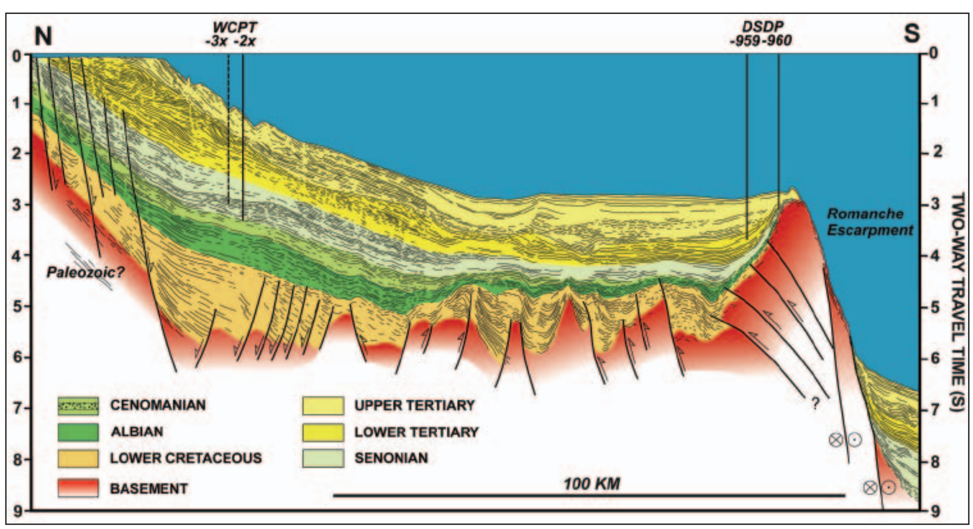

Figure 2. Line drawing interpretation of a composite regional seismic transect; for location see Fig. 1.

seismic transect, a reprocessed subregional seismic section some 50 km to the east reveals the nature of this significant feature (Fig. 3). Both the reprocessed and new 2D seismic data clearly image a large landward-verging overthrust system in the Cape Three Points Deep area.

On closer inspection (see inset), the seismic reflectors associated with the individual thrust imbrications within this "nappe" were attributed to southward-prograding sediments by previous interpretations. However, the internal geometry of the allochthonous nappe system is identical to that observed at the leading edge of classic fold belts.

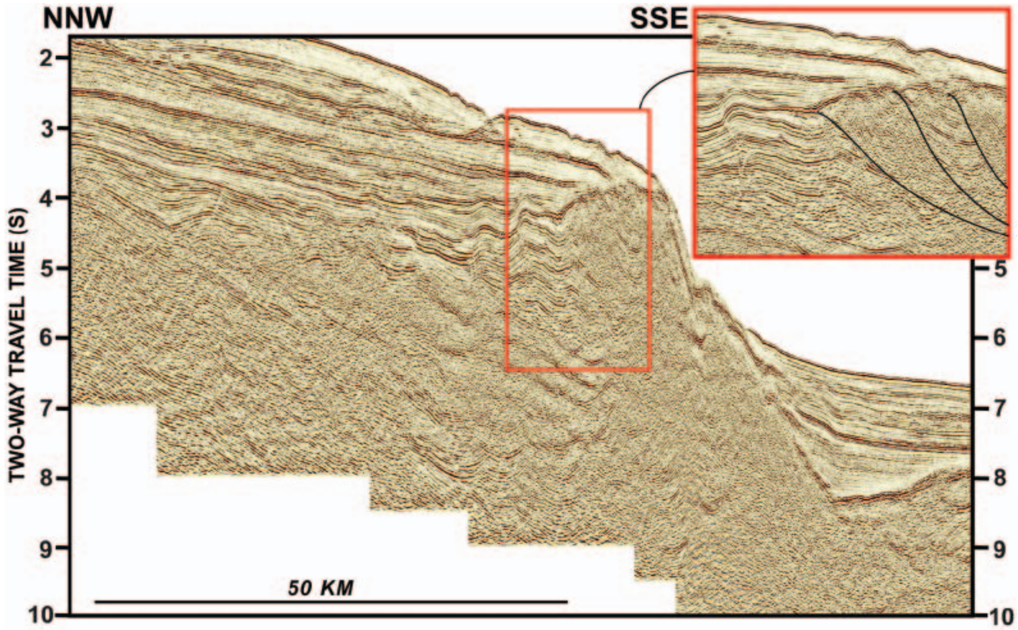

Figure 3. Subregional seismic transect across the Marginal Ridge of Ghana; for location see Fig. 1. This reprocessed 2D seismic profile shows the reflection geometry north of the Romanche Escarpment. Packages of south-dipping reflectors were previously interpreted as prograding clinoforms; however, closer inspection reveals the presence of imbricates in a north-vergent overthrust system.

Other evidence for compressional deformation is provided by the series of inverted syn-rift half-grabens and a well-developed "foredeep basin" that formed due to the load of the incoming fold belt. The map-view isopach of this sedimentary sequence shows a triangular basin with a maximum thickness of more than 4,000 m just in front of the north-verging nappe system. Note that the regional transect shown in Fig. 2 runs at the perimeter of the foredeep basin, and therefore it fails to document the foredeep basin as the key to understanding the Marginal Ridge.

The exploration history of the onshore Tano Basin began with initial drilling in the late 1890s immediately adjacent to the extensive oil seepages in both Ghana and eastern Côte d'Ivoire. By the l970s exploration efforts had moved to the offshore shelf, resulting in a number of oil and gas discoveries in Lower Cretaceous reservoirs charged from lacustrine and deltaic syn-rift as well as earliest marine source rocks. More recent drilling has occurred at and beyond the shelf break and has resulted in oil discoveries in Senonian reservoirs charged from Turonian-Cenomanian marine source rocks, a situation analogous to many discoveries made in Côte d'Ivoire.

Therefore, the traditional play types of the Tano Basin include syn-rift Albian fault blocks with en échelon map-view geometry and Senonian fan complexes beneath the present-day slope (Fig. 4). The Albian syn-rift fault blocks can be traced from the shelf area into the deep-water along subregional hinge zones. The Senonian fan complexes cover a fairly large area in the center of the Tano Basin.

Recently acquired 2D and 3D seismic data reveal unexpected new play types associated with the unusual structural evolution of the Marginal Ridge of Côte d'Ivoire and Ghana (Fig. 4). Because the structural geometries are analogous to those found in classic fold belts and foredeep basins, the same play types can be defined, such as transpressional en échelon anticlines, stratigraphic updip pinch-outs within the foredeep basin and sub-thrust traps beneath the north-verging nappe system. The Cape Three Points Deep area provides the very first case for this set of play types in the hydrocarbon exploration history of offshore Africa. ■

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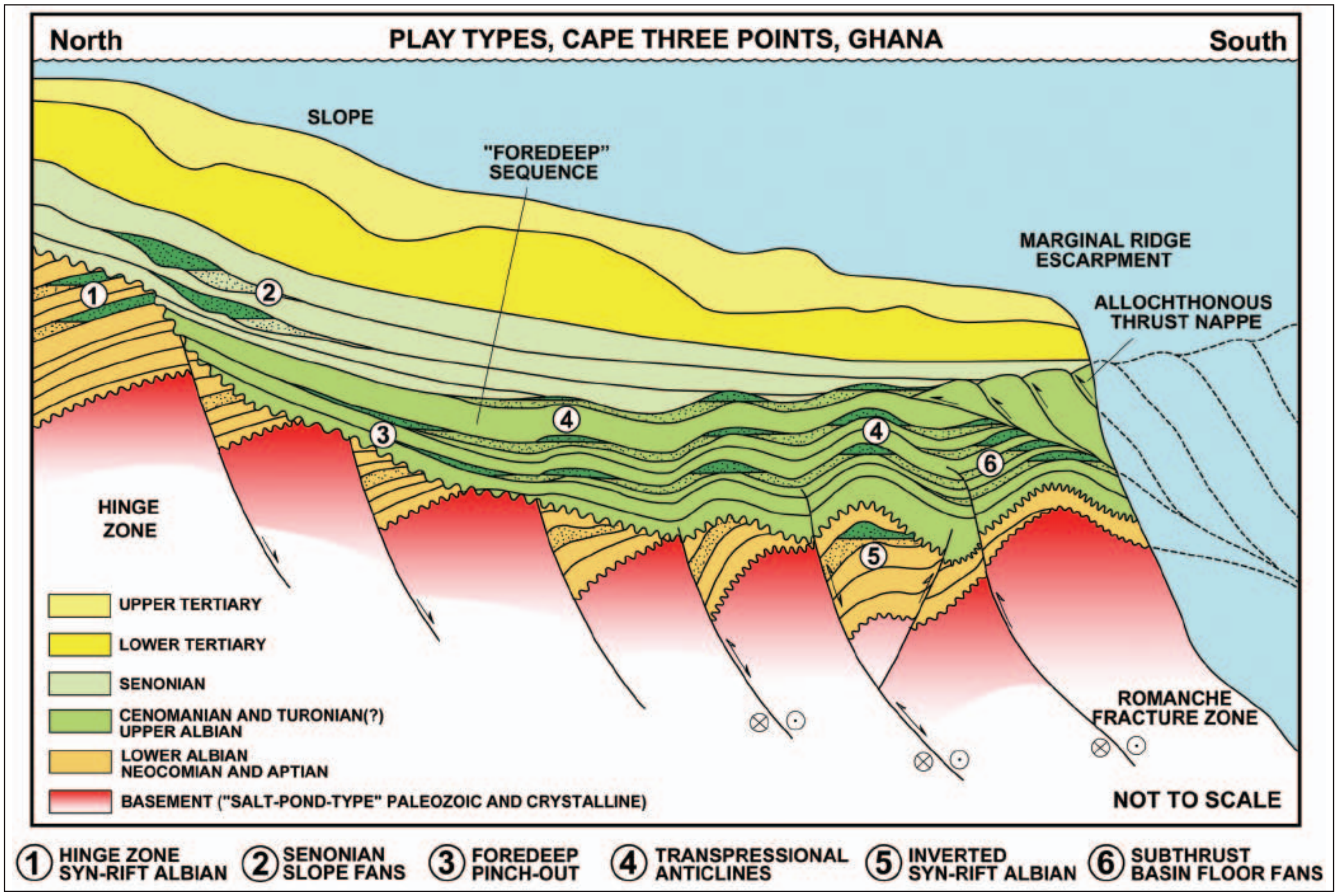

Figure 4. Summary of traditional and new play types in the Cape Three Points segment of the Tano Basin, Ghana.

Biographical Sketch

Dr. Gabor C. Tari holds Masters degrees in geophysics and in geology from Eötvös University of Budapest, Hungary. He graduated from Rice University with a PhD in geology and geophysics in 1994. After working for Amoco on several exploration projects focusing on the Romanian Carpathians and the Moesian Platform, he transferred to the Amoco Angola Team in 1996. At first he did regional evaluations for several Angolan bid-rounds, but later joined the Block 18 project, where several discoveries have since been made. Following the merger between BP and Amoco, he continued to work for the new organization.

Gabor joined Vanco Energy Company in 1999 and currently, he is Vice President of Geosciences working on several projects offshore Morocco, Ivory Coast, Ghana, Equatorial Guinea, Gabon and Madagascar. Gabor is also an Adjunct Professor at the Department of Geology and Geophysics at Rice University in Houston, teaching seismic reflection interpretation to undergraduate and graduate students.