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by *Cathy L. Farmer and Edward R. Shaw*
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Red Mango and Iron Horse Discoveries— Columbus Basin, Trinidad

The Columbus Basin of Trinidad is one of the largest emerging gas provinces in the western hemisphere. Major Trinidadian gas fields operated by bpTT include Immortelle (1967), Cassia (1983), Mahogany (1994), Flamboyant (1994), Amherstia (1995), Corallita (1996), and Kapok (1997–98). Two recent gas discoveries—Red Mango (2000) and Iron Horse (2003)—add substantial resources (Figure 1).

The Red Mango discovery represents the classic trap type for offshore Trinidad with multiple, stacked reservoir horizons extending across several separate fault blocks. The trap is a rollover anticline formed on the downthrown side of a large listric normal fault. The anticlinal crest is collapsed by a series of synthetic and antithetic normal faults. Gas-water contacts may be common across fault blocks depending on fault juxtaposition and fault-sealing capability. The Red Mango well has eight stacked pay horizons with over 900 feet of net pay. The gas pay is

distributed in five separate fault blocks ranging in depth from 6000 to 14000 ft below sea level. Pliocene reservoir sands are 100 to 400 ft thick with porosities ranging from 20% to 31% and net to gross ratios ranging from 43% to 95%.

The Iron Horse discovery is deeper and older than most of the Red Mango reservoir sands and represents a new play type for Trinidad. The single-level reservoir is aerially extensive and lacks the structural complexity of Red Mango. The trap is a large, tilted fault block bounded by major normal faults to the west and east. The southern updip portion of the trap is bounded by a minor cross fault that appears to have sealing capacity due to a pressure regression in the reservoir sand. The trap may also have an updip, stratigraphic component. Based on structural closure, the gas column height for Iron Horse is believed to be at least 1700 ft, extending from 11300 ft to 13000 ft TVDSS. At the well, the Pliocene age reservoir sand is approximately 300 ft thick with

an average porosity of 19% and an average net-to-gross ratio of 77%.

Recent discoveries in Trinidad resulted from multiple, extensive 3D seismic surveys that image complex, faulted, and stacked reservoirs. Conformance of bright amplitude anomalies to structural closure and “flat spot” detection are key techniques for mapping gas reservoirs. Flat spots in the thicker horizons correspond to fluid contacts.

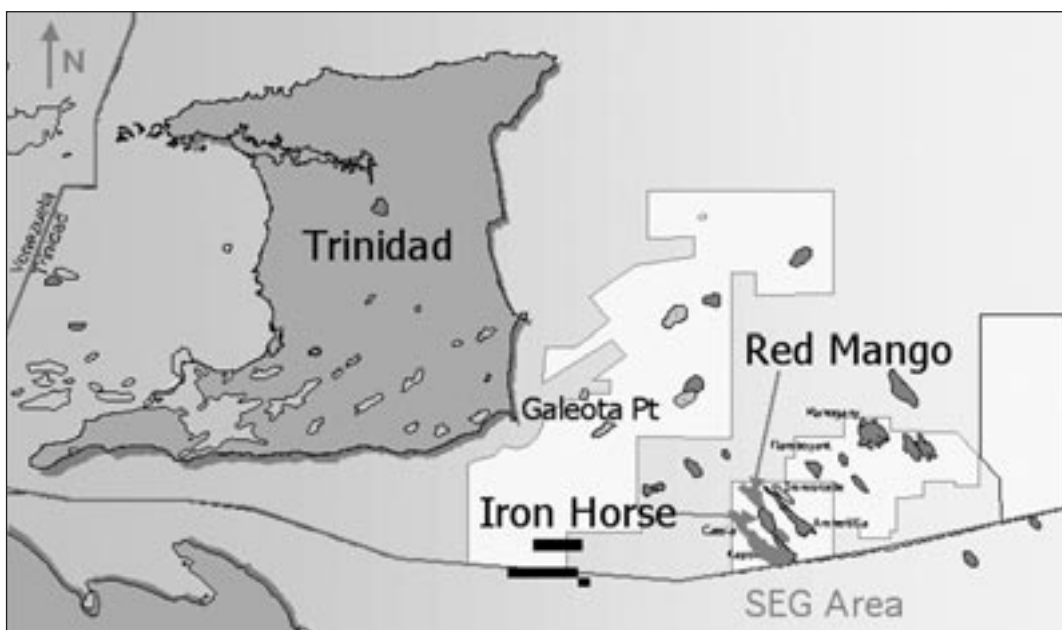


Figure 1 - Location of the Red Mango and Iron Horse discoveries, southeast Galeota area, offshore Trinidad.

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Excellent seismic resolution of reservoir horizons allowed for a relatively high pre-drill chance of success for both Red Mango (90%) and Iron Horse (80%). Continued exploration is planned by bpTT to expand the natural gas resource base for Trinidad and Tobago. ■

Biographical Sketches

CATHY L. FARMER (speaker) was the lead geologist responsible for bpTT's Red Mango gas discovery and worked on the initial play concept for the Iron Horse discovery. She is currently Chief Geologist for bp Venezuela. With twenty-five years' experience in the oil and gas industry, her career has focused on worldwide exploration in locations such as Venezuela, Trinidad, Norway, West Africa, and the Middle East. Before Trinidad, she spent six years as an expatriate in Stavanger, Norway, where she worked on Valhall Field and explored the Norwegian sector of the North Sea. She began her career with Amoco in Denver



working the Montana-Wyoming thrust belt, California's San Joaquin Basin, and Alaska's North Slope. Cathy is a graduate of Colorado School of Mines with a BS in geological engineering and an MS in geology.

EDWARD R. SHAW is a geophysicist with BP where he has gained experience in various exploration roles, working more than 15 countries over the last 35 years. He is currently a project leader for BP's shelf team for offshore Trinidad. He was lead geophysicist for four large discoveries in Trinidad: Iron Horse, Red Mango, Immortelle Deep, and Parang. He is also known in the industry for his lead role in the discovery of BP's (formerly Amoco's) giant Liuhua Field in China during the 1980s. Ed is a graduate of Michigan State University with a BS in physics and the University of Houston with an MS in geophysics. He has been a leader in BP/Amoco's recruiting efforts for 25 years.

