Evolving Models for Eocene Deepwater Channel Complexes and Fan Systems, Scotland District, Barbados

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EXTENDED ABSTRACT

A geologic field study of outcrops on the island of Barbados was conducted by an Exxon research team including this author in late 1994. Deepwater sandstones were described to compliment the company's worldwide exploration, production, and reservoir modeling portfolio. Easily accessible exposures of Eocene deep marine clastic sediments, oil production on the island, and the complex geologic origin of Barbados distinguish it from the nearby volcanic islands in the southern Caribbean Sea. This 166 sq. mi island exists because of an emerging accretionary prism of flysch sediments, presumably shed from South America, now positioned in the Atlantic Ocean above the subduction zone of the convergent Atlantic and Caribbean oceanic plates. To the west, the Windward Islands of the eastern Caribbean Sea form an island arc corresponding to the trace of the subducted Atlantic plate.

Within the Scotland District of Barbados, which is located along the central Atlantic coast, several spectacular turbidite outcrops provide windows into the reservoir-quality facies of submarine fans. Sandstone outcrops at Ragged Point, Chalky Mount, Windy Hill, and Green Hill represent contrasting transects through the submarine fan system. The ranges and juxtaposition of grain size, bedding thickness, and stacking pattern of Bouma-classified turbidites aid in assessing the relative position of each outcrop within a generalized fan model. Steeply dipping and overturned beds, thrust faulting, and shale diapirs confound the direct correlation of outcrops as a singular fan but attest to the composition and complexity of the accretionary prism.

Pleistocene and younger carbonate reef complexes have repeatedly and episodically formed atop the emerging Barbados prism creating broad limestone terraces and freshwater aquifers vital to the island. Mud volcanoes and imbricated thrust nappes in the clastic prism support the oldest limestone terrace and form the highest (300+ m) elevations of the island. Extensive karst geomorphology, including networks of caves, sinkholes, and collapse gullies, are common to the uplifted limestone terrains. Oil exploration efforts in the waters around Barbados have brought the long-studied Scotland District turbidite outcrops more recent attention.

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A 2009 field investigation was conducted by this author to the island in order to: revisit key Scotland District outcrops; reconsider earlier interpretations; assess the quality of the exposures for further study; and to catalogue photographically these outcrops and the other interesting geomorphologic features on the Island. In 2009, an alternative interpretation for the same series of outcrops was authored by Nysha Chaderton in her doctoral dissertation from the University of Texas. Figure 1 illustrates the contrast between the author's 1994 (published in Larue et al., 1995) and Chaderton's (2009) interpretations, owing to research perspective and experiences. This comparison provides enlightening insight to the limitations of data, observation, correlation, and advancements in the understanding of deepwater systems.

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