



Research paper

## Impact of strong easterly trade winds on carbonate petroleum exploration - Relationships developed from Caicos Platform, southeastern Bahamas

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### ARTICLE INFO

#### Article history:

Received 18 January 2017

Received in revised form

13 April 2017

Accepted 15 April 2017

Available online 18 April 2017

#### Keywords:

Petroleum exploration

Caicos Platform

Trade winds

Carbonate models

Carbonate sedimentation

Carbonate plays

Carbonate reservoirs

### ABSTRACT

Brisk, persistent easterly trade wind influences define Holocene patterns of carbonate sedimentation across the Caicos Platform (southeastern Bahamas). Resultant predictive sedimentary facies models based on trade wind influences are more widely applicable to the exploration for subsurface carbonate plays than are existing models based on the northern Bahamas facies patterns, which are characterized by gentle trade winds and strong platform-margin-related oceanic processes (swells and tidal currents). The Caicos Platform relationships may be more applicable because many ancient shallow carbonate depositional environments were within the trade wind belts and commonly within broad intracratonic seas that were little influenced by oceanic processes.

The grainstone-dominated Caicos Platform exhibits reservoir potential over much of its surface, in contrast to northern Bahamian platforms, where oceanic tidal currents or swells and gentle easterly trade winds confine higher energy environments with reservoir potential to platform margins. Strong easterly trade winds across Caicos Platform promote widespread Holocene platform-interior oolitic, skeletal and grapestone grainstone bodies on this platform. Orientations of ooid sand bodies vary depending on preexisting topography, water depth and bottom energy. Shallow subtidal ooid sand shoals orient parallel to these winds. Ooid sands developed along older shorelines orient parallel to the shorelines but prograde perpendicular into these winds. Deeper platform-interior oolitic sands exist as widespread, sheet-like deposits. These trade winds allow reefs and ooids to coexist in many settings, permit isolated linear reefs to flourish on certain leeward platform margins, and promote effective off-bank transport of carbonate sands that create onlapping grainstone wedges. These relationships are very applicable to the rock record.

Strong trade wind influences, such as seen on Caicos Platform, better explain the occurrence of Cretaceous reef and/or oolitic grainstone reservoirs developed well in from platform margins (Fairway Field in East Texas; Black Lake Field in Louisiana) than do existing northern Bahamian models. Depositional models based on conditions in the northern Bahamian models would predict low-energy facies in these platform-interior settings. A trade-wind-driven depositional model, characterized by strong persistent easterlies, also better explains the origin of the onlapping wedge of skeletal grainstones at Poza Rica oilfield in Mexico.

The Caicos Platform easterly trade-wind-driven depositional model should generally apply to any ancient shallow carbonate environment that developed 5–22° north or south of the paleoequator, whether or not a platform margin was near by. Future carbonate exploration or exploitation should always factor in not only geological age, but also physiographic, latitudinal and climatic setting at a global and local scale.

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