Constraints on Gulf of Mexico Oxfordian Acme 161 to Valanginian Acme 138 Source Rock UEP Imposed by Basin Margin Onlap/Erosion and Basin Center Oceanic Crust Age

Nawaz Bugti[1], Andrew Pepper[2], and Ted Godo[3]

[1]University of Houston, Houston, Texas
[2]This !s Petroleum Systems, Fredericksberg, Texas
[3]Geodog Exploration, Huntsville, Texas

Abstract

The proximal limits of marine source rock distribution on basin margins are readily appreciated due to transgressive limits of coastal onlap or later basin-margin uplift and erosion. Drilling has established the distribution and proximal source rock limits in the Gulf of Mexico: in the East Texas and Mississippi Salt Basins, in the offshore eastern U.S. Gulf of Mexico, and in the Tampico-Misantla Basin of Mexico, for example.

However, in basins where stretching has resulted in ocean crust formation, source rock distribution may also be limited in a basin-ward direction by onlap to coeval oceanic crust.

We examine both limits in the Gulf of Mexico, which provides an unusual opportunity to study the onlap of source rock depositional acmes 161 (Callovian-Oxfordian) through 138 (Valanginian) in a highly prolific deepwater petroleum system. Using the crustal isochron maps of Pindell we group and map the distribution of intervals: (1) acmes 161 and 157 (Oxfordian); (2) Acme 153 (Kimmeridgian); (3) acmes 148 (Tithonian) and 144 (Berriasian); (4) Acme 138 (Valanginian). Acmes 161 through 144 onlap progressively onto oceanic crust of the same age, while Acme 138 importantly postdates the cessation of spreading caused by the collision of Yucatan and Central America. UEP or ultimate expellable potential represents the maximum theoretical expellable petroleum yield from in interval of source rock in mmboe/km^2. It can be further divided into an oil potential UEO (mmb/km^2) and a gas potential UEG (mmboe/km^2). UEP (UEO, UEG) is calculated for each sample of assigned thickness within a source bed. The result is a source bed UEP log on which peaks of expulsion potential - called acmes - can be defined. The UEP of layers within each acme can be summed to define the UEP (UEO, UEG) of each acme.

Using a deepwater reference well with defined acme UEP intervals at Sturgis, we mapped the relative and absolute diminution of UEP onto J. Pindell's oceanic crust age panels: this area of onlap underlies current areas of production and exploration in the deep water Gulf of Mexico inboard and outboard of the Sigsbee Escarpment. Transfer zones can juxtapose panels with very different age and UEP, thus influencing the expellable volumes in otherwise seemingly similar adjacent prospect fetch areas; and in some cases determining areas where Oxfordian oil cannot be sourced. We complete these preliminary maps in basin margin areas at the zero edge of each of the four composited acme intervals, as best can be defined from published studies.