

Understanding the Origin of Widespread Direct Hydrocarbon Indicators in the Deep-Water Colombia Basin, Western Caribbean Sea

Luis Carlos Carvajal-Arenas, Lucia Torrado

AGI Exploration

9.29.2020 - 10.1.2020 - AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Bright spots, flat spots, polarity reversals, AVO anomalies, bottom-simulating reflectors, and gas chimneys have been observed in previous seismic interpretations throughout the Colombia Basin. These observations suggested that a large, poorly defined petroleum system could be present in the deep-water Colombia Basin. This study correlated deep-source-rock intervals of Cretaceous age with Mio-Pliocene intervals displaying direct hydrocarbon indicators (DHI). The dataset consists of 1) a 230 km-long regional 2D seismic line; and 2) new Rock-Eval analyzes of Cretaceous intervals sampled from the DSDP well sites 153, 151, and 146 which were 1D/2D thermal modeled to better understand the origin of direct hydrocarbon indicators identified in the deeper Colombia Basin. Seismic data shows a) sediment wedging from DSDP-153 well site towards the Colombia Basin suggesting further potential occurrences of thicker, and richer Cretaceous source rocks to be present in deeper areas of the Colombia Basin; b) a slow rate of sedimentation occurs in the Colombia Basin during Cretaceous to Eocene times while a thick succession of clastic sediments derived from the Magdalena River are deposited since Oligocene times; c) gas chimneys fed by Cretaceous intervals connect to Mio-Pliocene Magdalena Fan sands displaying bright spots, flat spots conformable with low-relief anticline structures, and d) a regional bottom simulating reflector (BSR) affecting Pliocene intervals. Rock-Eval analyzes show intervals of immature source rocks of Turonian to Santonian age in

DSDP sites 153 (10 m thick), 151 (9 m thick), and 146 (13 m thick). Organic-rich intervals contain a) kerogen type II and type III with minor traces of type I; b) an average TOC of 2.9% with a maximum TOC of 11.4%; c) an average HI of 241; and d) an average OI of 124. Although source rocks intervals found in DSDP wells are immature, 1D/2D thermal modeling suggests that mature intervals of Cretaceous source rocks are present in deeper areas of the Colombia Basin, having an onset of oil generation during the Late Miocene, and correlating with DHIs observations within a Cretaceous/Mio-Pliocene petroleum system present in the Colombia Basin.