Effects of Oceanic Anoxic Event-Associated Processes on the Potential of the La Luna Formation (Colombia) as a Liquid-Rich Unconventional Play

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Abstract

Deposition of organic-rich rocks paired with C-isotope excursions (δ^{13}CTOC) from several Mesozoic sections around the world are consistent with widespread but short-lived oceanic anoxia. These episodes, known as oceanic anoxic events (OAEs) played an important role in the deposition of source rocks. Oceanic anoxia is considered the main driver in the burial and preservation of organic matter leading to the deposition of black shales. The La Luna Formation in Colombia (deposited 94 Ma, during the event known as Oceanic Anoxic Event 2-OAE2) is well known for having high total organic carbon quantities (TOC), dominant kerogen types I and II, and organic matter rich in sulfur. However, how these three main features (i.e., quantity of organic matter, type of organic matter, and organic sulfur content) varied secularly throughout the deposition of La Luna, and how they will affect its potential to generate hydrocarbons is still a matter of heated debate. Here, we attempt to understand: 1) how euxinic versus suboxic conditions triggered an increase in TOC; 2) how organic richness and TOC-associated sulfur (S_{org}) will affect kerogen conversion kinetics (and ultimately hydrocarbon production from TOC), upon exposure to thermal stress. The present paper attempts to address these questions using a combination of sulfur speciation of the bulk organic matter (via Advanced Rock-Eval pyrolysis methods & organic petrology) and trace-element geochemistry (concentrations of redox sensitive trace elements and Fe-speciation). Initial results show that the organic sulfur fraction associated

with residual TOC is larger and plays a bigger role in hydrocarbon generation and sourness than previously thought. The results here presented have implications for the risk assessment of conventional and unconventional plays by improving the uncertainty associated with the real potential of La Luna Formation to produce hydrocarbons.