Estimating Overburden Erosion in Southwest Texas Using Production Data from the Eagle Ford Shale

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ABSTRACT

Substantial erosion during the Tertiary has led to shallower production depths for oil and gas from the Upper Cretaceous Eagle Ford Shale in southwest Texas. Datasets that cover the play area, including production-related (cumulative gas-oil ratios [GORs]) and product property data (gas gravity), have been used to estimate original burial depths. Cumulative distributions of these properties provide information on the range of values where each is particularly sensitive or insensitive to increasing thermal stress and depth of burial. The relationship between GOR and gas gravity also provided insights into the relative sensitivity of these parameters with thermal maturity. Adjusting current to original burial depths required development of idealized GOR and gas gravity curves as a function of depth. Temperature data for the bottom of the Eagle Ford Shale was also used to test the depth adjustments. Our estimates of original depth are consistent with previously published overburden erosion maps. It must be noted that these estimates are predicated on two key assumptions: (1) that limited migration in the Eagle Ford means that product properties and distributions reflect the thermal stress conditions at the original burial depth; and (2) that post-erosion thermal equilibration has been minimal and that current well temperatures recorded at the base of the Eagle Ford are indicative of the original burial depth. The spread in depths observed for wells with particular gas gravity or GOR values indicates that some migration has occurred or that these properties differ somewhat due to source rock variability laterally and with depth. This limits the resolution of the estimates of erosion. However, the large number of available datapoints (~5000 GOR and gas gravity values; ~4000 temperatures) spread across the play area provides a robust dataset for the examination of this issue beyond what is possible in most other studies of this kind.

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