Composition of Produced Gas and Mud Gas Samples from Greater Sabine Bossier and Haynesville Gas-Shale Reservoirs, Northern Louisiana USA

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Gas-bearing shales in the Upper Jurassic Bossier and Haynesville Formations in the Greater Sabine area (northwestern Louisiana and northeastern Texas) are being evaluated to determine their commercial potential. The molecular and C isotopic composition of mud gas samples collected using Isotubes and natural gas samples obtained at separators were studied to evaluate the origin of gas in different intervals, and to assess the utility of using hydrocarbon fingerprinting technology to allocate commingled gas production. The very dry nature of produced gas samples (C_1/C_2~950-2100), and the C isotopic composition of methane ($\delta^{13}C$ ~ -31.5 to -34.5 per mil; PDB) and ethane indicate the natural gas was generated by highly mature source rocks (VR >2.0). The C isotopic composition of CO_2 ($\delta^{13}C$ ~ +1.0 to +3.0 per mil; PDB) indicates this non-HC gas was generated during diagenetic reactions involving carbonate minerals. Systematic changes in the composition of gas samples produced from Bossier and Haynesville sub-layers across the study area demonstrate that the maturity of the kerogen in each interval largely controls gas wetness and the C isotopic composition of methane and ethane in that zone: i.e., the shales are compartmentalized vertically. Subtle differences in the molecular and C isotopic composition of the natural gas in different zones in the same well can be used to help detect and potentially allocate gas contributions from different layers. The molecular composition of mud gas samples obtained from numerous wells indicates that natural gas retained by two richer source-rock intervals (i.e., Haynesville/basal Bossier; middle Bossier) is significantly drier than the natural gas in poor to marginal source rocks that occur in the upper Bossier and lower Bossier intervals. In several wells the C isotopic composition of methane in mud gas samples from richer source-rock intervals is significantly different than the isotopic composition of methane obtained from adjacent leaner shales. Because these differences cannot be explained as thermal maturity effects, they probably reflect differences in the type of kerogen in richer and leaner source rock intervals. Finally, the composition of mud gas samples obtained from overlying Knowles and Cotton Valley intervals indicates they contain natural gas expelled by richer Haynesville and/or Bossier source rocks.