Characterization of Source Rocks in the Greater Sabine Bossier and Haynesville Formations, Northern Louisiana USA

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The commercial potential of gas-shale beds in the Upper Jurassic Bossier and Haynesville Formations is being intensely evaluated in the Greater Sabine area (northwestern Louisiana and northeastern Texas). Gas shale reservoirs are inferred to be self-sourced by natural gas generated from indigenous kerogen and subsequently retained in matrix porosity or adsorbed on organic matter. We have characterized Haynesville and Bossier source-rock intervals by determining the organic richness, kerogen type, and thermal maturity of shale lithofacies using cuttings and conventional cores obtained from 11 wells. The Haynesville/basal Bossier source rock contains ~1.5-5.0 wt% TOC; a second interval in the middle Bossier also has elevated TOC. The upper Bossier and lower Bossier, in contrast, generally are much leaner (<1.5 wt% TOC). It is difficult to determine with confidence what kind of kerogen Haynesville and Bossier shales originally contained because both intervals have reached a high level of thermal maturity (VR ~ 2.0-2.8) in the study area. Visual kerogen analysis demonstrates that non-fluorescent amorphous organic matter of indeterminate origin dominates the residual kerogen in both formations. However, inertinite and gas-prone vitrinite are more abundant in lean Bossier intervals compared to middle Bossier or Haynesville/basal Bossier intervals. We infer the two more organic-rich zones originally contained mixed oil- and gas-prone kerogen, while lean Bossier shales contained proportionately more gas-prone or inert kerogen. We estimate that the restored average richness of the Haynesville/basal Bossier source-rock interval ranged from ~3-7 wt% TOC across the study area. The two richer shale intervals probably generated more natural gas than their intrinsic gas storage capacity. The excess gas probably migrated into conventional reservoirs overlying the Jurassic shales: e.g., Cotton Valley sandstone.