Inferred Depositional Environments of Bossier-Haynesville Black Shales in the Greater Sabine Area, Northwestern Louisiana

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Integrated studies of the Upper Jurassic Bossier-Haynesville black shale sequence of NW Louisiana suggest a gradual change in depositional environment over ~15Ma. The lower Haynesville transitions upward from a shallow, anoxic to euxinic, sediment starved shelf environment to a deeper, more oxygen-enriched, shallow marine sag basin in the overlying Bossier. Input data considered include inorganic elemental analysis (chemostratigraphy), XRF, XRD, petrography, and the biostratigraphic classification of species, diversity, and count of macro, micro, and nanofossils.

Both biostratigraphy and chemostratigraphy support continuous Haynesville deposition without significant local thickness variations. Sections of the overlying Bossier thin significantly down dip with distance from a northern terrestrial sediment source. The study area within the Greater Sabine region is large enough to map broad chemical and biological sequences constrained within the window of the overall Bossier-Haynesville transgression, yet small enough to capture subtle mineralogical variations within the section. Such variations are attributed in part to local fluctuations in sea level that may be related to the position of the Sabine and Mount Enterprise basement highs during the onset of Haynesville deposition. The highs influenced sediment distribution by shielding areas between and around the paleo-structures from significant clay deposition. The Haynesville in the study area is predominately an argillaceous to calcareous silty mudstone. The overlying Bossier, less affected by the paleo-highs, exhibits a larger, more diverse clay distribution, including significant illite.

Burrowing in the lower Haynesville suggests some biological productivity persisted during this extremely anoxic time. Redox indicators reflecting geochemical signatures at the sediment-seawater interface distinguish the Haynesville from the overlying Bossier. Th/U ratios (<2.5) representing Haynesville anoxia gradually increase up section, reaching values closer to 4 in the upper Bossier in the study area. These values suggest a gradual increase in water depth, circulation, and biological productivity and also reveal subtle transgressive and regressive sequences marked by local flooding surfaces traceable throughout Bossier deposition.