

RECOGNITION OF DEPOSITIONAL ENVIRONMENTS USING PROGRAMMED PYROLYSIS

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ABSTRACT

Programmed pyrolysis of mudstone provides a rapid and effective technique to recognize nearshore environments of deposition in the subsurface. Ninety-three mudstone samples from four downdip Sparta Formation wells in south-central Louisiana were analyzed using a Rock-Eval pyrolysis analyzer with TOC module. Detailed conventional core analysis demonstrates that the Sparta Formation in the study area represents a prograding barrier island complex consisting of reservoir-quality shoreface, storm washover, and tidal-inlet sandstone (Lemoine et al., 1988). Sandstone units overlie open-marine mudstone and are capped by lagoonal mudstone. Mudstone of both facies is characteristically dark brown to black, laminated and organic rich. However, pyrolysis results reveal geochemical contrasts which can be used to distinguish between the marine mudstone facies and the lagoonal mudstone facies. Total Organic Carbon (TOC) (Fig. 1) and Hydrogen Index (with Oxygen Index, Fig. 2) were found

to be the most useful parameters for distinguishing depositional environments. Lagoonal mudstone has TOC values averaging 1.37% and Hydrogen Indices averaging 160. In contrast, offshore marine mudstone has much higher TOC values which average 2.61% and a dramatically higher average Hydrogen Index of 341. Average T_{max} of mudstone from both facies is 431°C and $S_1/(S_1+S_2)$ ratios average 0.096, showing that the Sparta Formation is marginally mature in the study area. Thermal maturity differences cannot be invoked to explain the observed geochemical differences between environments. The clear contrast of organic geochemical parameters is interpreted to reflect dissimilarity in kerogen types and in modes of preservation between mudstone facies. Lagoonal mudstone contains mostly terrestrial kerogen whereas more oil-prone kerogen predominates in marine mudstone.

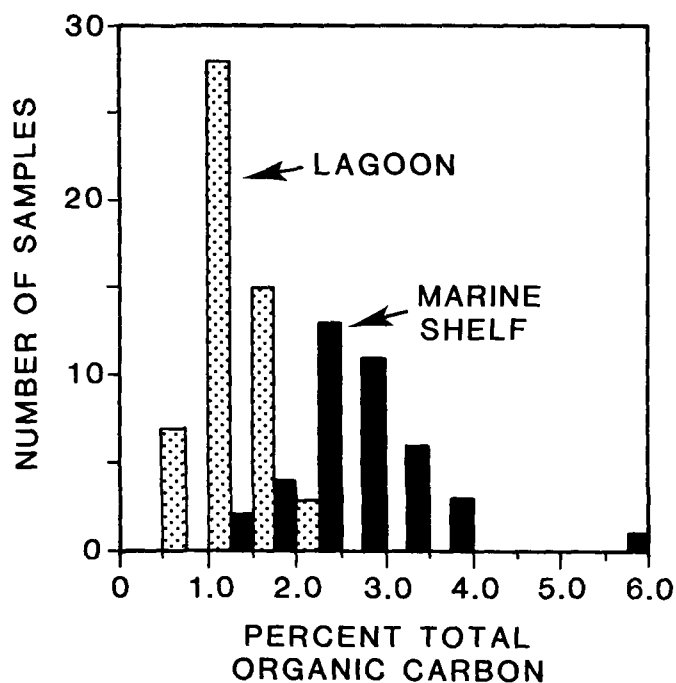


FIGURE 1: TOC histogram for 93 Sparta Formation mudstones associated with barrier island sand facies.

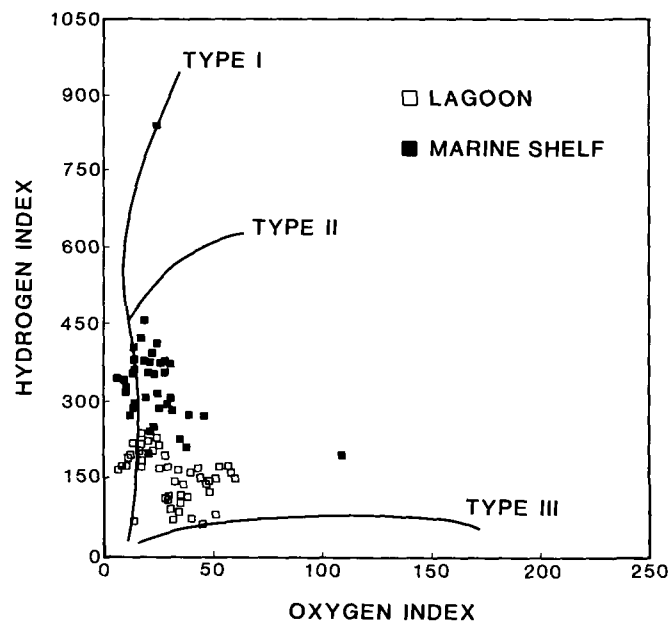


FIGURE 2: HI/OI diagram for 93 Sparta Formation mudstone samples.

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