

Organic Facies in Petroleum Systems Analysis: A Neglected Component with Profound Implication to Conventional and Unconventional Play Economics

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ABSTRACT

Volumes have been written that describe source rock distribution within a sequence stratigraphic framework. These studies have identified key controls on organic richness and source quality as an interplay of primary productivity (terrestrial vs. aquatic), preservation, and sedimentation rate in lacustrine / swamp, marginal marine, and marine (clastic and carbonate) systems. While full blown sequence stratigraphic studies are relatively rare (data availability, cost, etc.), experienced personnel can extract key variables from existing geologic / geochemical studies to integrate into the petroleum system analysis. Some of the most important examples include the position of effective source rock to migration conduits, organic facies assignment for the generated oils, and understanding the molecular methods of thermal stress. Practical application of these seemingly academic themes include expulsion efficiency, top seal integrity, preferential expulsion direction, hydrocarbon retention, in-situ vs. migrated hydrocarbons, quantification of migration vectors (distance and direction), and differential thermal stress (separation of imprint imposed by kerogen kinetics vs. expulsion). Practical examples are used to illustrate the concepts from Greater Rocky Mountain petroleum systems. Volumes have been written that describe source rock distribution within a sequence stratigraphic framework. These studies have identified key controls on organic richness and source quality as an interplay of primary productivity (terrestrial vs. aquatic), preservation, and sedimentation rate in lacustrine / swamp, marginal marine, and marine (clastic and carbonate) systems. While full blown sequence stratigraphic studies are relatively rare (data availability, cost, etc.), experienced personnel can extract key variables from existing geologic / geochemical studies to integrate into the petroleum system analysis. Some of the most important examples include the position of effective source rock to migration conduits, organic facies assignment for the generated oils, and understanding the molecular methods of thermal stress. Practical application of these seemingly academic themes include expulsion efficiency, top seal integrity, preferential expulsion direction, hydrocarbon retention, in-situ vs. migrated hydrocarbons, quantification of migration vectors (distance and direction), and differential thermal stress (separation of imprint imposed by kerogen kinetics vs. expulsion). Practical examples are used to illustrate the concepts from Greater Rocky Mountain petroleum systems.