

## **Aromatic Compounds as Maturity Indicators and Correlation Markers – Example from New Albany Shale Extracts and Oils, Illinois Basin**

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### **ABSTRACT**

Aromatic compounds such as alkylbenzenes, naphthalenes, phenanthrenes, and dibenzothiophenes are useful as maturity indicators in basin analysis. They are resistant to biodegradation, can span a wide range of thermal maturities, and under elevated temperatures, can still be identified and analyzed. These indicators respond to an increase in thermal stress with a predictable alkylation progression of a given parent compound or a shift in the isomer distribution of alkyl-aromatic homologues towards thermally more stable isomers. Numerous studies on the maturity trends of the New Albany Shale within the Illinois Basin have utilized vitrinite reflectance (Ro) measurements, Tmax (temperature at which the maximum rate of hydrocarbon generation occurs during pyrolysis of a kerogen sample) data, and conodont analysis. Interpretation of maturity trends determined from this data can be problematic due to vitrinite suppression, measurements derived from bitumen reflectance (vs Ro), paleogeotherm control on vitrinite reflectance, and differing laboratory protocols in geochemical analyses. Sweeny and Burnham (1990) developed a model for vitrinite maturation that integrates chemical kinetic equations over time and temperature to account for the elimination of water, carbon dioxide, methane, and bitumen from vitrinite. Using the EASY %Ro method, calculated Ro can be determined for specific time/temperature conditions and constrained using aromatic compounds such as methylphenanthrenes and triaromatic steroids. These correlations provide an alternative method for mapping thermal maturity across basins with complex burial histories. Source rock extracts from the New Albany shale were analyzed from various depths across the Illinois basin using gas chromatography-mass spectrometry (GCMS) to calculate specific aromatic compound concentrations. These data were plotted against calculated and measured Ro values. Problematic zones of suppressed vitrinite were identified along with indications of higher maturity (than previously interpreted) trends within the New Albany shale. Maturity indices calculated within the New Albany shale in central and eastern Illinois are elevated relative to Ro determination from reflectance measurements. Utilization of aromatic maturity markers (when calibrated appropriately) provide an invaluable measure of thermal maturity in basins with complex burial histories that may cause other methods to be problematic.