# THE EFFECT OF LITHOLOGY ON SOURCE ROCK PROPERTIES AND COMPOSITION OF EXPELLED PETROLEUM

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It is widely recognized that petroleum is a complex mixture of hydrocarbons and non-hydrocarbons generated and expelled from a source rock section. Source rocks can have significant spatial variability in lithology, and quality, quantity and thermal maturity of the organic matter, which impacts resource potential and the composition of expelled petroleum. However, most oil-source rock correlation studies have been focused on a few selected rock samples that may not be representative of the entire source rock interval.

The primary objective of this research is to understand variations in lithofacies and organofacies in source rock and their influence on composition of crude oil accumulations. To fulfill this objective a detailed core-based analysis and oil-source correlation study was conducted in the North Slope of Alaska focusing on the Shublik Formation source rock.

The Middle to Upper Triassic Shublik Formation is a key source rock for petroleum in Arctic Alaska and the greater Prudhoe Bay field area, accounting for nearly all of the oil in the Kuparuk River unit and about a third of the oil in the Prudhoe Bay unit (Peters et al., 2008). The Shublik Formation contains lithologies that include calcareous, glauconitic, phosphatic, organic-rich, and cherty facies, consistent with deposition in a coastal upwelling zone (Parrish et al., 2001). Recent studies of Alaska North Slope oil types by Peters et al. (2007) and Wang et al. (2014) used decision-tree chemometrics of selected source- and age-related biomarker ratios to classify forty-six Shublik crude oil samples into genetically distinct families. Two of those families were linked to calcareous and shaly organofacies of the Shublik source rock.

This work is based on extracts from sixteen core samples comprising six lithologies compared to ‘calcareous’ and ‘shaly’ oil end-members based on analyses of biomarkers and diamondoids (Moldowan et al., 2015) that include quantitative diamondoid (QDA) and extended diamondoid (QEDA) analyses. Biomarker analysis showed that $C_{22}/C_{21}$, $C_{24}/C_{23}$, and $C_{30}H/C_{29}T_m$ terpane ratios and diasteranes/steranes ($C_{27}$) were the most useful ratios for differentiating ‘calcareous’ from ‘shaly’ Shublik oil families as well as organofacies (Fig. 1). Biomarker correlations were performed on rock extract and oil samples of equivalent or similar levels of thermal maturity, while diamondoid methods were used for high-maturity source rock extracts as well as oil-source rock correlations. In addition, quantitative diamondoid analysis revealed essential information on contaminating fluids that are in some core samples.

This study of the Shublik source rock represents a thorough core-based investigation of the relationships between lithofacies, organofacies and composition of expelled petroleum that form commercial crude oil accumulations in the Alaska North Slope. Utilization of diamondoid and biomarker analyses provided the ability to overcome problems in correlating biomarker-poor overmature source rocks and oils, which helped to extend interpretations over large areas of the North Slope.

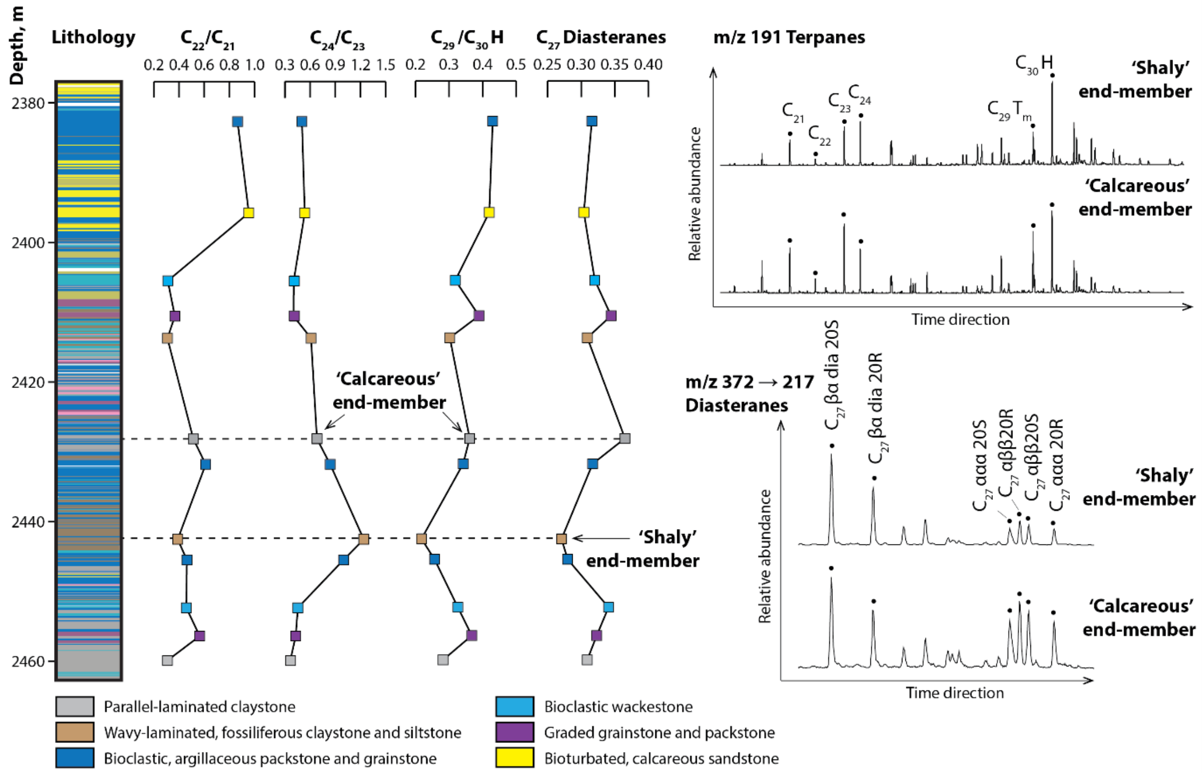


***Figure 1*** *Variation of key biomarker ratios with depth and lithology in analysed Shublik core samples. Comparison of terpane and diasterane mass chromatograms (m/z 191 and m/z 372 → 217) for 'calcareous' and 'shaly' rock extract end-members.*

## References


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