Reality or myth: The role of minerals in petroleum generation

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The prevailing hypothesis regarding the role of minerals in petroleum generation is that the source rock mineral matrix is an *inert container* for the kerogen, and that minerals do not significantly influence petroleum generation reactions. This is despite contrary observations including (1) the demonstrated catalytic effect of various minerals in laboratory petroleum generation experiments, resulting in petroleum-like distributions of gases and liquids, (2) the presence of compounds like diasteranes, diamondoids, and benzene and naphthalene isomers in crude oils that form through carbocation reaction mechanisms, and (3) the distribution of light hydrocarbon isomers in crude oil and the composition of gases produced from shales, that indicate mineral-organic reactions are occurring during petroleum generation.

Mineral surface area-total organic carbon relationships suggest there is an intimate association between organic matter and the mineral matrix of source rocks from the time of deposition. Extrapolating that result to petroleum generation, favorable conditions for the interaction of minerals with kerogen during petroleum generation may be established during source rock depostion. The goal of this paper is to evaluate the arguments for and against the role of minerals in petroleum generation, present new data that address the question and discuss the implications of mineral-organic reactions for petroleum generation.

Clay mineral control of organic carbon deposition and preservation in petroleum source rocks

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Previous work has shown a strong positive correlation between mineral surface area and adsorption of organic carbon in modern marine sediments. Our studies of black shales of varying thermal maturity and stages of diagenesis show a strong positive correlation between mineral surface area and total organic carbon in representative black shale deposits. This relation suggests that adsorption of dissolved carbon compounds or other mechanisms of preservation by clay mineral surfaces played a fundamental role in the burial and preservation of organic carbon. Additionally we have focused on the interlayer space of 2:1 smectitic clays. Our results imply that both polar and non-polar organic compounds are capable of gaining entry to the interlayer sites of smectite clay minerals. The MSA-TOC (mineral surface area) association implies organic carbon sequestration in an important class of black shales and petroleum source rocks may be more closely related to patterns of continental weathering and secular clay mineral trends than to the traditional models that consider only ocean water chemistry or marine productivity.