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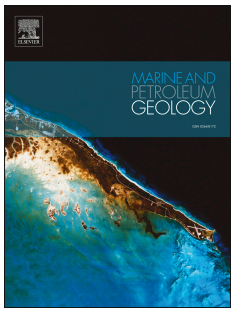

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Insights into the effects of matrix retention and inert carbon on the petroleum generation potential of Indian Gondwana shales

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Abstract

The Rock-Eval pyrolysis and total organic carbon (TOC) analysis technique is widely used for organic geochemistry screening of source rocks and potential unconventional petroleum reservoirs. The Rock-Eval-derived parameters, the Hydrogen Index (HI), which is the ratio between hydrocarbons released under the S2 curve (hydrocarbon formed by thermal pyrolysis; S2 is an indicator of petroleum generation potential) and total organic carbon (TOC) can be used to infer the type of organic matter present in a rock. However, HI is often under-estimated due to retention of some hydrocarbons included under the S2 curve by the rock matrix, and the presence of inert carbon within the rock. Here we describe and correct the matrix retention and inert carbon effects on hydrocarbon generation from a suite of shale samples from Indian Gondwana shale reservoirs. Removal of the petrographically-identified inert carbon component from the samples tested leads to less scatter in the TOC-S2 relationship obtained. The ratio of volume percentage of organic matter identified through optical microscopy to TOC is calculated, and that ratio was least in the one heat-affected sample, but higher in low-TOC shales (<12.5%) compared to high-TOC shales (>12.5%). With decreasing TOC content in the sample set analyzed, the corrected HI values calculated using the S2-TOC intercept, increase significantly. This correction can therefore lead to false indications about the type of organic matter present. A key novel finding of this work is the need while correcting HI for matrix retention effects, to consider samples with a specific range of TOC contents, and to match them to the kerogen types present (e.g. Types III and IV in the samples analyzed). Filters should also be applied to adjust for the degree of thermal maturity and organic facies.

Keywords: ***Rock-Eval source rock analysis; Total Organic Carbon; Hydrogen Index; inert carbon; matrix retention; shale TOC.***