A Global Investigation of Shale-Oil Potential: Insights from a Global Geochemical Database

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Summary

The collation of a database of organic geochemistry data from across the globe can have many applications to the exploration for oil and gas. These include the ability to characterise, quantify or define analogues for the quality and maturity of source rocks in a basin being exploited for its conventional hydrocarbon resources. The same database can also be used in the evaluation of the potential for the global occurrence of unconventional hydrocarbon reserves in the form of shale-oil or shale-gas. Using such a database, an attempt has made to high-grade the world's geological basins to identify the best potential shale-oil candidates.

The best shale-oil candidates are likely to be world class source rocks with high TOC values with large areas of source rock at peak oil maturity. The maturity of organic-rich shales can be determined through an interpretation of standard geochemical parameters (e.g. R_o or T_{max} values) and through an assessment of changes in the S_1 values with depth. These values record the presence of free hydrocarbons that have migrated into pore space of the source rocks. Furthermore, empirical data suggests that where S_1/TOC values are >1, production from a shale or tight formation can be considered as possible. Therefore, if these geochemical paradigms are accepted, then a global database of geochemical data can be screened to identify the best shale-oil candidates.

Once identified, and when combined with regional geological models for the extent, size and thickness of mature source rocks, it has been possible to use the same database to provide the input parameters necessary to define the size of the shale-oil resource in each basin. Outside of the US, over ten shale-oil candidates have been recognised. Even through the adoption of realistic recovery factors of less than 1.5%, then simple calculations suggest that the potential reserves within these high-graded shale-oils are vast and are equivalent in size to 28% of those known in all conventional oil reservoirs today.