Temperature Dependence of Kinetic Parameters: A Neglected Issue That Affects Calculation of Hydrocarbon Generation

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ABSTRACT

The kinetic parameters A and E for hydrocarbon generation from source rocks are determined from data acquired at laboratory temperatures, which are much higher than the temperatures at which hydrocarbons are generated in nature. This statement is true for Rock-Eval-type kinetics (one run or multi-run) as well as kinetics from the various hydrous pyrolysis techniques. However, it is well known that both A and E are dependent in systematic and predictable ways regarding temperature. Our preliminary calculations suggest that using values for A and E derived from laboratory measurements could result in errors large enough to significantly affect calculations of hydrocarbon generation. Those errors would also affect the link between generation and Ro. Up to now, this issue has, to our knowledge, never been examined, and temperature effects on kinetic parameters are not taken into account in modeling hydrocarbon generation.

We are have just launched a small research project to develop an empirically based method of adjusting laboratory-derived kinetic parameters, so that they are more appropriate for use at natural temperatures. Our initial data indicate both, that we have developed an appropriate analytical method and scheme to solve this difficult problem, and that the effects uncovered by our study will indeed potentially affect exploration decisions. In the future, we plan to include investigations of the behavior of other types of kerogen; studies of whether Rock-Eval, SRA, and possibly Hawk show the same phenomenon; investigations of the effect of holding Mean Ea constant and varying only A; and determining the best way to correct kinetics parameters obtained from laboratory experiments.