Charge Is Not an Issue – Or Is It?

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ABSTRACT

The advent of user-friendly map-based modelling software must be credited with significantly raising the profile of petroleum systems analysis. It made basin modelling accessible to a wider community of geoscientists, allowing them to test multiple source rock maturation and hydrocarbon migration scenarios very quickly. However, concurrent with the above appears a renaissance of common pitfalls, four of which will be discussed; these are 1) incorrect temperature correction, with 2) the subsequent conversion to geothermal gradients, 3) the use of vitrinite reflectance values to describe source rock 'maturity', and 4) leaping from a very regional map-based approach to very narrow, prospect-specific predictions without rigorously testing each charge model. Temperatures represent one of the most important calibration parameter for basin modelling. Even though most temperature information does require correction, it should only be done if the necessary additional information is available. On-line correction tools need to be treated with care, as incorrect information can make it into basin models and databases. Using geothermal gradients to describe subsurface temperature regimes within sedimentary basins presents another potential pitfall. Unless each gradient is referenced to a depth below mudline, such an approach can result in the incorrect assessment of heat flow changes across a basin, with detrimental consequences for source rock (SR) maturity predictions. Since SRs have a tendency to be located deeper than any available temperature information, assessing their maturity inherently comes with uncertainty. Converting modelled maximum temperatures or thermal stresses to VR values seems to be an unnecessary step, introducing yet more uncertainty. Given that different SR facies expel petroleum at very different thermal stresses, an 'early oil window' coloured in green on a VR map might be anything but. Additionally, a VR value of 0.6%, for example, will represent different thermal stresses altogether, depending on which kinetic scheme has been applied. While map-based assessments - when performed correctly - are extremely powerful, it is highly advisable to add an additional analytical step before assigning charge risk to individual prospects. Running calibrated 2D/3D basin models, i.e. honouring all available off-set data, is a great way to rigorously test prospect-specific charge models and potentially avoid a costly dry hole in the middle of a 'green' VR map.