A New Workflow for Basin-Scale Sediment Prediction: Integrating Plate Tectonics and Palaeoclimate Models in a Source-to-Sink Context

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Over the last few years novel technologies have been developed within the themes of plate tectonic reconstructions, paleoclimatic modelling and forward sedimentary modelling. However, greater understanding can occur when these technologies are integrated and iterated toward a common result. To this aim, a workflow for integrating plate tectonic and paleoclimatic data with the prediction of sediment deposition in a regional context has been developed. This workflow utilizes: (1) an internally developed plate reconstruction and lithospheric modelling tool known as 4DPlates; (2) a proprietary paleoclimatic atlas including in-house paleoclimatic modelling capabilities; and (3) externally developed forward modelling tools for predicting sediment basin fill.

In an exploration setting, the tectonic, stratigraphic and subsidence framework of the basin or play is commonly determined based on limited data and large uncertainties. Understanding the effects of alternative models can lead to significant advantages in understanding the petroleum system at basin, play and prospect scales. This workflow is designed to allow the rapid evaluation of multiple scenarios and their effects on a number of critical variables such as heat flow, burial depth, reservoir and source-rock presence, and continuity of seal. As an example, the effect of different tectonic models on paleo-topography and water circulation can dramatically alter the prediction of reservoir distribution in the basin.

The integration of all data into a single workflow improves consistency in interpretations and data throughout the process. The ability to iterate the workflow increases the sensitivity of the results to the various model inputs and quantifies the uncertainties that are carried along throughout the workflow. It is this combination of both integration and iteration of previously independent modelling tools that yields such a powerful workflow for source to sink analysis.