Abstract

Paleolatitudinal Controls on Depositional Processes and Products: A Reality Check from Global Analogues of Clastic and Carbonate Reservoirs

Jose I. Guzman[1] and Allard W. Martinius[2]
[1]Statoil Exploration North America, Houston, Texas, USA
[2]Statoil ASA, Trondheim, Norway

The effects of latitude on depositional processes and products are examined in ancient examples of clastic and carbonate reservoirs from a global analogues database of >1000 hydrocarbon fields in >220 basins. The locations of these fields have been restored to their paleolatitude at the time of deposition of the reservoirs and source rocks by rotating their coordinates using the UTIG Plates model. We then evaluate the differences in reservoir and source parameters at low, mid, and high paleolatitudes in both the northern and southern hemispheres.

At high paleolatitudes (55 degrees or higher) source rocks are dominantly of Cretaceous or Jurassic age and deposited in marine-shelf or lacustrine environments, with average TOC of up to 10%. Source rocks of continental (swamp and/or coastal plain) origin are uncommon but proportionally more significant when compared to lower paleolatitudes. This may be reflected in the common occurrence of type II-III and type III kerogen, whereas at mid to low paleolatitudes type II kerogen is dominant.

Reservoirs at high paleolatitudes are mostly of post-Jurassic age with a greater proportion in the Cretaceous and are dominated by coastal and fluvial systems in mostly intracratonic and rift basins. Carbonate reservoirs are absent but this is due to the selected cutoff at 55 degrees and to bias towards clastic reservoirs in most databases. Continental clastic reservoirs chiefly occur in braided and meandering rivers; in coastal systems, shoreline-shelf and fluvial-dominated delta reservoirs are dominant. Submarine-fan channels/lobes are recognized in >80% of deep-marine reservoirs. Estuarine deposits occur in similar proportions at high-, mid-, and low-paleolatitudes. The detrital composition of sandstones at high paleolatitudes suggests that colder temperatures may have slowed down the destruction of rock fragments and feldspars.

We examine specific examples at various paleolatitudes for relevant details and contrasting statistics (for example, related to reservoir architecture and heterogeneity) and provide some hypothetical insight into the operating factors including an assessment of potential biases in applied depositional models and controlling parameters. We also evaluate other potential controls such as the existing plate configuration at the time of deposition in order to distinguish between true latitudinal effects and source-to-sink configuration.